OCA
Quarterly

QUARTERLY JOURNAL

OF

MICROSCOPICAL SCIENCE:

EDITED BY

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AND

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VOLUME VI.—New Series.

With Illustrations on Wood and Stone.

LONDON:
JOHN CHURCHILL AND SONS, NEW BURLINGTON STREET.
1866.

TRANSACTIONS

OF THE

MICROSCOPICAL SOCIETY

OF

LONDON.

NEW SERIES.

VOLUME XIV.

LONDON:
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PRINTED BY J. E. ADLARD, BARTHOLOMEW CLOSE.

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ORIGINAL COMMUNICATIONS.

On Raphides *as* Natural Characters *in the* British Flora. By George Gulliver, F.R.S., &c.

It has been well remarked by Dr. Lankester, that "the biography of our British plants has yet to be written, microscope in hand; and it is not till the minute details of the cell-life of each plant have been recorded that we shall be in a position to arrive at the laws which govern the life of the vegetable kingdom." And, it may be added, until due attention has been paid to this important subject, we shall never be able to comprehend and realise all the mysterious plans and specifications by which nature has marked, for our instruction, her own affinities and contrasts among allied groups of that kingdom.

As a fragment towards this desirable object, it is now proposed to give an abstract of my researches on the distribution of raphides in the British Flora, compiled from numerous papers published piecemeal in the 'Annals of Natural History' and other journals; with elucidations, by some experimental trials and facts, now first submitted for publication. Besides these new observations and the inherent interest of the subject, the present digest may afford materials for useful help to such botanists as may like to try the value of raphides as natural characters in our native plants, and for the employment of these characters, should the verdict be favorable to them, in appropriate parts of future editions of the British Flora.

Of the former papers a summary, with many fresh observations, was given in the 'Popular Science Review' for October last; but I was then so much engaged with the exotic Flora and other parts of the subject as to be obliged to dismiss our indigenous plants with a curt and insufficient notice. How easily and pleasantly these researches may be made, and with what hopes of success, I have shown in that Re[illegible] nd now it remains to display more particularly the treasures in question of our own Flora, ever bountifully spread before us for the prosecution of the inquiry, and well fitted to afford many agreeable and instructive "half-hours with the microscope."

Though nothing like a primary importance is claimed for the raphidian character, it is constant in and diffused throughout the species, snd sometimes exhibits the only visible distinction at all, as in fragments of plants; while I believe that a fair examination will prove that raphides may give a diagnosis at once as fundamental and universal, and as simple and truly natural, between plants of some different and proximate orders, as any one of the secondary characters heretofore used for this purpose in systematic botany. That raphides are a true exponent of an essential function of the cell-life is shown by their constancy in certain plants; bearing in mind, too, that the question is not merely one of such saline crystals as have ever yet been made by the art of the chemist. An excellent observer, Edwin Quekett, thought he had formed them artificially, and Mr. Rainey has given several very instructive observations concerning the mineral structure of vegetable and animal cells. But John Quekett, Payen, and others, came to the conclusion that raphides either have an organic basis or pellicle; and certain it is that they commonly occur in bundles, within a living and beautiful cell, the whole forming an organism as inimitable by mere chemistry as a spore or a grain of pollen. We must, therefore, attach a far higher meaning to raphides than would be implied only by the term crystals.

Concerning the exact value in systematic botany of the raphidian character, far more observations are required than I have been able to make. As these are extended, more or less irregularities and exceptions will surely be found, some in proof of and others irreconcilable with the rule, especially in the Flora of the World. Among exotic species I have already met with anomalies in the Palms, Vines, an Onagrad, and a Chenopod. But a close examination might show that many of these exceptions are rather apparent than real. The abundance of raphides throughout the frame of the foreign *Thelygonum*, as well as the thicker, larger, and angular crystals in the testa of that plant, cannot yet be reconciled with our present knowledge of the intimate structure of the species of English Chenopodiaceæ. But the Palms may, in truth, include more than one order. The deviation in Vines occurs in *Rhaganus*, a genus lately removed, on other grounds, from this order; and *Montinia*, in which I have failed to find raphides, perhaps does not really belong to the order Onagraceæ.

An amusing and not uninstructive asserted exception among our indigenous Exogens was lately brought to my notice by a friend. He took a fragment from a plant in his collecting-box, put it under the microscope, and told me to look and declare fairly what I saw. Plainly many small raphides. I then learned that the plant was a Dodder; and much to my surprise, as I had never found raphides in our plants of this genus. Accordingly some flowers and bits of its stem were carefully examined, and with much interest, when no raphides could be detected. The plant was at last given to me, when, in reply to my question as to the part in which he had shown them, he pointed to what he called the scales. And these turned out to be nothing more than small withered leaves, probably of *Sherardia;* certainly forming no part of the Dodder, and as surely belonging to a species of the raphis-bearing order Galiaceæ!

Even granting that the production of raphides, or other plant-crystals, as the sphæraphides of Rhubarb, may be more or less modified, either by climate, soil, situation, or other conditions, numerous experiments have led me to the conclusion that such agents or influence have so little power as not to affect the value of raphides as natural characters in the British Flora, if in any flora; and we shall soon see how constantly they are present in the plant at all stages of its growth.

Of our native Onagrads I have for years, and at all seasons, been examining specimens from various localities, and ever with the very same result as to the raphidian character of these plants; and so, too, of the Daffodil, Blue-bell, and Star of Bethlehem. Raphidian and exraphidian plants invariably preserve these respective characters in my garden. A Bed-straw and St. John's-wort will always show this difference, though taken in the same clod from the hedge-row; so will the Black Bryony and its supporting Guelder-rose or Hawthorn, and their red berries; while the next bank, whereon the wild Thyme grows, mingled with the Little Field-madder, will as surely never fail to give through them the same answer whenever questioned. A profusion of Daffodils and Ramsons grow together, and often in very contact, under cover of a wild thicket, whence I have always obtained an abundance of raphides in these Daffodils, and none at all, in any single instance, from their companions the Ramsons; this, too, after attentive examinations during several seasons and years, and in the face of my opinion, before entertained, of finding results to the contrary. Two or three species of Duckweed, touching each other in the same pool, will differ constantly in the quantity of their raphides. The Bur-reed and Water Plantain grow with their roots close together in a neighbouring ditch, and yet I find the former plant regularly abounding in raphides, while the latter plant is as surely destitute of them.

To turn from nature's own experiments to artificial trials: I have often had growing, from their seeds onwards, in one pot of mould, a raphidian and an exraphidian plant, when both of them preserved these distinctive characters as well as in the wild state. In short, I know of no means by which a raphidian plant can be grown in health, if at all, so as to extinguish this character, nor by which a plant regularly devoid of raphides can be made to produce them. If we sprinkle over the surface of a pan of soil seeds of a Willow Herb and Loosestrife, plants not far apart in our Flora, every one of the former species may be easily picked out, merely by the raphidian character, as soon as the seed-leaves are well grown. But nature, no doubt, requires much further questioning as to the constancy of raphides and their cells, their significance and form, and the conditions under which they may or may not be produced or checked, or modified either in quantity or quality. A multiplication of such inquiries would be easy and desirable in different localities, and a pleasant and instructive addition to rural amusements.

Many more experiments than are here mentioned have I made to the same effect, especially on seedlings of different orders, and seldom without the questions occurring to my mind — What other single character, heretofore used in systematic botany, would serve for the diagnosis between these infant plants; or, during the winter months, by mere fragments of the roots and underground buds, between old plants of the same kind and others with which they are liable to be confounded? How can a character invariably present in the seed-leaves, and thenceforth throughout the frame, from the cradle to the grave, be otherwise than a natural result of an important and intrinsic function of that plant? And how can a phenomenon thus constant in the cellular tissue be without a certain share of the value belonging to this most fundamental or elementary organ of the vegetable kingdom? Moreover, as no botanist is likely, in the present day, to underrate the importance of this tissue, surely its structure and functions, when at all characteristic, ought to form a part of the history of every plant, notwithstanding the present neglect thereof throughout the descriptions of allied orders, and their subdivisions, even in the latest, truly valuable, and most comprehensive books of systematic botany. Therefore it is hoped that this memoir may pave the way for British botanists to pursue at least some part of this subject, and with the effect of establishing a few diagnoses at once novel and true, easy and useful, in their own Flora. To this end raphides will be chiefly considered now; and, for the sake of perspicuity, short characters first given of raphides, crystal prisms, and sphæraphides, leaving casual exceptions to be dealt with incidentally, and referring for measurements, more particular descriptions, and further information, to the October number of the 'Popular Science Review.'

Raphides are the well-known needle-shaped crystals occurring in bundles within an oval or oblong cell. They are very easily separable from each other and from their cell; each raphis is generally without any obvious faces or angles on the shaft, which gradually vanishes, without any angular appearance, to a point at either end.

Crystal prisms are also acicular forms, but occur, for the most part, scattered singly, seldom more than two or three in contact, and then as if partly fused together; they are with difficulty separated from the plant-tissue or from each other; faces and angles are always plain on their shafts, which do not gradually taper to points at the ends, but present either variously sloping angular shapes or pyramids there. These prisms are for the most part larger, and sometimes smaller, than raphides. The best examples of crystal prisms occur in exotic plants, as *Quillaja, Guajacum, Fourcroya,* and *Iris;* they may be seen, too, in most of our Iridaceæ, and, of smaller size, with occasional modifications of form, in the ovary-coat of British Cynarocephaleæ, and in the bulb-scales of the Onion and Shallot.

Spæraphides are more or less rounded bodies, aggregations of minute crystals, sometimes with a granular surface, and often with the tips of the crystals jutting so as give a stellate appearance to the sphæraphides. This term includes the conglomerate raphides of Quekett and the cystoliths and crystal glands of Continental writers. Sphæraphides occur in very distinct cells, and sometimes so regularly in a cellular network as to form that which I have depicted under the name of sphæraphid-tissue. Good examples of this tissue occur in the leaves or sepals of our Lythraceæ, Geraniaceæ, &c., and in the leaves and bark of exotic Araliaceæ. Sphæraphides are more or less abundant in many orders of the British Flora.

And now, proceeding in company with Professor Babington's 'Manual of British Botany,' taking the objects in lineal sequence as they occur in that book, the exotic Flora will only be noticed when some of its members may be cited as additional evidence as to the character of a British order.

Dicotyledons.

Of this class I have never seen true raphides in any of our trees and shrubs, nor in any of our Spurges. The confusion arising from the vague application of the term raphides to all microscopic crystals in plants has led to the prevailing statements as to the frequency of raphides in the Lime, Elm, and many other trees, &c.; while the starch-sticks of the latex of the Spurges, as described in the 'Annals of Natural History' for March, 1862, p. 209, have probably been mistaken for saline crystals. Only three orders of British Dicotyledons can as yet be characterised as raphis-bearers, and these are—

Balsaminaceæ, Onagraceæ, and Rubiaceæ.—In our Flora this character is so truly diagnostic that by it a plant of either of these three orders may be easily distinguished at any period of its growth, even in the seed-leaves, from the plants of its neighbouring orders; and the diagnosis has never yet failed in the many trials which I have made of all the exotic species at my command of the first two orders, excepting *Montinia* before mentioned. Even in the somewhat irregular members of Onagraceæ, *Circæa* and *Lopezia*, the character is as good as in the other genera, and I have examined one or more species of all the sections placed by Lindley under Onagraceæ. But the exotic Rubiaceæ, comprising very different plants, divided by that eminent botanist into the two orders Galiaceæ and Cinchonaceæ, afford different results. While I have never found any plant of Galiaceæ, native or foreign, devoid of raphides, I have always failed to find them at all in the large or shrubby Cinchonaceæ; and yet in the herbaceous species of this order raphides occur as in Galiaceæ, that is to say, commonly less in size and quantity than in Onagraceæ. But in the trees or shrubs of Cinchonaceæ sphæraphides are beautiful and abundant.

In the event of a revision of the old order Rubiaceæ, systematic botanists will have to consider what value may belong to these characters. And, besides the interest which I have shown to be possessed by the raphidian character in exotic plants, as detailed in the 'Popular Science Review,' the remarkable conflux and limitation of this character to three widely separated orders of our native Dicotyledons so surely indicate an important and intrinsic function of the plants of these orders as henceforth should claim a place in every true description of their nature. Were Lindley's plan of Alliances used in our Flora, the shortest and most constantly present mere diagnosis for Balsaminaceæ might be—*Geraniales, abounding in raphides;* and in like manner of the two other orders.

Monoctyledons.

Raphides are much more plentiful in this than in the preceding class, so no wonder that a partial examination should have led to the belief that "they are abundant in Monocotyledons generally." This and other such vague and incorrect statements are current in our best and latest treatises of phytotomy; whereas the truth is that, however raphides may abound in many Monocotyledons, they are either very scarce or absolutely wanting in several extensive orders of this class. As before mentioned, our indigenous plants only are now under consideration; and we shall soon see that about a fifth part of the 'Manual of British Botany' is occupied by Monocotyledons and Cryptogameæ Ductulosæ, which I have searched in vain for raphides.

Dictyogenæ.—In all our plants of this group raphides are plentiful, and they occur in every one of the exotic members of it that I have examined; only in *Roxburghia* raphides are mostly replaced by crystal prisms. I have found that the beautiful shrub *Lapageria* is also a raphis-bearing plant. In the lineal series of the natural arrangement the Dictyogenæ stand isolated by this character between Coniferæ and Hydrocharidaceæ, two orders in which it is wanting.

Hydrocharidaceæ.—This order is remarkable as devoid of the raphidian character, though standing between two groups, Dictyogenæ and Orchidaceæ, in full possession thereof.

Orchidaceæ.—Raphides were found in every plant, British and foreign, that I have examined of this order. They are by no means confined to the sepals, as might be supposed from current descriptions, but are common in the placenta and ovary, in the stem and leaves, and parts which are modifications of leaves, and in the roots. The raphides are commonly much shorter than their soft pale cells, and may be well seen without disturbing them through the semi-transparent edge of the leaf of *Neottia spiralis.*

Iridaceæ.—True raphides are scanty and often not to be detected in this order, but it abounds in crystal prisms ('Annals of Nat. Hist.,' March, 1865). These last occur in all our plants except *Sisyrinchium anceps,* in which, as well as in the exotic *S. Bermudianum* and *S. striatum,* I have failed to find any such crystals. They are very remarkable in the common garden species of *Iris*.

Amaryllidaceæ.—In all our Amaryllids raphides occur. They may be well seen in the leaves, scape, ovary, bulb-scales, and bulb; and smaller and less plentiful in the bulb and perianth.

Asparagaceæ.—All our plants of this order are raphis-bearers. This character is common in the root, leaves, perianth, and ovary of *Asparagus*, &c., and more remarkable in the perianth than in the leaves of *Ruscus*.

Liliaceæ.—Of the four tribes of this order, as they stand in the 'Manual of British Botany'—I, Tulipeæ, destitute of raphides; II, Asphodeleæ, with *Gagea* and *Allium*, also devoid of raphides, though they abound in *Ornithogalum* and *Scilla*; III, Anthericeæ, perhaps without raphides, as I could not find them in a dried bit of *Simethis*; while in both plants of IV, Hemerocallideæ, raphides are abundant. Crystal prisms also occur more or less, especially in the exotic plants of the order, and these, with the distribution of raphides in foreign and native Liliaceæ, and a notice of the prismatic crystals in the bulb-scales of certain Onions, are more fully described in the 'Annals of Nat. Hist.' for April, 1864, and March, 1865. In our plants it is easy to distinguish by the raphidian character alone, even in mere fragments of the leaves, the Hemerocallideæ from Tulipeæ and *Allium*.

Colchicaceæ.—Excepting a few minute raphis-like objects in the root-fibres, the British plants of this order are quite without raphides. The sphæraphid-tissue occurs in *Tofieldia*; and, among the foreign plants, *Veratrum* presents beautiful examples of this tissue, and abounds also in raphides.

Eriocaulaceæ.—I could find no raphides in dried leaves of *Eriocaulon septangulare*.

Juncaceæ.—In our indigenous species of *Luzula* and *Juncus* I have in vain searched for raphides. A few small raphides, or objects resembling them, occur in the leaves of *Narthecium*.

Alismaceæ.—Raphides are wanting in our native species, as well as in the few foreign ones that I have examined.

Typhaceæ.—All our plants are raphis-bearers.

Araceæ.—Raphides abound in *Arum*, but are wanting in *Acorus*. All the exotic Araceæ that I have examined are raphis-bearers, and so are all the orders of Professor Lindley's Aral Alliance. As to *Acorus*, it is placed by him in the Juncal Alliance of his 'Vegetable Kingdom;' and as the type of the distinct order Acoraceæ, between Juncaceæ and Juncaginaceæ, among our native plants in his 'School Botany.'

And as I have found these last two orders, like *Acorus*, deficient in raphides, an additional reason appears for separating this genus from an order in no species of which have raphides yet been found wanting. I have, however, discovered a few small raphides, like those of *Narthecium*, in the exotic *Gymnostachys*.

Lemnaceæ.—Raphides occur in all our plants, more abundantly in *Lemna minor* and *L. trisulca* than in *L. gibba* and *L. polyrrhiza*; and are very plentiful, with sphæraphides, in the tropical *Pistia Stratiotes*.

Potamogetonaceæ, Naiadaceæ, Cyperaceæ, Graminaceæ, and *Cryptogameæ Ductuloseæ.*—In none of these plants, which conclude and form so large a share of the 'Manual of British Botany,' have I yet found raphides.

Thus, besides the Cryptogameæ Ductuloseæ, above half of the British Monocotyledons would appear to be devoid of raphides; and it is remarkable that most of these plants, still more than half of all our species of Monocotyledons, occur together at the end of this class in the 'Manual.' Among the foregoing orders the results are equally noteworthy. Dictyogenæ abounding in raphides, though these crystals are totally wanting in the orders immediately preceding and succeeding that subdivision. Our plants of Hydrocharidaceæ are, on the other hand, without raphides, which yet abound in the orders between which that order is placed; and, indeed, as far as my observations have yet gone, the orders of the Hydral Alliance of Lindley's 'Vegetable Kingdom' are devoid of the raphidian character. Raphides are plentiful again in the next succeeding orders, except Iridaceæ, as far as, and inclusive of, some sections of Liliaceæ; then suddenly disappearing or deficient in the four continuous orders Colchicaceæ, Eriocaulaceæ, Juncaceæ, and Alismaceæ; present again profusely in Typhaceæ, Araceæ, and Lemnaceæ, three orders thus characterised, and yet standing together between Alismaceæ and Potamogetonaceæ, two orders in which, on the contrary, this character is wanting; and finally wanting also in all the succeeding orders. Thus, the main or parallel-veined group of Monocotyledons begins and ends with exraphidian orders. And not less remarkable is the contrast between Lindley's Aral and Hydral Alliances, the former pregnant with, and the latter sterile of, raphides. Of Liliaceæ, the regular presence of raphides in the whole or parts of some sections, and the equally regular absence of raphides from the whole or parts of other sections, are phenomena of which the exact significance can be learned only by further research in this direction. And, in truth, how far the raphidian character may prove useful in the revision which this and some of the other orders seem to require remains to be decided after a careful extension and correction of these observations, especially as regards the Flora of the World, by judicious inquirers, who may have the requisite materials at their command, and the will to use them, for the elucidation of the question of the value of raphides and their cells as natural characters in systematic botany. Meanwhile it is hoped that the present memoir may induce some of our countrymen to study the subject in their own Flora.

STOPS *recommended for* OBLIQUE ILLUMINATION *with the* ACHROMATIC CONDENSER. By B. WILLS RICHARDSON, F.R.C.S.I., Surgeon to the Adelaide Hospital, Dublin.

THE attempts to resolve the markings of certain diatoms with oblique light are frequently attended with considerable difficulty, so much so that the management of oblique illumination requires very great patience to prevent failure. One moment the field is too milky, at another the glare is most distressing, next the valves are too thick, and at last, after a great deal of trouble and strain of vision, a tolerably good view is obtained. But, on the other hand, we may not be so fortunate, and, notwithstanding all our perseverance, complete failure in procuring a satisfactory demonstration is often experienced. Of course, I assume that the object-glasses are properly adjusted, a neglect of which is of itself sufficient to interfere with the delineation.

Not only have I seen the difficulties enumerated experienced with the mirror and condenser, but likewise with the prism, when used for oblique illumination. And even when the diatom markings are sharply brought out with the latter, there is often a milkiness of the field and object very distressing to the eye of the observer.

During the course of the summer I devoted a few evenings to the making of a variety of stops for my achromatic condenser, hoping that by so doing I might succeed in constructing stops better adapted for rapid demonstration of markings by oblique illumination than the solid discs I had hitherto been in the habit of using.

After numerous trials I was successful in forming some stops for my Smith and Beck's achromatic condenser, with the assistance of three of which, in particular, the markings of many diatoms requiring oblique illumination can be quickly and beautifully exhibited, and with a field, I may say altogether, free from the glare and milkiness so often experienced with the mirror, as well as with the prism.

I do not know a more exquisite microscopic object than a properly mounted *P. Hippocampus*, seen with stop third of the illustration and Smith and Beck's $\frac{1}{5}$th objective. In fact, nothing could be more perfect than the definition of both sets of lines on that diatom with the above combination. Again, *P. angulatum*, which requires a nicer management of the light than *P. Hippocampus*, with the mirror, condenser, and ordinary disc stop, is instantly resolved clear and sharp with the same objective, and either stops second, third, or sixth of the illustration. The fourth stop will be found useful for exhibiting diatoms with only one series of lines, longitudinal or transverse. And the first and fifth are also adapted to illumination of some diatoms with the so-called double lines. The first likewise gives a very excellent black ground with low powers, and is a useful stop for examining Coscinodiscus, Arachnoidiscus, Heliopelta, Triceratium, &c.

As the only high powers of English makers I have used were the $\frac{1}{5}$th and $\frac{1}{8}$th of Smith and Beck, I cannot, of course, say how the stops would act with their higher objectives, or with the glasses of other English opticians; but I can confidently recommend the second, third, and sixth particularly to those microscopists who possess Smith and Beck's powers above mentioned, for to my eye, at least, the definition of their $\frac{1}{5}$th and $\frac{1}{8}$th with those stops could scarcely be exceeded.

It is essential for the most perfect illumination with the stops, they should be so arranged that they can be rotated. The tube, therefore, which carries them ought only to slide in that of the achromatic combination, and should also be of sufficient length to project inferiorly, in order that it may be easily got at for rotation and for rapid change of stops, if required.

The projecting extremity should be provided with a milled rim, at least half an inch wide.

Since the above was put in type I have made a seventh stop for oblique illumination, and which produces such excellent results with the condenser that I likewise had an engraving made of it. This stop works well with the $\frac{1}{8}$th.

The Histology *of the* Reproductive Organs *of the* Irid, Tigridia conchiflora; *with a* description *of the* Phenomena *of its* Impregnation. By P. Martin Duncan, M.B. Lond., Sec. Geol. Soc., &c.

Contents.

I.—Some years ago, when the great German structural botanists were investigating, and not with their usual calmness, the phenomena of the development of the embryo in flowering plants, I was led to follow in their path of research. Instead of examining the complicated phenomena of the impregnation of Dicotyledonous ovules, I laboured amongst Monocotyledons; and the following history of ovular development, of the growth and function of the pollen-tube, and of the impregnation of the embryo-sac, may be taken as a fair example of part of the philosophy of reproduction in that class.

The abstract of the original paper, which was read at the British Association, and published in the 'Transactions,' gave a fair analysis of the new matter. Since then the notion that the embryo was formed out of the end of the pollen-tube has been proved to be fallacious by its once very resolute supporters. It is a matter of satisfaction that the ideas of English botanists have passed safely through the ordeal, and that time has proved the correctness of the following observations.

The *Tigridia conchiflora* was chosen for the following reasons:

1st. The flower is very large, and therefore easily studied.

2nd. The organs of generation are very distinct, and there s no fear of impregnation taking place before the expansion of the perianth.*

3rd. The life of the flower is very short, and the passage of the pollen-tube down the long style very rapid.

4th. The ovary is large, the impregnation of one of each pair of associated ovules very certain, and the facilities for making transverse sections are very great.

5th. There are several flowers in each spathe; they bloom in succession, and the development of the ovule and the maturation of the seed may be studied in the same plant.

II.—The flowers blow in July and August, opening at about 8 o'clock a.m., and the perianth closes and decays long before sunset.

The stamens encircle the style for three inches and then become separate, and the style, suddenly losing its protecting tissue, issues forth to end in a triple termination. The anthers are large, and their opening is external. The ovary is large, inferior, and its apex is surmounted and surrounded by the origin of the combined stamens. The style, even at its entrance to the ovary, is thread-like, but is supported by the encircling filaments of the stamens. The tripartite stigma is covered with papillæ, and has an oleaginous secretion. The remote end of the style is continuous with the tissues composing the axis of the ovary which supports the ovules, and whose tissues are to be traversed by the pollen-tubes.

The ovary is divided into three cells; each cell has its rows of ovules, and placentæ, and is separated from its fellows by strong tissue.

A transverse section of the ovary shows two ovules, side by side, in each of the cells (Pl. I, fig. 1); the ovules are attached to the central axis by the continuity of their vessels and general structure, and the micropyle (fig. 1, *e*) is external and touches the placenta (fig. 1, *e*).

The placentary axis of the ovary is a very complicated affair; it has to give off vessels to three pairs of ovules, over and over again; moreover, it has to produce, under each micropyle, a papillary structure† (fig. 1, *c*), which is usually perforated by

* Some imagine that impregnation occurs only in the perfect flower, but this is a mistake, and that it is so may be well proved in the Leguminosæ.

† This papillary structure cannot be the homologue of even part of the placenta; it is perforated by the pollen-tubes, and has nothing to do with the nutrition of the ovule. The whole of the nomenclature of the sexual parts of flowers has been complicated by the attempt to recognise the

the pollen-tubes in their passage from the axis to the micropyle; neither the axis, the placentæ, nor the papillary structure, are hollow for the passage of the pollen-tubes; on the contrary, the tissues are remarkably cellular and well supplied with moisture.

The ovules, when ready for impregnation, are large, very cellular and transparent; and a very simple manipulation splits off the external coat from the long and narrow nucleus.

Each ovule is attached to the axis by its hilum, is a long oval in shape, and the orifice through which the pollen-tube has to pass is external to the hilum. Transverse sections show this orifice very well. The orifice of the micropyle is not at the extremity of the ovule, but is close to the hilum; the ovule is therefore "anatrope" in appearance, but not so in reality, for there is no reflection of the ovule during its development, but one half of it is, from the first, devoted to the vascular system, and the other to the formation of the coats and embryo-sac. There is no space between the ovule and the walls of the ovary until long after impregnation. The micropyle is very distinct, being situated in the long mammillary end of the nucleus, which projects considerably below the external coat (figs. 1, *b*, *e*; fig. 4, *c*).

For all the purposes of the study of its impregnation, the ovule may be first examined in the rudimentary flower, whose anthers are as yet uncovered by the perianth; secondly, when the anthers are covered; and thirdly, immediately before impregnation, or when the flower is in bloom.

1. A transverse section (through the axis) exhibits the ovules adherent by their cellular and vascular tissue to the axis (at the placenta), shows the projection of the nucleus cropping out of the external cellular coat, and presents to the eye the situation of the upper and globular part of the nucleus, covered now by the external coat, distinguishing it by a track of transparent tissue. By gently removing one of the ovules, and placing a piece of thin glass over it, and pressing the glass gradually with the handle of the knife, the nucleus may, in the majority of instances, be slipped out of its external cellular coat.* Then the nucleus is proved to be cylindrical, rounded at one end, and tubular, with the micropyle at the other (fig. 2). It is very tender, and consists of two parts—a body and a neck. The neck is

homologies of the sexual apparatus in animals. The anatomist may well be perplexed at a placenta inside an ovary, and part of it perforated by the male element.

* This external coat is cellular, the cells being square in their outline; it leaves more than two thirds of the neck of the nucleus uncovered.

the part which projects, and which is tubular and nearest the hilum of the ovule; it is open at its free extremity—the micropyle—and is traversed by a canal, leading from this open extremity to the body of the nucleus—the canal of the micropyle. Its structure is cellular, the cells being long ovals, their long axes being parallel to the canal. The orifice is formed by a circular series of these cells (fig. 4, *c*; fig. 2, c^x). The body of the nucleus is joined to the neck, and at the point of junction the canal ceases. The rounded end of the body is imbedded in the cell structure of the ovule, and at this early stage is barely cellular; but nearer the neck, square cells (fig. 2, d^x), with a cell-nucleus in each, are seen. The contents of the body of the nucleus at this period are fluid; there are neither granules nor cells in it, and the canal of the micropyle is in existence, but barely patent.

2. At this period the external coat has covered all but the free third of the neck of the nucleus; the canal of the micropyle is recognised by a dark line in the axis of the neck, and the micropyle is more open and better rounded (fig. 2, *a*, *b*, *c*.) The same plan of manipulation as in 1, sets free the nucleus, whose body is now seen to be perfectly cellular outside, and filled with more than a simple plasma or fluid. Proceed now as follows:—Having obtained several nuclei free from their external cell-coats, take a fine-pointed knife and operate, under the 1½-inch object-glass. Glycerine and water, plain water, and olive oil, are good media, and should be tried separately. Pierce the nucleus at its round extremity, and place it under a piece of thin glass; use the handle of the knife as before, and with a little jerking pressure a delicate globular-looking film will escape through the rent in the nucleus. This is the early embryo-sac; it is of tolerable distinctness, being composed of a very fine layer of cells, forming a membrane and enclosing a quantity of fluid. The embryo-sac nearly fills the body of the nucleus, and its contents are *not* granular, *neither is there any trace of cell growth in them.* The membrane of the sac is so delicate that the edges of its cells are barely distinguishable, but their position may be inferred from the presence of cell-nuclei (fig. 2, *e*). It requires an object-glass of ⅛-inch focus to determine the structure of the embryo-sac, but one of ¼-inch focus is sufficient for the examination of the nucleus; but in all cases, the lowest power must precede the employment of the higher.

The anterior extremity of the embryo-sac, when it is within the nucleus, is in contact with the canal of the micropyle; and the effect of the cylindrical shape of the nucleus at this spot is to make this extremity of the sac rather angular in outline.

A dark line shows the margin of the embryo-sac when the nucleus is examined by transmitted light, and the globular shape and refractile contents of the sac throw the sides of the nucleus in shade, and its centre in high light (fig. 2).

The cells of the nucleus are more perfect.

3. The ovule, when ready for impregnation, is larger than in the imperfect flower, the neck of the nucleus is more covered by the external coat, and the micropyle is close to and touches the "papillary structure. The same method of manipulation suffices to show that the canal of the micropyle is open, that the *cell-coat of the embryo-sac is perfect,* and that its anterior extremity blocks up the end of the canal. The embryo-sac is now of considerable size; its contents are *not* granular, however, but consist of simply colourless fluid. The appearance of the membrane of the sac is now *distinctly cellular,* the cells being delicate, and, generally speaking, they overlap each other at the edges (fig. 3, *c*).

The cells of the external coat of the nucleus are larger, more perfect, and firmer. The ovule is now ready for the pollen-tube.

I have never found any cells in the embryo-sac, and it is evident that the cells of the membrane of the sac, when seen through, cause many illusive appearances in the fluid below them.

III.—The pollen-tube issues from the pollen-grain, insinuates itself between the papillæ of the stigma, passes into the central tissue, and descends the style. The base of the style is traversed, and the tube enters the axis of the ovary; the ovules are then only separated from the pollen-tube by the tissue of the axis and the "papillary structure" opposite and touching the micropyle. The tube has to deviate from its course and pass at right angles to gain the base or attachment of the "papillary structure" to the axis, and this deviation is determined by the direction of the vascular bundles, which pass from the axis at right angles to reach the hilum of the ovules. The pollen-tube cannot traverse the dense tissue of the vessels, but is turned outwards and runs along them to the base of the placenta, and the "papillary structure," whose cellular structure is easily pierced, the cells making way for and *nourishing* the tube in its marvellous course. Arrived at the margin of the "papillary structure," the micropyle, being open and pressing against the papillæ, is speedily gained; the tube now passes along the canal of the micropyle and abuts against the anterior and convex end of the embryo-sac. I propose to describe the pollen-tube in various parts of its course, to state the results of experiments performed by Dr. Maclean* and myself, upon the independence of the tube of the pollen-grain after it has once passed into the style, and to explain the change which occurs in the tube at its contact with the embryo-sac.

The pollen-grain of Tigridia is large, oval, and contains in its external coat much oil; it is barely visible to the naked eye, yet it is the originator of a tube which passes along at least four inches of stigma, style and axis, in less than twenty-four hours; this tube perforates the stigma, insinuates itself between the cells of this organ, and reaches the so-called conducting tissue of the style. This tissue ought, for reasons presently to be given, to be called nourishing tissue.

The fact is that the life of the pollen-tube is very short, and the period which elapses between the application of the pollen-grain and the entrance of the tube into the ovule must be found out before the phenomena of impregnation in the plant in question can be determined with any accuracy.

The received idea is as follows :—That upon the stimulus of the secretion of the stigma upon the pollen-grain a tubular prolongation of its internal membrane is ejected and thrust between the papillæ and superficial cells of the stigma; that this tube reaches the central tissue, and finally gains the ovule—and all along the course the tube acts as the pipe through which the granular fovilla, spermatic fluid, and its granules, pass from the pollen-grain to the ovule; whether the theory that in the ovular end of the pollen-tube the future embryo is developed holds good or not, the theory of the descent of the contents of the pollen-grain has always been inferred.

I wish to be understood that I am now about to speak of Tigridia alone, and that I believe that the following processes occur in all Monocotyledonous plants, with long styles.† The experimenter must remember, before he follows the path of these investigations, that water influences the pollen-tube in the following manner—it swells out the tube between the denser and solid parts in the axis of the tube and the tube-wall; it moreover puts an end, generally speaking, to the movement of the granules, but oil or glycerine will give a good idea of the normal size of the tube.

The mechanical ideas of the primary formation of the pollen-tube must be abandoned; it is essentially a vital process, and

* Allan Maclean, M.D., of Colchester, one of the greatest raisers of hybrids and a most careful observer.

† The phenomena can be readily traced in the Crocus.

is not dependent upon endosmosis and exosmosis; it is a growth of the cell-wall of that layer of the pollen-grain which contains the granules and fluid usually termed protoplasma. The growth is peculiar to the perfect pollen-grain, and occurs at a certain period when the viscid secretion of the papillæ of the stigma is strong enough to hold the pollen-grain in perfect apposition, and to resist the effects of the pressure exercised by the end of the pollen-tube upon the tissue of the stigma before entering. Were this viscidity insufficient, the gentle force of perforation could not take place; and when the viscidity is sufficient the growing tube, with its conical tip, is held forcibly against the cell-structures of the stigma; the force to cause these to diverge and to admit the tube between them is "growth." The amount of force employed may be roughly estimated by adding water to the viscid secretion, some hours after perforation has taken place; the pollen-grain is released from its durance vile and jumps away from the stigma; its restraining fluid having been rendered inefficient.

Once entered between the cells of the stigma, the pollen-tube, consisting of a cell-wall enclosing the spermatic materials, closed by a conical end, and continuous with the pollen-grain, begins to elongate with extraordinary rapidity (fig. 5, *a*, *b*). The following are the results of experiments by Dr. Maclean and myself:

1. *Four hours* after the application of pollen to the stigma the pollen-tubes were detected one inch down the style; day fine, and good sun.

2. *Eighteen hours* after application, the pollen tubes were detected at the base of the style, three and a half inches from the end of the stigma.

3. *Twenty-four hours* after application, the pollen-tubes were seen in the micropyles of several ovules.

4. *Thirty hours,* impregnation is complete, and the pollen-tubes are wasting in the micropyle.

Series II.—*Experiments by Dr. Maclean and myself.*

1st. Tigridia fertilised with pollen-grains by twelve o'clock in the day (not much sun).

The perianth closed as usual about five o'clock, and at nine o'clock two inches of the style were removed with the stigma, and the rest of the flower placed in water.

In these two inches of style, hundreds of pollen-tubes existed, and the diameter of the style was considerably increased by their presence. *They were cellular, and the cells of the* *pollen-tubes were long and very distinct* (fig. 5, *a*, *b*), some being filled with granules, others containing but few, and those near the end of the cells.

At twenty-four hours after the application of the pollen-grains, the rest of the style and the ovary were examined. Pollen-tubes were found in both, and many of the ovules contained pollen-tubes in their micropyle-canals (fig. 6 *e*, *f*, *g*, *h*; fig. 7, *a*, *b*).

2nd. Tigridia fertilised with the last. At the same hour in the evening all the style but one inch was removed. Ovary examined at the same time as the other, viz., twenty-four hours after the application of the pollen-grain, and multitudes of pollen-tubes were in the cells of the ovary and in the ovules.

3rd. These experiments repeated, with same results.

4th. Two inches of the style and stigma were removed four hours after fertilisation, and in the removed portion, the pollen-tubes were seen in abundance.

5th. Dr. Maclean endeavoured in vain to prevent the plants seeding, by removing the style from the axis before the perianth had fallen.

From these experiments it is proved that the impregnation is perfected in a little more than twenty-four hours; that the pollen-grain produces a tube-cell, which grows according to the manner of cells, which passes through stigma, style, and to the remotest ovule in the ovary—a space oftentimes of five inches—in twenty-four hours; that, taking the average length of the tissue to be perforated to be four inches, the pollen-tube grows at the rate of one inch in six hours; that before the pollen-tubes are half way down the style, if their connection with the pollen-grain be destroyed, they still grow and impregnate; that after the pollen-tube has fairly entered the style it is independent, both as regards its subsequent growth and impregnating properties, of the pollen-grain; and that the varying conditions of the atmosphere influence the rapidity of the growth of the pollen-tube, and consequently impregnation.

Tearing the style with needles suffices to show the long pollen-tubes, and it is as well always to examine a non-impregnated style with the impregnated. No one can mistake the one for the other; the abundance of very long cellular tubes, where all divisions are at right angles to the cell-walls, and which are to be traced several times across the field of the microscope, indicates the fertilised style.

It is evident that a *force* of *some* kind is requisite to propel the conical end of the pollen-tube at the rate of an inch in six hours, at the rate of an inch in four hours, and sometimes at even double that rate, through cellular tissue whose formation is very much adapted for the transition. It is demonstrable, from repeated experiments, that this force is exercised most efficiently when the direct sunlight and heat are accompanied by a warm and humid atmosphere, and most inefficiently when there is no sun. In fact, the greatest stimuli to vegetable growth are those which strengthen all the powers of the pollen-tube.

From the above experiments it is to be proved that the *force* just spoken of is exercised when the pollen-grain, and even one half of the pollen-tube, are removed.

It is manifestly no *force* arising from the pollen-grain as a fixed point. The whole secret is contained in the pollen-tube itself; and in *Tigridia,* if by careful manipulation in making longitudinal sections of the style and tearing with the needle a few tolerably lengthy pollen-tubes are exposed, it will be noticed that the pollen-tube *is not one continuous elongation of the cell-wall of the pollen-grain, but that it is* CELLULAR (fig. 5, *a, b*). Transverse inflections of the tubular cell-wall exist every now and then, and the pollen-tube is really a tube formed by elongated cells. These cells resemble, in a most singular manner, those of the Conjugateæ, when their spiral contents are removed; the cell-wall is beautifully definable by the highest powers, and it is evident that the cylindrical shape of the tube is often lost when, passing between the long cells of the style, no great space can be obtained. I have found the cells of the pollen-tube in all parts of the style, and also within the canal of the micropyle. The force of the progression of the pollen-tube is then cell growth; the cells, in their passage through the style and axis, are nourished *by the juices of the cells of the style-tissue contiguous to them;* and each cell, by its elongation upwards and downwards, tends to produce a force which thrusts the free end of the pollen-tube along. It may be observed that the pollen-tube is in intimate contact with cells throughout the whole of its course, and that these cells are as delicate in structure as it is. The stimuli to cell growth affect the nutrition of the cells of the style, and these contribute, under most favorable circumstances, to the most rapid nutrition and consequent elongation of the cells of the pollen-tube. The contrary is equally true. The cutting off the pollen-grain, and the bisection of the pollen-tube, before its free end has even reached half an inch below the line of incision, prove the independence of the remaining part of the tube to depend upon its cellular character. Each cell is independent of the one above it, that is to say, of the one nearer the pollen-grain. The influence of the female organ in thus nourishing the male "spermatic tube" is very interesting, and is seen in the animal kingdom in the effects of the vaginal and uterine mucus upon the spermatozoa.

The length of the cells of the pollen-tube varies; and it appears to me that whenever any difficulty in the passage has to be overcome by a little exertion of fresh force the cells are nearer together, and that when the passage is free the cell is found very long.

The contents of the pollen-tube, the fertilising agents, are granules; these often contain—more especially in the terminal cell (Schact noticed this years ago in *Pedicularis silvestris*)—small highly refractile globules, larger masses of filmy looking stuff, and the fluid of the tube. This fluid is certainly denser than water, for the application of this swells the space between the fluid of the cell and the cell-wall. This liquor seminis is secreted by the cell-wall of the pollen-tube, after the formation of the first cell in the tube; and its individuality and specific male properties are not influenced by any length or any amount of subdivision into cells.

In many spots the cell-contents are very scanty, and the tube is ribbon-shaped, but the free end of the tube, and especially where it passes from the papillose placenta into the canal of the micropyle, is cylindrical, very turgid, and filled with granular masses and cell-fluid (fig. 5, *c*). I have already noticed that at the time of impregnation the open micropyle is in contact with the papillary structure close to the placenta, and it will be as well to observe that there is an indubitable vital attraction between the end of the pollen-tube and the micropyle of the ovule, quite as great as there is in many plants between the anthers and the stigma.

Once within the canal of the micropyle, the pollen-tube is nourished by *the contiguous cells of the nucleus*; and here a cell is usually added to the pollen-tube, and oftentimes two. The free end, completely filling the canal of the micropyle (fig. 7, *a*, *b*), passes onwards, and as the nutrition of the cells of the nucleus is active, so is its progress rapid; it impinges, at last, against the anterior convex cellular wall of the embryo-sac. The progressive force still continues, and the terminal cell of the pollen-tube presses the embryo-sac, at the point of contact, backwards, until, at last, the end of the pollen-tube-cell is hidden by the wall of the embryo-sac.*

* This was well shown by Schleiden, but he mistook the bulbous end for the embryo.

According to the previous turgidity of the terminal cell of the pollen-tube, so is the amount of pushing inwards which the embryo-sac-wall suffers, and the more rounded does the end of the pollen-tube become (fig. 6, *a*, *y*).

It must be distinctly understood that *no* perforation of the embryo-sac occurs; that the pollen-tube presses the sac inwards, and produces, as the finger does upon a bladder, a concave depression; and that the pollen-tube swells out from a *vis a tergo*, and fills the whole of this artificial depression. If the pollen-tube be pulled out of the canal of the micropyle its very shortness will tend to disprove the idea that it perforates the embryo-sac.

Twenty-four hours after impregnation, and forty-eight hours after the application of the pollen-grain to the stigma, the terminal cell of the pollen-tube—*i. e.* that in contact with the embryo-sac—is found to be nearly empty. The anterior surface of the embryo-sac, which was in contact with the end of the pollen-tube, is perfectly identical, in its overlapping cell structure, with the rest of the sac; but within the sac, in its former cell-less, granule-less contents, a change has occurred. After this time the pollen-tube decays.

IV.—The appearances of the embryo-sac and the non-granular plasma within it, in the flower whilst in bloom, but before impregnation, have been noticed; the overlapping, circular, or ovoid cells of the sac, each with a distinct nucleus, are most delicate, and the simplest pressure will cause them to take on various forms or to rend. After the contact of the cell-wall of the pollen-tube, the cells of the embryo-sac being pressed in upon the fluid contents of the sac, and yet not ruptured, suffer great flattening, and this must also be the case with the end of the pollen-tube. The transmission of the contents of the last or ultimate pollen-tube-cell—its fluid plasma and granules—from the interior of the tube-cell to the interior of the embryo-sac, is effected very shortly after the contact of the end of the tube-cell with the small cells of the embryo-sac; and in a few hours the contents of the embryo-sac have become granular, whilst the pollen-tube's last is empty cell (fig. 9, *e*). If the pollen-tube be forced out of the canal of the micropyle forty-eight hours after the pollen has been added to the stigma, and the nucleus, with its large embryo-sac, submitted to the compressorium, under the lowest power of the microscope, and then the anterior part of the embryo-sac examined with the highest powers, it will be seen to be intact, to have retained a somewhat concave form, but the small cells are overlapping, and present no symptom of violence (fig. 9, *a*, *b*).

On the third day after the impregnation of the ovule, the granular contents of the impregnated embryo-sac have collected together in a more or less elongated form, the anterior extremity being in contact with the inner surface of that spot of the embryo-sac where the contact with the pollen-tube occurred. The anterior end receives a sort of concave edge from the still existing depression in the anterior part of the embryo-sac. Ten days elapse, and the ovules, greatly increased in size, have a tough external coat, and the embryo-sac is very remote from the micropyle; the presence of *cells* is now evident *within* the sac, whose simple overlapping cells are becoming thick and hard.

V.—There is no difficulty in the manipulation necessary for these investigations; the ordinary flat knives and needles will suffice as instruments, and water, glycerine, and the usual reagents, are necessary. The impregnation of the ovule differs as regards the time it occupies in most species; moreover, temperature and moisture determine its rapidity. The stigmas of some plants are impregnated before the flower is perfectly open; others remain virgin for a long period. It will then happen that, unless the nature of the efflorescence, the duration of the flower, and the time of the increase of the diameter of the style be noticed, the microscopist may look in vain for any trace of pollen-tubes. The rapidity with which some ovules in plants with very short styles are impregnated can be well imagined after what has been brought forward in reference to the rate of pollen growth in *Tigridia*.

Immediately after the impregnation, changes commence in the pollen-tube, as well as in the whole of the female organs. The tubes become flaccid, all granular movement ceases, and they lose their tenseness. The style is swollen by the descent, through cell-growth, of the numerous pollen-tubes; the nutrition of its central cell system is at its height, and this vital activity is kept up until the tubes pass into the axis of the ovary. Then the stigma and upper part of the style droop, and the perianth begins to lose its brightness, to become flabby, and to fold. The ovules are not yet impregnated. After a few hours the pollen-tubes passing down the axis, nourished by its juices, are turned off laterally by the barriers formed by tough vascular tissue which passes off to each ovule; the tubes pass through the papillary structure near the placenta, and reach the micropyle. The nutritive processes of the upper part of the axis are vastly increased in activity, the tissue swells, and the nutrition of the perianth, the style, and the filaments of the stamens, is interfered with by a pressure from within outwards, which diminishes the calibre of their cells and vessels. The ruin of the flower is clearly produced, in part, by the increase in calibre of the lower part of the style and the upper part of the axis. The balance between the rapidity of the pollen-tube growth and the development of the micropyle of the embryo-sac is, of course, exact when the impregnation is being perfected, and it is the chance of this balance being incomplete which renders fertilisation by strange pollen generally so difficult. The influence of the female organ in nourishing the male element is very suggestive.

TRANSLATION.

On the DEVELOPMENT *of* ASCARIS NIGROVENOSA.

By E. C. MECZNIKOW.

(From Reichert and du Bois-Reymond's 'Archiv,' 1865, p. 409, pl. x.)

IN the following pages the anthor proposes to communicate the result of researches on the peculiar development of *Ascaris nigrovenosa,* which have been conducted in the laboratory at Giessen, and of which a brief report has already been given by Prof. Leuckart.*

The fully developed worm, as is well known, inhabits the lungs of the brown frog (*R. esculenta*), and feeds upon its blood.

The lips surrounding the mouth are but very slightly developed. Behind the oral orifice lies a minute cavity with chitinous walls, and usually regarded as the pharynx. To this succeeds the so-termed œsophagus, in the interior of which, besides the transverse striæ, may be noticed opaque granules and clear nuclei. The cuticle of the body, as well as the subjacent muscular layer, are comparatively thin, a circumstance which well accounts for the little mobility of the animal. The remainder of the cavity of the body is filled with numerous granules, either isolated or aggregated into a few common masses.

Ascaris nigrovenosa deposits a great number of ova 0·013 mm. in length, and which contain fully developed embryos, whose development has been already described by Kölliker.†

The fully formed embryos when liberated from the egg are 0·36 mm. in length, and present the following characters. They are cylindrical in form, tapering more behind than in front. The mouth is surrounded by a cuticular lip, and it communicates with an organ resembling the pharynx of the parent worm. The œsophagus presents two enlarge-

* "Helminthologische Experimental-untersuchungen," 4 Reihe, in 'Göttinger Nachrichten,' 1865, No. 8, p. 219.

† Müller's 'Archiv,' 1843.

ments, the second of which contains a peculiar chitinous apparatus first described by Professor Leuckart. The intestine runs straight backwards, terminating in a rectum; its wall exhibits clear nuclei surrounded by a granular cell-substance. In the middle of the body is placed a largely developed rudimentary reproductive organ, in which may be perceived numerous cell-nuclei inclosing nucleoli, and which are lodged in a common protoplasm. Similar cells occur in the caudal and in the anterior portions of the body.

These embryos therefore are characterised especially by the considerable development of the rudimentary sexual organ, and by the double dilatation of the œsophagus—character which they possess in common with the free-living genus *Diplogaster* (*Rhabditis*), and which characters have previously been pointed out by Professor Leuckart as existing in the young larvæ of *Dochmius trigonocephalus* (l. c.).

From the lungs, the ova, that is to say the embryos, find their way into the intestinal canal of the frog, collecting themselves for the most part in the rectum. In this situation, though increasing considerably in size (0·55 mm.), they undergo no other changes, which do not occur until the embryos have been voided, and been deposited in the moist earth.* Under these conditions the young larvæ continue to grow as before, and cast their skin for the first time at the end of about twelve hours. But it should be remarked that the length of this period depends very much upon the season of the year, so that in summer the entire development of the free larvæ requires only half the time that it does in autumn.

After this ecdysis, individuals of two kinds may be distinguished. One of these kinds presents a close similarity with the early larval form, from which they differ merely in their larger size and the rather considerable growth of the sexual organs. But the second kind of individuals exhibits much greater differences, the most striking of which consists in a considerable shortening and curving of the caudal extremity. In these individuals the rudimentary sexual organ assumes the form of a band, which extends as far as the rectum;

* In water the embryos invariably perish, to which circumstance the miscarriage of my first experiments was due. But in order to afford the embryos an opportunity of further development, the contents of the rectum of the frog in which they were found must be mixed up with the moist earth, and placed in a watch-glass in a moist room, It should here also be remarked (as pointed out by Professor Leuckart, l. c., p. 227), that the Ascaridan larvæ, taken directly from the body of the parent, do not become completely developed; a circumstance which would seem to indicate the necessity of a residence in the rectum.

which part of the intestine, moreover, is distinguished by its thickness and solidity.

The further growth, besides the increase in size, consists in a further differentiation of other organs, and, above all, *in the transformation of the sexual rudiment into perfectly developed reproductive organs.* These changes are completed as early as the third day of free life (in summer), at which time the distinction between the males and females is obvious; and it will be found that the former are produced from the short-tailed individuals above described, and the females from the others.

Thus it is manifest that the larvæ of *Ascaris nigrovenosa*, which differ in many respects from their parents, *enjoy a free existence, in which they attain to a sexual development.*

The organization of the fully developed males of this free generation of *A. nigrovenosa* resembles, in general, very closely that of the above described short-tailed larvæ, but differs from it in the further differentiation of certain organs.

The body of the male is tolerably plump, its length being not more than about 14 to 1, as compared with its diameter. In dimensions, individuals differ considerably, some attaining a length of 1·1 mm., whilst others are not more than 0·55 mm. The inwardly curved tail is tolerably thick and blunt; and on each side of this part may be observed a row of minute conical projections (Zapfen) which are connected together by a delicate membrane, and thence represent the similar organs which occur so frequently in various free and parasitic nematodes.

In other respects, the external organization of the body of the males differs from the structure above described of the younger larvæ simply in the presence of a special excretory orifice in the anterior part. During the course of development, the intestine undergoes no particular modification, whilst at the same time the cells occupying the anterior part of the body constitute a central nervous ring. And at this stage also differentiated muscular fibres may be discerned.

The reproductive organs consist of a single tract, at whose upper (usually curved) end the sperm-cells are visible, behind which lie the excessively minute spermatic corpuscles. The inferior portion of the sexual apparatus consists of a thick-walled *vas deferens*, which opens into the rectum. From the walls of the same part of the intestine arises the copulatory organ, consisting, in the present instance, of two connate spiculæ and an undivided chitinous sheath or groove.

In the caudal portion of the body is lodged a mass of glandular cells, which opens on the exterior.

The female differs from the male chiefly in in its longer and slenderer tail. The excretory orifice is present as in the male; but it is otherwise as regards the nervous system, which in the female appears to consist simply of an aggregation of undifferentiated cells.

The fully developed female possesses a plumper form than the male, its length not being more than twelve times its diameter. During the growth of the ova, that is to say, of the embryos, the female continues to increase in thickness. In length it generally exceeds the male, but differences in this respect may be observed. Whilst some individuals may be seen 1·13 mm. in length, others will be found barely 0·65 mm. long.

The vagina is situated in the middle of the body; it leads into the double reproductive organs, which are of extremely simple structure. They consist merely of contiguous cells, which are developed into ova, of which only those which lie nearest the sexual orifice complete their development. In the female reproductive organs I have been unable to detect any special walls, whose existence has been affirmed by Professor Leuckart (l. c., p. 228). And the impregnated ova also are equally without any membranous covering.

The embryonic development of the new generation goes on in the interior of the free-living female, and presents nothing worthy of remark. The new embryos, which are not enclosed in any special sac, and are developed to the number of from one to four, straighten themselves out soon after their completion, and exhibit spontaneous movements in the interior of the maternal body. At the same time they begin to devour the undeveloped ova, as well as to prey upon the internal organs of the mother, in consequence of which they grow very rapidly. At the end of a few hours nothing remains of the maternal body except the cuticle, within which the actively moving embryos may be perceived, surrounded with numerous opaque granules.

On the fifth day after the exit of the young larvæ of *Ascaris nigrovenosa* from the rectum of the frog, the embryos of the new generation just described are ready to quit the cuticle of their devoured parent. These new larvæ, about 0·65 mm. long, differ from their parents in their lively movements and far slenderer form, the proportion of their length to the diameter being as 25 to 1. Their cuticle exhibits distinct, sharply defined longitudinal striæ. The minute oral orifice leads into the œsophagus, which for some time, as in the parents, is furnished with two dilatations; but subsequently this conformation disappears, when the œsophagus represents a slender elongated organ, dilated at the extremity. The intestine continued from it is straight and cylindrical, with a contracted calibre. The anal orifice is placed in the hinder part of the body. The sexual rudiment of these larvæ is placed in the middle of the body, and is of very inconsiderable size.

The habits of the above-described larvæ differ from those of their parents in the circumstance that they are normally aquatic, and are capable of performing extraordinarily rapid, serpentine movements.

In this condition the larvæ live for an indefinite time in the mud without undergoing any change whatever, until they have entered the body of the frog.* When small frogs (especially the green frog) are fed with the mud in which the new generation of *Ascaris nigrovenosa* has been developed, the larvæ are afforded an opportunity of making their entrance into the lungs. When they have reached this locality they cast their skin for the first time, and at the same time some other changes will be observed to take place. The old longitudinally-striped cuticle is now cast off, in consequence of which the tail appears much blunter than before. The head, after the ecdysis, presents minute projecting lips encircling the oral orifice. In individuals in this condition the excreting orifice is also apparent, as well as a differentiation of the future muscles, which at this time consist of an exterior homogeneous and an internal granular layer containing cell-nuclei.

During their abode in the frog's lung the larvæ increase considerably in size. On the fourth day of their parasitic existence the author has noticed some already well-grown larvæ in the act of their second ecdysis, but unfortunately was unable to preserve them alive sufficiently long to allow of drawings being made from them. Eight days after the migration of the young larvæ into the body of the frog he observed these parasites in a further stage of development. Their length is now about 1·25 mm. The oral orifice surrounded by minute lips leads into a cavity furnished with chitinous walls. The succeeding œsophagus, like that of the fully developed *Ascaris nigrovenosa* of the frog's lung, exhibits only a terminal enlargement, and in the interior, granular transverse streaks and clear cell-nuclei. The intestine of

* The mediation of the fresh-water molluscs in the transmigration of the Ascaridan larvæ into the frog, which from the earlier observations on this subject (Leuckart, l. c., p. 229) was deemed to be requisite, has been shown to be unnecessary, since the larvæ are able to effect a direct entrance by themselves.

individuals in this stage is an elongated tube with glandular walls, which runs straight to the rectum, and is always seen to be filled with reddish-brown contents consisting of the altered blood-corpuscles of the frog. The rectum, as usual, is represented by a slender canal, which opens on the ventral aspect of the body. At the point where it is continuous with the proper intestine, gland-cells of large size are placed; and cells of less size are also to be seen in the caudal prolongation.

In the above described individuals will also be observed a peculiar granular gland lying on the ventral side of the anterior part of the body, and communicating by a duct with the excretory orifice. In the interior of this glandular body one or two cell-nuclei containing nucleoli will be seen. The nervous system at this period consists of an œsophageal ring and of two trunks, which become fused into the muscular layer. The muscles appear as completely developed fusiform cells. The strongly-developed lateral lines consist of closely contiguous cells 0·013 mm. in diameter, in which may be perceived a nucleus containing a large nucleolus 0·006 mm. in diameter. I have been unable to perceive any lateral vessels.

All parasitic individuals of *Ascaris nigrovenosa* which the author has had an opportunity of examining in the above-described stage of development have proved to be females. This circumstance speaks strongly in favour of the supposition thrown out by Leuckart (l. c. p. 230) that the parasitic female of *Ascaris nigrovenosa* is parthenogenetic.* The female generative organs are double, and even at this stage exhibit a differentiation into ovary, vagina, and uterus. In the first of these three divisions large germinal vesicles, with a germinal spot 0·025 mm. in diameter, are lodged. The vagina is represented by an elongated canal.

All the observed parasitic specimens in the just-described stage were taken in the act of ecdysis, since the old skin could be seen raised up from the surface of the body.

When the individuals inhabiting the frog's lung just described are compared with the fully developed parasitic *Ascaris nigrovenosa*, we shall be satisfied that the difference between them is only a gradual one, consisting as it does mainly in the greater size of the latter, and in the disappearance of certain internal organs. On this account, the want of observation of the later intermediate stages becomes of less consequence.

* It is equally favorable also to the view expressed by ourselves in 1846, that the parasitic guinea-worm was a parthogenetic female.—G. B.

But, from what has been observed, it is manifest that *Ascaris nigrovenosa has two sexual generations, of which one is parasitic, whilst the other, which presents the characters of the genus Rhabditis, enjoys a free existence.*

This fact shows not only a remarkable mode of propagation, but also indicates peculiar relations between the parasitic and free modes of life. The correspondence of certain free nematodes with the parasitic has been partially recognised by many earlier writers. Goeze and Dujardin,* for instance, observed that the young larvæ of *Ascaris acuminata* are capable of living in water; and Will† has shown that *Angiostoma limacis* occurs, not only in the interior of snails, but also free in the water.

But the genetic relations between the parasitic and free nematodes were first made clear by the observation of Professor Leuckart, who watched the growth in the free state of the Rhabditis-like larvæ of *Dochmius trigonocephalus.*

These intimate relations, as well as the circumstance that the nematodes possess a much better-developed digestive apparatus than all the other parasitic helminths, suffice to prove that the mode of life of the parasitic nematodes must exhibit peculiarities of some kind. It appears more than probable *that many of the nematodes found in the intestines of animals are not true parasites,* since they feed, not upon the living tissues, but upon the excrementitious matters of their host. In favour of this view may be adduced the observation made by Dujardin fourteen years ago, of the presence in the intestine of *Oxyuris curvula* of various solid vegetable particles. The author has also found in the intestine of the *Sclerostomum* of the sheep abundance of fæcal particles in great variety belonging to that ruminant.

Having thus indicated the principal circumstances attending the development of *A. nigrovenosa,* the author feels compelled to pass to a more unpleasant and far less scientific task, viz., to the assertion of his right to the credit of this discovery, which has not been fully admitted by Professor Leuckart.

The Professor speaks thus: "What I have to relate in the following pages contains only that part of *my* observations which has been brought to a more or less complete conclusion. The greater part of my researches *were instituted during the past winter semestre, and in them I have in almost every point enjoyed the assistance and co-operation of Herr Mecznikow*" (l. c., p. 221).

* 'Hist. des Helminthes,' 1845, p. 228.
† 'Archiv für Naturgesch.,' 1849, p. 179.

Although the terms "assistance" and "co-operation" have no definite meaning, no one, probably, would understand them as conveying a recognition of perfectly independent discoveries, no small number of which it has fallen to the author's lot to make. The most important of all the facts adduced by Professor Leuckart in the memoir above cited is, beyond doubt, the peculiar mode of development of *A. nigrovenosa*, which was discovered by *him alone during the autumn vacation, when Professor Leuckart himself was no longer at work in the laboratory.* But not only was the fact of the origin of a sexual free larval generation from the embryos of *Ascaris* discovered and demonstrated by the author, but the method also in which the experiments must be conducted (consisting in the placing of the young larvæ in moist earth) was determined by him quite independently of Professor Leuckart, who had recommended him to try various other unsuccessful modes.

In the anatomical investigation of the various stages of development he owns himself indebted to Professor Leuckart for directing his attention to several particulars, and especially to the existence of chitinous structures in the second œsophageal enlargement (as before remarked).

The last stages of the development of *A. nigrovenosa* in the frog's lung were observed by himself alone.

Lastly, he ventures to express the hope that the reader, as well as Professor Leuckart himself, will not hesitate to recognise his claim to the discovery.

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GERMANY.—**Kolliker's und Siebold's Zeitschrift.** Fourth Part, 1865.—"*New Researches on the Reproduction of the Viviparous Dipterous Larvæ,*" by M. Hanin, Prosector in the University of Charkow. The author of this paper, which deals with a most interesting subject, gives the following conslusions to be drawn from his observations:—1. That the development in these animals does not result from the corpus adiposum. 2. That the young larvæ originate from eggs, which develop in an ovary. 3. That the process of egg formation presents some resemblance to the formation of the egg among some mature Diptera (*Musca vomitoria, Sarcophaga carnaria*). The egg originates from more cells, and is further distinguished from the egg of mature insects by the deficiency of the germinal vesicle. 4. That the egg, before it becomes fertilised, commences to develop embryos, and that the commencement of the development of the embryo has some likeness to the development of the same among some perfect Diptera. The development of the embryo proceeds from one part of the primitive embryonal mass. And finally, 5. That in consequence of what has been said, the phenomenon of the increase of the larvæ, instead of being an enigma, as it appears according to Wagner's interpretation, receives a very natural explanation.

"*Contributions to a nearer knowledge of the Young Forms of Cypris ovum*" is the title of a paper by Dr. C. Claus. His results are as follows:—1. The *Ostracoda* pass through a kind of metamorphosis, in so far as in the various steps of their free state of existence they possess a varying form of shell, and first acquire the full number of their limbs by gradual development. 2. The youngest stages are shells bearing *Nauplius-forms*, with three pairs of limbs for movement, namely, the two antennæ and the mandibular appendages. 3. There are in *Cypris ovum* nine successive stages, which are distinguishable from one another; of these the last represents the sexually mature form. 4. These stages of development are marked by the stripping off of the skin; there are therefore eight corresponding moults. 5. The *mandibles* arise first in the second stage, as powerful jaw-prolongations at the basal joint of the mandibular foot. 6. Only the hinder antennæ already possess at the youngest age the complete jointing and figure of the sexually mature animal. 7. In the second stage the anterior maxillæ and anterior feet, except the antennæ and mandibles, are attached. 8. The maxillæ of the second pair originate first in the third stage, consequently later than the following pair of jointed bodies, distinguished as the first foot. 9. The maxillæ of both pairs and the hinder foot present in their first appearance a nearly corresponding form as a triangular plate running out into a little hook. 10. The anterior feet proceed from the top to the base in their jointing. 11. The abdomen gives rise to two long furcal joints.

Dr. Claus also contributes a paper "*On the Sexual Differences in Halocypris.*"

A very lengthy and exhaustive memoir also appears from Professor Wilhelm Keferstein, entitled "*Contributions to the Anatomical and Systematic Knowledge of the Sipunculidæ,*" which, though perhaps not a microscopical paper, will doubtless be found of much value by the readers of this Journal. A complete *résumé* is given of all that is known of the anatomy of these doubtful annelids, and the known species discussed, while many new forms are added to the list and new anatomical details described

The same indefatigable naturalist contributes a paper on the "*Anatomy of Janella bitentaculata, Q. et G., of New Zealand.*

Herr Mecnikow has a paper "*On some little-known Lower Animals,*" in which he deals with the anatomy, &c., of *Chætonotus, Chætura, Icthydium,* and others.

Perhaps the most valuable paper in the quarter's 'Zeitschrift' is that by Dr. Hermann Dorner, "*On the genus Branchiobdella of Odier.*" In this paper the author deals in a most able manner with the anatomy of Branchiobdella and its allies, and discusses the homologies of its organs and those of the genera investigated by Claparéde, Kölliker, Herring, and others.

Dr. Leonard Landois publishes the fourth part of his monograph "*On the Lice which infest Men.*" In this part he treats of the *Pediculus capitis,* and also reverts to *Pthirius inguinalis.*

We avail ourselves of a short translation of a paper by

Professor Claus "*On the Organization of the Cypridinæ*," given in the 'Annals and Magazine of Natural History,' the original of which we chronicled last quarter as appearing in 'Kölliker's und Siebold's Zeitschrift,' p. 143. During a residence at Messina Professor Claus turned his attention to the little Crustacea which swarm in the waters of the sea. He was particularly struck by a small Ostracode, of the genus *Cypridina*, in which he detected, even with a low power of the microscope, an accessory single eye in addition to the large, paired, compound eye, and a heart beating with regular pulsations. This latter discovery naturally surprised him, as in the other two families of *Ostracoda* (the *Cypridæ* and the *Cytheridæ*) the heart is entirely deficient. A more attentive examination of these Crustacea soon showed, however, that the *Cypridinæ* differ much more from the other *Ostracoda* than the *Cypridæ* and *Cytheridæ* from each other. The fact that an organ so important as the heart may sometimes exist and sometimes be deficient in animals so nearly allied to each other is doubtless surprising, but by no means without precedent. Thus, it has been demonstrated that the *Copepoda* are in the same case. M. Claus himself has shown that if the *Cyclopidæ*, *Harpactidæ*, and *Corycæidæ* are always destitute of a heart, the allied *Pontellidæ* and *Calamidæ* are always furnished with one. Moreover, the author is not the only person who has observed the heart in the *Cypridinæ*, as M. Fritz Müller mentions it in a recent work ('Für Darwin,' 1864). The sole visual organs hitherto known in the *Cypridinæ* were the paired eyes, in which M. Lilljeborg has detected a complication of organization very similar to that of the eyes of the *Cladocera*, although the latter are fused into a single mass, forming, as it were, a median eye. Nevertheless, traces of a primitive division into two halves in the *Sidæ*, the *Lyncei*, and the *Estheriæ*, enable us to establish unhesitatingly the homology of this apparently single eye of the *Cladocera* with the paired eyes of the *Cypridinæ*. A further homology is presented when we find in the *Cypridinæ*, besides the large compound eyes, a small, simple, median eye, perfectly similar to that which exists, in addition to the compound eye, in the *Daphniæ*. The *Cypridinæ* present other peculiarities worthy of mention. As a general rule, the *Ostracoda* are characterised by the small number of their appendages, as there exist only two, or at most three, pairs of locomotive appendages behind the gigantic maxillæ. In fact, the last pair of feet disappears completely, and the others are converted into organs of manducation. On the other hand, the mandibles are converted into locomotive appendages. The antennæ also serving for locomotion, we find that throughout their whole life the *Cypridinæ* employ the three anterior pairs of appendages as locomotive organs. Now, this is exactly the case in all *Entomostraca* during the *Nauplius*-phase, and furnishes a new argument to be added to those adduced by Fritz Müller in favour of the derivation of all Crustacea from the *Nauplius*-form.

Max Schultze's Archiv fur Mikroskopische Anatomie.—The second and third parts of this valuable contribution to microscopical periodical literature have appeared, forming a part about equal in size to the first part. The contents are of equal value and interest to the former, and the illustrations are copious and excellent. The sight of such copious and well-executed plates, eleven in number, and all but two of quarto size, and nearly all more or less coloured, makes us wonder more and more, and still more lament the strange condition of things that wholly prevents our doing the same in this country. Whether it be owing to an absolute dearth of artists capable of making such drawings, which, we fear, is very much the case, or the far higher rate of payment publishers are compelled to submit to, the truth is no less certain that the illustrations given in nearly all the numerous journals, &c., of Germany and France, but especially of the former country, completely put to shame our puny attempts in the same line. The time really appears to be coming when we shall be obliged to have recourse to foreign artists and lithographers for the proper illustration of natural history works. It is true we may justly be proud of several artists in that line, who are excelled by none of any country, and perhaps scarcely equalled in any; but no one can deny that the number of good artists available for the current exigencies of periodical literature more especially is very restricted, and only those who know it can tell how much this scanty supply necessarily enhances the cost of all illustrations at all worthy to compete with such as issued so copiously in such journals as that we are now noticing, Kölliker's 'Zeitschrift,' Reichert's 'Annalen,' and several others which might be named, in Germany, France, and elsewhere.

Having thus vented the natural feelings of an editor, we will proceed to state the contents of the present part of the 'Archiv für Mikroskopische Anatomie.'

1. The first is a long and elaborate article, by Professor W. His, of Basle, entitled "Observations on the Structure of the Mammalian Ovary." Professor His's observations refer chiefly to the mature ovary of the cow and its *corpora*

lutea. The ovary of the cat, whose structure has already been amply discussed by Schrön and Pfluger, has also formed part of his study, in consequence of which he has been enabled, he says, to establish rather more definitely than before certain points with respect to the mode and formation of the *membrana folliculi.* He has also added some preliminary observations on the structure of the human ovary in the fœtus. And his researches on this subject have led him on to the study of the earliest stages of development of the sexual glands, a subject of great general interest.

2. The second paper is one by L. Cienkowski, "Contributions to a Knowledge of the Monadina," in which will be found much matter of great interest to all microscopical observers, but of which it will be needless here to say more, as we shall hope, in our next number, to give a translation or full abstract of this valuable communication. The author, we may say, is not inclined to adopt the opinion of those who regard all the Monadina as motile spores of various Algæ and Fungi, being convinced that, although this may be true of a great many of these Infusoria, still there are whole series of whose independent existence there can be no doubt.

3. The next contribution is "Researches on the Development of the Urinary and Sexual Systems," by Dr. C. Kupffer, of Dorpat.

4. "On *Phreoryctes Menkeanus,* Hofm., with Remarks on the Structure of other Annelids," by Professor Leydig, of Tubingen.—The extraordinary worm which forms the subject of Professor Leydig's communication was originally discovered by Herr Menke, in a brook at Pyrmont, and it was first described by Hofmeister in the 'Archiv für Naturgeschichte' for 1843, under the name of *Haplotaxis Menkeana,* which was afterwards changed to its present appellation. A further account of it will be found, by the same author, in his 'Arten der Regenwürmer' (1845). For a long time the only known habitat was the original site in which the worm was discovered, or its immediate vicinity; but it has since been met with by Leydig at Tubingen, and it is stated by Leuckart (1860) to be common at Giessen, so that we may hope to hear of its occurrence in this country. A second species, apparently belonging to the same genus, was described by Schlotthauber in 1859, in the 'Report of the Gottingen Meeting of Naturalists,' who proposed to change the generic name to *Georyctes.*

It is impossible here to give even a summary of the excellent account, illustrated by beautiful figures, given by Leydig, of the structure and affinities of this remarkable creature and we shall content ourselves with a description of its external form and appearance.

The worm, which from the figure strongly resembles a *Gordius*, has a cylindrical body about half a line thick, and more than a foot long. When viewed alive with the naked eye or a pocket lens, it is at once seen to present all the characters of a true Annelid. The body is divided into very numerous segments, of which the most anterior forms a pointed "head-lobe," in which lies the upper portion of the nervous ring, and beneath which lobe is placed the mouth. The anterior or cephalic extremity, except just at the point, is less attenuated than the posterior or caudal, nor is it so much tinged with red; whilst in the rest of the body the transparent walls allow the numerous red blood-vessels to be seen through them. There are four rows of setæ on the sides and ventral aspect, each segment presenting on either side a larger seta, which is placed quite on the ventral aspect, as in the common earthworm, and a smaller one, which might, from its position, almost be termed dorsal. Every segment, except the cephalic and the penultimate and ultimate caudal, are thus furnished. In the middle portion of the body the ventral setæ sometimes occur in pairs on either side, but more usually only one is met with. The setæ themselves have a slight sigmoid flexure, with a slight enlargement in the middle. The free end is blunt and straight, whilst the other is usually sharp-pointed and sickle-shaped. According to Schlotthauber, the proper habitat of the worm is moist earth; but according to Leydig's observations it would seem to be truly aquatic, or at any rate to require exceedingly wet mud for its abode.

In the remaining part of the paper numerous interesting observations will be found relative to various points in the organization of other Annelids, and especially of *Lumbricus* and *Hirudo*.

5. "On the Epidermoid Layer of the Frog's Skin," by Dr. M. Rudneff, of St. Petersburg.—In his investigation of this structure the author employs a weak solution of nitrate of silver (1 to 1000), in which the swimming membrane of the frog is immersed for a quarter, or at most half, an hour, when the animal, having been rendered motionless by the administration of a few drops of alcohol, the microscopic examination is proceeded with. By this procedure the author is able to define accurately the outlines of the epidermic cells, which are marked by black lines, and has discovered the existence, in the intercellular spaces, of bodies having, at first sight, the appearance of cell-nuclei, with which it is probable they have hitherto been confounded, but from which the bodies in

question differ in the capacity they possess of being blackened by the argentine solution. In speculating upon the nature of these peculiar bodies, which are of a cellular nature, the author suggests that they may bear some analogy with the peculiar bodies described by M. Schultze in the nasal mucous membrane, or those noticed by Hensen, also in the frog's epidermis, as being connected with nerve-fibres; he also adduces the bodies described by Schultze, Kölliker, and H. Müller, in the epidermis of *Petromyzon*. And it appears not improbable that they may, in fact, represent a sort of *corpuscula tactûs*.

6. "Further Remarks on the Action of Hyperosmic Acid on Animal Tissues," by M. Schultze and Dr. M. Rudneff.—These observations are in continuation of those given in the former part of the 'Archiv' on the same subject. The principal subject in which the acid was employed seems to have been in the investigation of the luciferous organ of *Lampyris*, and the chief property of the reagent is that of rendering the nerve-fibres distinct, in consequence of the readiness with which the nervous tissue is coloured by it. It would seem to possess properties well worthy the attention of histologists.

7. "On Nobert's Test-plates," by M. Schultze.—M. Nobert, it seems, now prepares his celebrated "tests" in a new form. The specimens described by Schultze contain nineteen groups of lines, from $\frac{1}{1000}'''$ to $\frac{1}{10000}'''$ apart, and thus arranged:

1st set, $\frac{1}{1000}$.	4th set, $\frac{1}{2500}$, &c.
2nd " $\frac{1}{1500}$.	18th " $\frac{1}{9500}$.
3rd " $\frac{1}{2000}$.	19th " $\frac{1}{10000}$.

The highest set M. Schultze has been able to define with central illumination is the 9th, which is resolved by Hartnack's immersion system No. 10, and by Merz's immersion system $\frac{1}{24}$. With oblique illumination he has not been able with any combination to get beyond the 15th. He considers the most difficult specimens of *Pleurosigma angulatum* to be about equal to the 8th or 9th set of Nobert's lines, and the larger instances to correspond with the 7th.

Reichert's und Du Bois-Reymond's Archiv (Muller's).—In another part of our pages we publish a translation of a paper which appears in the 'Archiv,' by Herr Elias Meczniknow, "*On the Development of Ascaris nigrovenosa.*"

Dr. Albert Eulenburg, of Greifswald, publishes a long essay in the same journal on the "*Action of Sulphate of Quinine on the Nervous System,*" in which the physiological part of the question more particularly is dealt with.

"*On the Nervous Plexus in the Intestine of the Child*" is the title of a paper by Dr. P. Schröder, in which he gives the following as the results of his labours:—1. The observers who hitherto have written on the nerves in the intestine are not in accordance as regards their statements; they have only this in common, that they view the structure in question as belonging to the nervous system. 2. The bodies of Billroth become developed from a network of vessels filled with stagnant blood, as Reichert, and after him Hoyer, have already some time since described. 3. The bodies named belong to the part of vascular system which is intermediate in the passage of the capillary to the vein, and forms networks in the *stratum vasculosum*. 4. The bodies of Billroth are wanting in every characteristic mark of nerve-fibres, or ganglion-corpuscles, or of nerves and ganglia. 5. By injection of the vessels of the intestine with carmine solution one can find injected networks in the *stratum vasculosum*, which have quite the structure of the "bodies of Billroth." Throughout the injected mass one can perceive the characteristic formation for the same. 6. Passages between undeniable vessels and the Billrothian bodies can with certainty be determined. 7. Also in intestines of growing animals, in which it is not usual to find the networks in question, one can detect these same bodies, by skilful management, in the region of the portal vein. 8. The formation of Billroth's bodies can be prevented in the intestines of new-born animals if the conditions under which they arrive at completion be removed.

It is so long since anything has appeared on the *Gregarinidæ* that a paper from Dr. Lieberkühn on some points connected with them is of great interest. In the 'Trans. Mic. Soc.' for this quarter also will be found a paper on *Gregarinidæ*. Dr. Lieberkühn, whose researches on the *Monocystis Lumbrici* are so valuable, observes that in the perivisceral cavity of the earthworm are to be found, between the intestine and integument, numerous cylindrical *Gregarinæ*, which exhibit a uniform longitudinal striping of changeable length and breadth, disposed on the inner surface of the whole cortical substance of the saccule which constitutes the *Gregarina*. They may be observed to perform lively movements in water, whereby the fluid matter contained in their interior, together with the granules and vesicle, are driven about from end to end. The same movements were observed in other examples which were undergoing the pseudo-conjugation peculiar to these creatures. In these cases the *Gregarinæ* were so tightly joined as not to be separable without tearing, and the body wall was observed to be as thick at the line of junction as elsewhere, and the long striations as perceptible. Here and there a *Gregarina* is to be found still moving *itself*, but enclosed by a structureless, enveloping, elastic "veil," which resembles a cyst-membrane. The *Gregarina*, frequently swollen in the middle, is so placed that the finer ends are bent towards the thickened wall, so that they touch, the one under the other. The body-contents are alternately driven from the middle into the turned-up ends, and back again; or into one of the ends, when the walls of the hollow sac fall together, and part again so soon as the granules and fluid return. If the enveloping "veil" burst, the *Gregarina* stretches itself out straight again. The appearance of *Gregarinæ* within cells has been observed to occur. They are often found in the vesicular corpuscles of the testicular sacs of the earthworm, when the spermatic filaments, in various stages of development, are disposed around their outer envelope. Such a *Gregarina* is sometimes so small as not to equal in size the third part of the diameter of the filamentous vesicle, in other cases so large that it quite fills up the vesicle, and in others it is still wider. These must not be confounded with the cyst-membranes, in which also the *Gregarinæ* sometimes show movements. By the movements of a large round *Gregarina* in water the hyaline cortical layer may be seen to thicken itself at particular spots, and thereby the upper layer to sink in. If the thickening extends itself upon the whole *Gregarina* annularly, it appears more or less laced in; the thickenings may also appear in more spots at the same time, and the resulting depressions give the *Gregarina* the appearance of an Amœba with short pseudopodia. In smaller examples this alternate thickening and thinning does not occur, since the cortical layer is too thin to permit of the separation appearing. It has been as yet universally admitted that the *Gregarinæ* become surrounded by a cyst, when the formation of pseudo-naviculæ or psorosperms takes place. As a rule, this is the case; and the published researches of Kölliker, Stein, and others thereon have received confirmation and assent. The formation of pseudo-navicels, however, takes place without encystation, as is evidenced by the minute groups of pseudo-navicules to be found in the testes of worms unencysted, yet held together by some glutinous substance.

The remaining papers do not deal with microscopical matters, excepting a very short one by Dr. Anton Schneider, "*On the Hæmatozoa of the Dog.*"

Archiv fur Naturgeschichte (Leuckart und Troshel). Third Part, 1865.—There are the following papers in this journal dealing with micro-zoology, which will, therefore, interest our readers:—Professor Grube, "*On the Genera Estheria and Limnadia, and on a New Apus.*" Dr. J. E. Schödler, "*Diagnoses of some Daphnidæ.*" Professor Fritz Müller, "*On the Cumaceans.*" This appears to be a very valuable contribution to our knowledge of these remarkable little Crustaceans, which have been already written of by Kröyer, Van Beneden, Milne-Edwards, Goodsir, Spence Bate, and others.

The two most interesting papers, however, are by Professors Leuckart and Mecznikoff, the one "*On the a-sexual Reproduction of the Larvæ of Cecidomyia,*" and the other *on the development* of the same larva. The results of Herr Hanin's paper on the same subject we have already given above, and intend to return to Professor Leuckart's paper hereafter.

A short but interesting communication from Professor Mayer, "*On the Chorda Dorsalis in Fishes,*" completes the list of microscopical papers in this journal.

Hedwigia.—We have two numbers (6 and 7, of 1865) of this spirited little journal before us, which is devoted to cryptogamic botany, and is printed in the German characters. No. 6 contains a paper by Dr. Ferdinand Cohn, of Breslau, "*On Two New Beggiatoæ.*" The first of these is *Beggiatoa* (*Oscillaria*) *mirabilis,* the second *B. pellucida.* Dr. Cohn also describes a variety *B. alba,* var. *marina.* The species are carefully drawn in a plate accompanying.

In No. 7 Dr. Cohn describes a form of *Chlamydomonas, C. marina,* which he obtained, as also his *Beggiatoæ,* from his marine aquarium. The *Chlamydomonas,* which is of very simple structure, and colours water green by its presence, is illustrated in a woodcut. The same number contains a review of Mr. Mordecai Cooke's little book, "*On Rust, Smut, Mildew, and Mould.*"

FRANCE.—**Comptes Rendus.**—A communication from Professor Kuhne, "*On the Nervous Laminæ* (*plâques*) *of Motor Fibres,*" occurs in the 'Proceedings of the French Academy' of the 16th of October. The nervous laminæ, which the author described as the continuation of the *cylinder axis* in the nervous cones of the muscles, has been contested by some authors. Thus, M. Rouget (an abstract of whose researches will be found in our Chronicle of last April) believes that it is produced only by a series of fissures, of vacuoles, and coagulations, which form after death. He rests the principal proof of his explanation on the fact that some parts of the lamina offer no continuity with the nervous fibre. Kuhne found this also himself, but believes that all the parts of the lamina form a complete organ, without interruptions. Moreover, he has made his examinations on fresh specimens of tissue, in which contractility and irritability still remained. Sections were cut from frozen muscles, by which means very thin yet unchanged specimens could be obtained. Osmic acic (OsO^4) was used to test whether the terminal lamina possessed properties similar to those of the medullary part of the nerve. It was found that there was no coloration of the tissue, and hence it is inferred that the terminal lamina has none of the medullary matter of the nerve in it.

"*On a New Mode of Parasitism observed in an Undescribed Animal*" is the title of a paper by Dr. Lacaze-Duthiers in this journal for the 13th of November. In studying the marine fauna of the coast of Tunis M. Duthiers observed on the polyp of an Antipatharian little, flattened, reniform bodies, of a rose colour. On opening one of these bodies a colony of living animalcules escaped, which were seen to be embryonic Crustacea. The body from which they escaped appeared to be a nest, but when placed beneath the microscope it was found to be a living organism. It has the appearance of a minute lobster, with six pairs of claws, and a large alimentary canal of a brown colour. Dr. Duthiers proposes to call this little Crustacean *Laura Gerardiæ*. The most remarkable part about the animal is its mode of parasitism; it is attached to the polyp by a number of little tubular "roots," which spring from the carapace, and plunge into the tissues of the *Gerardia*. The *liver* is very largely developed indeed; the *circulatory* and *respiratory organs* are at a minimum. The *generative organs* are very remarkably disposed, since the parasite is hermaphrodite. M. Duthiers promises other memoirs as the result of his investigations when on his voyages.

In the 'Comptes Rendus' for the 20th November the same author publishes a paper "*On the Multiplicity and Termination of the Nerves in the Mollusca.*" He takes *Thetys leporina* as his type, and proceeds in the present memoir to deal with the distribution and termination of the buccal nerves in a most detailed and careful manner.

The same number contains some interesting researches by M. P. Bert "*On Animal Grafting.*" The microscope may well be applied to investigate the phenomena of growth which are here manifested.

Annales des Sciences Naturelles.—The June number of this journal contains two valuable microscopical papers, one by M. Lacaze-Duthiers, "*On the Spicules of Gorgoniæ*" as specific characters, and the other by M. Alexander Agassiz, "*On the Embryology of the Echinodermata,*" in which he gives the results of some very careful observations, leading him to differ, to a certain extent, from the views of Johannes Müller and others. The July number contains "*A second Memoir on the Antipatharians,*" by that most diligent and accomplished naturalist, M. Lacaze-Duthiers; whilst the August number is devoted to a very valuable and extensive memoir "*On the Family of the Tridacnidæ,*" by M. Léon Vaillant, in which many microscopical matters concerning the anatomy of these molluscs are entered into.

ENGLAND.—**Annals and Magazine of Natural History.**— In the October number of this journal is a valuable paper by Professor H. James Clark, read before the American Academy of Science and Arts, with the title "*Proofs of the Animal Nature of the Cilio-flagellate Infusoria, based upon Investigations of the Structure and Physiology of one of the Peridinia* (*Peridinium cypripedum*, n. sp.)." The author commences by speaking of Darwinism as a resuscitation of previously advanced doctrines, wherein we must be allowed to remark that he appears to misunderstand the work which Mr. Darwin has done. The species of Peridinium which Professor Clark has studied differs from those described by Professor Allman, in the third volume of this Journal (1856), and for it he proposes the name *cypripedum*. It has an oblique, pyriform outline, more than one third longer than its greatest breadth, and hollowed on one side by a broad longitudinal depression, extending from the narrower end to a short distance beyond the broadest part of the body. Not far from the narrower end the so-called flagellum is attached, in the middle line of the broad depression, and is so long as to project beyond the end near to which it is situated. As the narrower end is always the posterior, and the broader end the anterior, in the act of swimming, and the relations of the other parts of the body, such as the position of the mouth, and particularly of the œsophagus, correspond to these, the one which precedes should be called the anterior, and the other the posterior, end of the body. Two shallow furrows encircle the body; the whole of it posterior to the narrower of these furrows is clothed with vibratile cilia, but the anterior end is devoid of them, and appears to be covered by a low cap, in the form of the segment of a sphere. Close to the posterior end is the large, clear, contractile vesicle, which has hitherto escaped notice, owing, it is believed, to the incessant and rapid movements which the animal performs.

Professor Clark manages to confine his Peridinia by strewing the glass slip on which the water containing the specimens is to be placed with abundance of indigo. In this way little lagoons are formed, in which the Infusoria become imprisoned, and are examined without the use of a glass cover. The systole of the vesicle takes place once in *forty seconds;* between diastole and systole the vesicle is more or less irregular in outline, but gradually approximates to a spherical form, and the contraction is sudden and rapid. If the water in which the specimen is placed be not renewed the systole occurs five or six times in a minute, owing to the unhealthy condition. Tincture of opium stops the action of the contractile vesicle at once; the effect is to swell it to an enormous size, and then, breaking through the posterior end of the animal, it expands to a dimension often exceeding that of the whole body before it bursts. The mouth, œsophagus, and digestive vacuoles, are carefully described. It appears that the flagellum has nothing to do with the mouth, which is entirely dependent on the small cilia surrounding it for the introduction of food. The vacuoles are sometimes very large, but the particles of food taken in are excessively minute. No anus was detected, as, indeed, was not expected. The *flagellum* is composed of several filaments, which frequently divide into two groups or are spread out at times as a brush. Its function appears to be that of a powerful rudder and axis of gyration. The so-called cuirass is evidently a part of the whole investing tunic, but differs from the rest in its punctuation. The *nucleus* in December had a U-shaped form, and was of large size. Frequently it was observed to be invested by a delicate envelope, and close to its dorsal region a vesicular corpuscle, apparently the nucleolus or testicule, was observed overlying it. *Reproduction* from the egg was not observed, but transverse division, as observed by Allman, occurred in many instances.

"*On the Microscopic Structure of the Shell of Rhynconella Geinitziana*" is the title of a paper, by Dr. Carpenter, in the November number. It may be remembered that a somewhat unequal discussion has been going on between Dr. Carpenter and Professor King, of Galway, as to whether, as Dr. Carpenter ably maintains, the shell in question and the *Rhynconellidæ* generally are imperforate in their histological structure, or whether, as Professor King asserts, the *Rhyncopora Geinitziana* has a perforated structure similar to that of the Terebratulidæ. Dr. Carpenter has re-examined his preparations made from specimens supplied by Mr. Davidson, and clearly points out the origin of Professor King's mistake. The internal surface of the debated shell is *pitted.* When the outer surface is abraded these pits appear as complete perforations; and a careful examination of vertical and horizontal sections, made with a binocular microscope and a magnifying power of 120 diameters, shows this to be the case. Professor King used only a Stanhope lens and unprepared specimens. Dr. Carpenter very fairly urges, upon similar grounds, the improbability of Professor King's assertions with regard to another histological matter, viz., the foraminiferous nature of *Eozoon Canadense*, which the Galway '*savant*' pronounces to be a product of chemical and physical agencies.

Raphides.—Professor Gulliver is still adding to his proofs of the importance of microscopical structure in the diagnosis of allied orders of plants. In the November number of the 'Annals' he compares Vitaceæ with Araliaceæ, and gives the results of his examinations of Hæmodoraceæ.

He has now examined species, including *Pterisanthes*, of each of the genera included by Lindley under Vitaceæ. They all prove to be characterised by an abundance of true raphides, excepting *Bersama* and *Natalia* (*Rhaganus*), in which two genera raphides are replaced by crystal prisms. Sphæraphides also occur plentifully with the raphides in the typical Vitaceæ. In *Aralia* sphæraphides only appear, and this often in a sphæraphid-tissue, which forms a beautiful microscopic object in the *A. spinosa*. He recommends the leaves of this plant and of *Vitis apicifolia* for comparison. As to Professor Lindley's observation that, "if Aralia had an adherent calyx, erect ovules, with stamens opposite the petals, it would be a *Vitis*," Mr. Gulliver now shows that the addition also of raphides to an *Aralia* would be required to make it a *Vitis*.

The departure of *Rhaganus* from the true structure of a *Vitis* is a curious fact in favour of the value of the raphidian character, for *Rhaganus* has lately been separated on other grounds, by Bentham and Hooker, from Vitaceæ.

Of Hæmodoraceæ Mr. Gulliver has examined fragments of species of Lindley's three subsections, and finds raphides abundant in Hæmodoreæ and Conostyleæ, but wanting in Vellozieæ; an interesting observation when we recollect that Don proposed to make an order of the Vellozias, but which Lindley well declared would be premature till their structure and that of the bloodroots had been thoroughly investigated.

In the December number of the 'Annals' Mr. H. J. Carter has some remarks on Professor Clark's paper "*On Peridinium.*" He considers that Professor Clark is mistaken in supposing his animalcule to be a *Peridinium*. It is, he states, *Urocentrum Turbo*, of Ehrenberg. He further observes that Professor Clark "has confounded two kinds of Infusoria, which, although extremely alike, belong, one to the animal, and the other to the vegetable, side of the imaginary (?) line which divides the two great kingdoms of organized beings." In fact, the deductions as to the animal nature of the *Péridinens* which Professor Clark seeks to draw from his researches do not apply to these beings, since the Infusorian he examined was not a *Peridinium*, but a *Urocentrum*. This does not, however, detract from the value of Professor Clark's observations.

Miscellaneous.—An ingenious device for *a growing slide* is given in 'Silliman's American Journal of Science' for September, 1865, by H. L. Smith, of Kenyon College, U. S. The "slide" consists of a rectangular glass cell 3 × 2 inches, and about $\frac{1}{25}$th inch deep. A small hole is drilled in the cover, which is closely fitted and cemented to the cell, excepting at one corner, which is cut away so as to allow the introduction of water into the cell by a pipette. The living object which it is desired to keep supplied by fresh water is placed near the small hole drilled in the cover, and it and the hole are both covered by a piece of thin glass. As the water in which the object is placed dries, more is absorbed by capillary attraction from the cell through the small hole. The cell will need replenishing (through the larger hole left by the cutting away of the corner of its cover) but once in three days. This simple little appliance seems to be a very valuable addition to microscopical apparatus.

NOTES AND CORRESPONDENCE.

Count Francisco Castracane's New Method of Illumination.—Will you allow me to offer a few remarks on the letter referring to a new mode of illumination by Count F. Castracane, which appears in the last number of the 'Quart. Journ. Mic. Sci.,' especially with reference to the diatoms on which it is desirable to test the powers of the new method of illumination. It is perfectly true that a few years ago *Pleurosigma angulatum* was recommended as a valuable test object for good objectives; but it, like the scales of Podura, is now scarcely recognised as a test for the best $\frac{1}{4}$-inch and higher objectives of large angular aperture. You very properly observe in your foot-note *P. angulatum* is now recognised as very easy of resolution. I beg to suggest to Count F. Castracane the desirableness of his trying experiments with all or any of the following diatoms, the striæ on which are much more faint and close than are those of *P. angulatum*, and the proper resolution of which is a severe test, not to $\frac{1}{5}$ths and $\frac{1}{8}$ths only, but to objectives of even higher power.

If the monochromatic mode of illumination suggested by Count F. Castracane enables him to resolve with moderate distinctness the markings on *Pleurosigma arcuatum, Donkinia carinatum, D. rectum, D. minutum,* its adoption would be of great service to all microscopists who are interested in the study of Diatomaceæ.

I have endeavoured, but unsuccessfully, to resolve the markings of the diatoms just enumerated, and have used an excellent $\frac{1}{5}$th with Nos. 1 and 3 eye-pieces and draw-tube. *Pleurosigma angulatum, Foxonidea insignis, Pleurosigma lanceolatum,* and other finely marked diatoms, are easily resolved by the appliances I have at command; but the other forms named baffle all my endeavours to resolve them.

I shall be most happy to supply Count F. Castracane with specimens of all the Diatomaceæ I have named, gathered from the Northumberland coast, either mounted ready for inspection or prepared in readiness for being mounted. No address is given in connection with the count's letter; I therefore beg you will grant me this mode of addressing him.—T. P. Barkas, Newcastle-on-Tyne.

[We have received a communication from Mr. Barkas, in which he says that since forwarding his note relative to Count F. Castracane's new method of illumination he has succeeded in resolving the striæ in *Donkinia rectum*, *D. carinatum*, and *D. minutum*, with the appliances named in his paper, but that the lines are exceedingly faint and difficult to detect.—Count F. Castracane, "Rome."—*Ed. Q. J. M. S.*]

On Cleaning Glass Tubes.—I have just been reading the communication of Mr. Wenham in the October number of your Journal, and certainly felt great surprise in learning the marvellous effects of passing a metal wire through a glass tube, the more so as I have for years been in the constant daily habit of cleaning my tubes precisely in the manner described without in a single instance observing the result mentioned. I use glass tubes with an internal diameter of say $\frac{1}{8}$th and $\frac{1}{16}$th of an inch. These are used to draw from the test-tubes the supernatant water in cleaning diatoms, and are afterwards most carefully cleaned by being first washed out and then having a pellet of cotton-wool forced through the bore by means of a metallic knitting-needle. This practice I have followed constantly for upwards of ten years, and have never experienced the bursting and cracking recorded by Mr. Wenham. I need scarcely say that the wire came in contact with the tube as frequently as not. Possibly the phenomenon mentioned in Mr. Wenham's paper may be only produced in tubes of larger diameter and stouter glass. It is nevertheless very strange I should never have witnessed it in the small ones.—Geo. Norman, Hull.

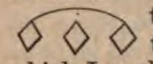
Collins's Binocular Dissecting Microscope.—This is a cheap, handy, and convenient instrument. We would particularly allude to the great advantage of binocular vision for low powers in dissecting; and to the superiority of this little instrument over others at present employed, on account of its portability and great efficiency when in use. The case, when closed, measures 6 in. by $3\frac{3}{4}$ in. The top and front let down by hinges, and on them can be fitted the instruments requisite for dissecting, as shown in the diagram. The sides draw out 5 in., and serve the purpose of rests for the hands. A circle of glass is in the centre of the gutta-percha trough, so that light can be transmitted from the mirror. Altogether it is the best and most useful instrument we have seen.

It is made by Mr. Charles Collins, 77, Great Titchfield Street, Oxford Street, from the plan of Dr. Lawson, Professor of Histology at St. Mary's Hospital.—*Lancet.*

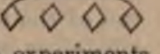
Note on Binocular Vision.—I have made what I consider a very important observation, and one which, so far as my reading is concerned (which is rather extensive on subjects of this kind), is new. I scarcely dare call it a discovery.

In order to explain myself, I will relate a few observations which I made about thirteen years ago, when stereoscopic science was in its infancy. I must premise that for many years past it has been an uncontrollable habit of mine to converge the optic axes of my eyes upon any two objects of whatever kind, similar or dissimilar. The following experiments, made, as I said, thirteen years ago, astonished me amazingly.

I laid myself on my back, with my head directly under a cane-bottomed chair, looking towards the ceiling of the room. I combined the two contiguous openings, when a beautiful example of solidity and lustre was produced; but when I combined one opening with the second from it, thus,



the bottom of the chair instantly separated into two distinct planes, the one the natural distance, which I could touch with my finger, and the other removed to a considerable distance. But the strangeness of the thing consists in this, that the holes of the more distant ones were apparently double the size of the nearer ones, and the whole

plane expanded likewise to double the size. The effect was still more striking when I superposed each third.

In the latter case the size of the holes was colossal. When I say I have performed 1000 experiments in this direction, I do not in the least degree exaggerate.

Tending to the same point were experiments made in taking stereoscopic pictures with one camera (single). If I take two landscapes without moving the camera, *i. e.* at the same angle, and combine them in the stereoscope, all objects near at hand and afar off are projected upon the same plane, so that a person standing, say fifty yards from the camera, and say fifty yards nearer than a house, he seems in absolute contact with the house, and therefore, of course, immensely large. The same experiment succeeds, though not so strikingly, by taking two cartes de visite from the same negative, and superposing them in the stereoscope.

On the contrary, if two pictures be taken of the same view and of not very distant objects, at a large angle, say ten or twenty yards, the combined picture, instead of being a true representation of nature, is nothing more than a small model, and the nearest objects almost seem to touch the nose. The conclusion, therefore, to be drawn from these experiments is this—*the larger the angle the nearer the objects, and the smaller;* and, conversely, the smaller the angle the more distant the objects, and the larger they are. This I have proved in innumerable instances, and in no simpler way than the following:—Frequently, when I am reading the services of the Church, my eyes almost touch the words, then the words are extremely minute; but instead of being apparently on the surface of the paper, they are suspended in the air, about midway between the surface and my eyes, and surrounded with intense lustre. If, without converging the optic axes, I shut one eye and look at the letters with the other near, they are, of course, magnified in proportion to nearness. Besides, if I take a pair of stereoscopic pictures, and make a very sudden effort at superposing them, instead of getting the usual effect, the combined picture is suspended midway in the air, and, as I said before, almost buried in lustre.

And now to the microscope (the binocular). When the rays from the object emerge from the left-hand tube (enclosed) they do so at a great angle, and therefore, according to what I have shown, the picture is formed near the eye, and comparatively small, notwithstanding the magnifying power of the glass. If the left-hand eye-piece be brought to a state of nearer parallelism with the right-hand or vertical one, the angle of emergence will be diminished, and the picture will be thrown further from the eye, and be very largely increased in size. The picture no longer seems to touch the end of the tube, but is formed far away from it. The effect altogether is to me astonishing.

I proceed in this way:—I use the second pair of eye-pieces with the 1-inch objective. I draw them as far out of the tube as they will bear, to hold, and, as they fit rather loosely, I grasp the two eye-pieces with my left hand, and bring them as parallel as I can, when the picture will instantly start off to a great distance and become magnified; and if the left-hand eye-piece is moved backwards and forwards, *i. e.* from left to right, &c., the image will alternately approach and diminish, and recede and enlarge, in a strange way.

This is a subject which requires both physiological and mathematical investigation. For the absolute truth of the principle I can vouch.—Rev. J. Maynard, Cape of Good Hope.

At a soirée given by the Professors of University College on the 14th instant we had an opportunity of seeing the application of a new mode of illumination of opaque objects, when viewed by high powers, in an instrument exhibited by Messrs. Smith and Beck, and in one shown by Messrs. Powell and Lealand. The illumination was, we believe, effected in the same way in either case, although in Messrs. Smith and Beck's instrument the object-glass was $\frac{1}{5}$th, and in Messrs. Powell and Lealand's $\frac{1}{12}$th. The effect was marvellously beautiful, and the definition of the object (the scales of some Coleopteron) remarkably good and distinct. The way in which this successful result was brought about is remarkably simple, consisting simply of a piece of thin plate glass introduced into the lower part of the tube, immediately above the object-glass, and placed in an oblique position, so that rays of light impinging upon its under surface, and received through a small lateral opening, and thrown down through the object-glass, and of course concentrated in the focus of the latter upon the object, whilst the transmission of the magnified image is not appreciably interfered with by their passage through the thin glass reflecting diaphragm. In the American contrivance for the same purpose the light is thrown down in the same way by a metallic reflector, which covers about one half of the object-glass, and thus, of course, destroys at least half of the illumination. The contrivance above described, we believe, was hit upon about the same time by the two celebrated firms we have named.

PROCEEDINGS OF SOCIETIES.

Microscopical Society.

October 11*th*, 1865.

James Glaisher, Esq., President, in the Chair.

Mr. Roper read a communication received by him from the Royal Society of Tasmania, and added that copies of the "Transactions" of that Society had been transmitted and would be placed in the library.

The Secretary stated that there were no papers to be read. He also announced the resignation of the late Curator of the Society, and the appointment of Mr. Evans to that office. The members were requested to return to the Secretary all books, &c., belonging to the Society, in order that a proper account might be taken of the Society's property. With reference to papers to be read at future meetings the President suggested that he should be informed beforehand of their subjects, so that notice might be given in the 'Athenæum,' and otherwise, thus giving gentlemen qualified to discuss them the opportunity of coming to the meetings properly prepared.

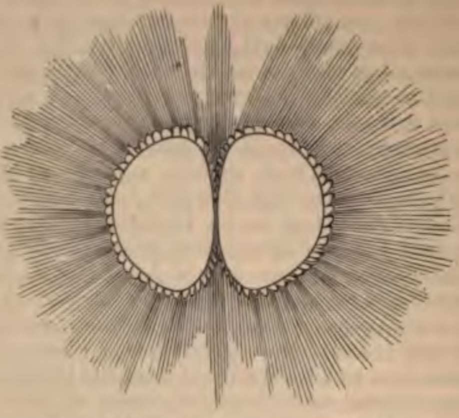
Mr. Ince called the attention of the Society to some diseased wheat from Droxford, Hants. It was grown on a field of three acres and three quarters, and the crop was so seriously damaged that the whole sold for only £6. He hoped by thus bringing the matter before the Society to elicit some information as to the nature of the disease in question.

Mr. Slack said—If I had known that there were no papers to be laid before the Society this evening, I would have brought and shown to the Society the new form of spectroscope I received, a few days ago, from Mr. Browning. I expressed at the last meeting a belief that the best spectroscope would be a direct vision one. I thought that looking round a corner was an inconvenient thing for microscopists to do, and if a spectroscope could be arranged to pull in and out with facility, and capable of being adjusted with nicety, it would be highly appreciated. Now Mr. Browning has been experimenting with Mr. Sorby for some time on a spectroscope which is being brought out, and I believe he calls it the "Sorby-Browning spectroscope." It is a few inches long, contains an eye-piece, and between the two lenses of the eye-piece there is an apparatus for adjusting the slit. You can adjust the slit in the usual way by a side screw, so as to get any amount of opening you like. You can further adjust a vertical shutter up or down the slit, so as to reduce the limits of the spectrum in that direction. That you can form a little cage in which small objects can be optically placed, and isolated from all surrounding objects. The prism fits on the top of the eye-piece, which carries the slit and other apparatus, and indeed very much in the same way in which you can put the analysing prism of a polariscope on the top of an ordinary eye-piece. By removing the prism or opening the slit you look through the two lenses of the apparatus which constitutes an eye-piece, through your object-glass, and see the object that you have in the field. You can then bring any portion you wish into the centre of the field, and adjust the dimensions of the field, if necessary, in two directions, and obtain your spectrum either by transmitted light, viewing the object as a transparent one, or by reflected light, viewing it as an opaque one. There is also a provision for sending a second beam light through the prism, it enters on one side, strikes against a little right-angled prism, and passes through the slit to the chief prism: thus you can easily get two spectra for comparison, at the same time, in the field. The general arrangement of the apparatus carries out the ideas that were expressed in this place, by Mr. Wenham and other gentlemen who have discussed this subject. Historically speaking, I believe the matter stands thus: To Mr. Sorby belongs the merit of introducing this kind of investigation, and he applied it at first exclusively to small quantities of fluids contained in cells. Mr. Huggins then sent in a paper which was read a meeting or two back, and Mr. Wenham made some special remarks on it. That paper and Mr. Wenham's observations called our attention to the importance of obtaining the spectra of opaque objects, and to the very curious fact that some mineral and other objects yielded mono-chromatic light, while others were deficient of the rays they might be expected to possess. I saw, and others who are here also saw, a card with a small drop of dried blood upon it, and I was told that Mr. Sorby had obtained an excellent spectrum from that object. Now, in this instrument of Mr. Browning's these things can be accomplished with very great ease; you take an infinitesimal quantity of blood, and you may either view it as an opaque object when dry, or as a transparent one, and you can immediately detect its characteristic spectrum. Remembering the hint of Mr. Wenham, I took a small quantity of fresh blood, and viewed it under Messrs. Smith and Beck's excellent $\frac{1}{25}$th. I isolated a single globule, closing the slit horizontally and vertically, so that there was no other globule in the field. I immediately got, as Mr. Wenham said we should get, a beautifully characteristic spectrum with the two distinct dark bands indicating blood. This form of spectroscope can be placed under the stage when it is required, but it is my present opinion that this will not be a very frequent mode of using the instrument. It appears to me that the plan of putting it on as an eye-piece would in the majority of cases be most convenient. When you have an ordinary-sized drop that would fall from a bottle of any such fluid as aniline-dye, you do not want an object-glass at all, as you get its spectrum clearly without. If you operate upon a good-sized drop you can do it very well with a three inch or two inch power; if you take a very small drop such a power as a three inch would be convenient, and with a smaller quantity you may work with as high a power as Messrs. Smith and Beck's $\frac{1}{20}$th, or even with Powell's $\frac{1}{50}$th. I found a very convenient mode of operation to be, to put a glass stage upon the microscope with a rim all round so as effectively to prevent corrosive fluids from running over, and, if I had one made on purpose, I should make the bottom rim stick up a little at an acute angle. If you take a little piece of glass tube and draw it out to the size of a needle and turn it round the corner, like the crook of an umbrella, you can hook up a small quantity of fluid and transfer to the glass stage a drop so small as to have no chance of falling down, and which will yet last several minutes without disappearing from evaporation. I find that in this way a series of minute experiments could be carried on with great facility. The union of spectroscope with microscope opens a most interesting range of inquiry, and not the least interesting result, in one point of view, will be the getting a better notion of what the colours of certain objects really are. It is well known that we can take two solutions which are very nearly alike to the ordinary eye and are perhaps undistinguishable by it, and yet the spectroscope discriminates them at once. I apprehend that when we view an object—a transparent or an opaque one, as the case may be—the spectroscope shows us precisely what our eyes would show us if they were more exact; and it is interesting to know exactly what rays are deficient in particular colours, and also to see how the application of small quantities of different reagents can effect such molecular or chemical changes as to change the spectrum.

Mr. Slack did not know, when making those observations, that some of the new spectroscopes were in the room.

The President announced that several microscopes to which the Sorby-Browning principle was applied were in the room for the inspection of the members.

Mr. Lobb gave an account of a vacation visit to Oakshott, near Leatherhead, in Surrey, and to Keston, near Bromley, in Kent. At Oakshott he had found in a spring on the heath great abundance of Closteria, with scarcely any admixture of other genera. The gathering was exceedingly pure. At Keston he had obtained Desmidiaceæ of almost every genera and species figured in Ralfs: among them he had discovered what he thought was a new species either of Cosmarium or Staurastrum; there was, however, a difficulty in deciding which. The frond has conic spines round the edges, each segment being full of granular endochrome, surrounded with thickly-set hyaline rays extending to some distance beyond the segments, similar to those of *Actinophrys Sol*, but far more



closely set together; between the segments the rays extend in a straight line, the frond having something of this appearance. Should it be a new species, Mr. Lobb thought it might not be inaptly named *Cosmarium radiatum*.

November 8*th*, 1865.

James Glaisher, Esq., F.R.S., in the Chair.

Jabez Hogg, Esq., F.L.S., read a paper entitled "Further observations on vegetable parasites, particularly those infesting the human skin." ('Trans.,' p. 10.)

Dr. Hunt said: Mr. President,—As Mr. Hogg has very kindly mentioned my name in connection with his paper, I take the liberty to rise for the purpose of making a few remarks upon it. The subject of skin diseases is not attractive to those who are not engaged in medical practice. It is one of those departments of nature which illustrates (and in a very important manner) certain laws of nature. I think in the paper read to-night there is involved a very important question, viz.: the question relating to that law of nature by which Providence prepares a remedy for all physical evils. Wherever there is a decay nature immediately prepares some animal or vegetable structure to remove the decayed matter. That we are familiar with from the carrion crow to the mites in cheese. We know that decay or even death cannot be, but there must be some animal or vegetable designed by Providence to carry away the dead or decayed matter. Now, from my experience in skin diseases I may say that they all tend to produce decayed matter on the surface of the body, and this matter is sometimes situated too deeply to be cleared away by ablution. Here Providence has prepared the parasite to eat it away or to be sown into, and, so to speak, nourish it away. Where the parasite is vegetable there is a soil produced; in that soil the parasite thrives, and it carries away the soil until at length, in many cases—the common ringworm for instance—though nothing is done to remove it, the whole soil is after a few years absorbed by the parasite, and the disease is cured by the parasite—cured by its own agency irrespective of the physician. Now, there is a tendency in all diseases to be cured by nature. There never was a fever or any other disease in which there was not to be found (if you would search for it) an effort of nature to remove that disease. We are apt sometimes to be blind to this; but, if we have anything to do as medical men, it is to find out what nature is doing to assist nature when she seems feeble, and to check her when she seems to be doing too much—for, strange to say, nature often does too much. Sometimes to relieve inflammation she produces gangrene; gangrene would destroy life, and therefore we must cut off the gangrene. Sometimes parasites do too much, and, as Dr. Tilbury Fox has rightly remarked, they produce disease; but they do not originate disease, for disease always originates them. I deny that the so-called new class of diseases called parasitic diseases are a class at all, and I demur to the term altogether. If the term means that diseases are produced by parasites I deny it *in toto*. The disease forms the *anides*, a soil or food for the parasite, and the parasite comes to feed upon it; the disease is there before, or the parasite could not be there. But then, if what is meant by "parasitic diseases" is that they are *not* diseases *produced* by parasites; that they are diseases attended by parasites, incidentally or accidentally, then I maintain that there is no distinction, for every disease is accompanied by parasites. There never was a disease of animal or vegetable matter that was not attended by parasites, or for which some parasite has not been prepared to carry away the results of the disease, and it is only because we shut our eyes to one half of nature while we are dreaming of the other half that we do not see these things plainly. It is a law of nature that Providence sends no evil in the shape of a disease for which it does not send the remedy; and, therefore, I am sorry to have observed that many clever men both here and abroad have taken upon themselves to say that there is a distinct class of skin diseases produced by parasites. They might as well say that there was a distinct class of eye diseases, of brain diseases, or nose, or any other diseases. These diseases, in common with all others, are attended with parasites, as may be frequently discovered by the microscope, which is nothing but a peep into nature. He concluded by stating that if any of the members were desirous of examining the parasitical products of skin diseases, he should be happy to afford them two or three hundred cases a week.

Mr. SLACK said—In some prolonged examinations of the vinegar plant made under various circumstances, I have found nearly all the forms of cells which Mr. Hogg has described as resulting from the spores or cells generated by certain peculiar forms of disease. I paid some attention to the development of these fungi, and I was exceedingly pleased to find so distinguished an authority making havoc among the numerous species of these minute bodies. I think it would not be without interest if the members would get so easily obtainable a thing as a vinegar plant, and, by growing it under different conditions, find these different cells all associated with a great quantity of bactrium cells as they appeared in one of Mr. Hogg's experiments. I think that experiment confirms the opinion I have expressed, that when a large quantity of bactrium cells are associated with yeast cells, the acetous fermentation appears to set in.

Dr. VARLEY explained the curative effect of carbonic acid gas in certain diseases, and detailed the method of application as pursued by himself and his late uncle.

The PRESIDENT, after some remarks on the importance of the microscope in pursuing medical inquiries, proposed a vote of thanks to Mr. Hogg and Dr. Hunt, which was carried with applause; and announced that the former had promised to present to the Society a number of specimens illustrative of his paper.

The PRESIDENT announced the receipt of a paper from Dr. Greville, on "New and Rare Diatoms." ('Trans.,' p. 1.)

DUBLIN MICROSCOPICAL CLUB.

May 18th, 1865.

Mr. Archer exhibited, from a gathering made near Enniskerry, a number of globular, densely spined bodies, with green contents, the spines very numerous, very slender throughout, and acute. These bodies were generally to be found distributed in pairs over the field, and they might easily at first sight be taken for so many zygospores of some Desmidian; but, much as such a structure resembled a possible zygospore, these bodies were not like that of any known Desmidian, nor was there any evidence in the gathering that they might actually be zygospores of any form not yet known in the conjugated state. Hence, but for an observation made by Mr. Archer on a previous occasion, the source of the curious bodies now exhibited would have been not a little puzzling.

In a gathering made (not, however, from the same locality) during last year, Mr. Archer had taken a quantity of the rather common Desmidian, *Penium digitus*, and a number of these showed, some individuals one, the majority two, and a few three, quite identical stellate bodies in the interior of each cell. These were evidently formed at the expense of the cell-contents of the individual Penium in which they occurred. Some of these showed the cell-contents partially absorbed, and the remainder dead and brown; whilst others did not exhibit a trace of the original contents, but contained the (generally) two stellate bodies, green and vigorous, one in each half of the old cell-wall of the Penium which still enveloped them. But afterwards these bodies might be found without the encompassing old membrane of the Penium, and usually distributed in pairs over the field.

Now, although in the present instance Mr. Archer was unable to trace back these spinous bodies to a Penium, their identity in appearance in every way, and the fact of their having been found distributed in pairs (as if left behind, as Mr. Archer had seen on the previous occasion, by the decayed or dissolved outer wall of the Penium), seemed to point out that, be their nature what it might, these bodies were in both instances one and the same thing, and that in the present instance, like the former, the spinous bodies exhibited owed their origin to *Penium digitus*.

These bodies were, in fact, the "asteridia" of the Penium, to adopt Thwaites' term as applied to the stellate bodies occurring within the cells of other Conjugatæ, and, like such similar bodies, must probably be regarded as parasitic growths. These, indeed, were altogether unlike the smooth, rounded, or irregularly shaped, opaque, brownish spore-like bodies, often seen in various Desmidiaceæ, whose nature continues equally problematical. In the present instance, in regard to these bodies, though with green cell-contents, like other asteridia, the fact of the cell-contents of the original Penium becoming mostly all absorbed—if not quite all absorbed, the residue becoming quite effete and brown—seems to speak for their parasitic nature.

But besides the spinous bodies, Mr. Archer likewise drew attention to a number of slightly smaller, globular, green and smooth cells lying over the field, in some of which a directly transverse well-marked light line could be seen, indicating a commencing self-division. A few of these bodies might be seen loosely invested by a colourless coat, externally covered by slender spines; these loose external coats stood off from the inner spherical, smoothly bounded bodies, the whole somewhat like the doubly bounded spores of *Volvox globator* before these assume the golden hue—that is, of course, excepting the fact that in the latter the outer coat, as is well known, is then destitute of spines. These loose outer coats permit the escape of the definitely bounded inner smooth cell by the rupture of the former by a large rent. After escape this body, in some measure, called to mind, as before mentioned, the still green inner spore of Volvox, or a very small specimen of *Eremosphæra viridis* (De Bary), but any one acquainted with these forms would at once recognise that it was neither the one nor the other that he had before him. It is possible that some of these smooth green bodies may have originated from the Penium, and never had a spinous coat developed. In a small form of Mesocarpus (which, not being conjugated, could not be identified) Mr. Archer had lately seen a number of minute stellate bodies ("asteridia") similar to those not infrequently seen in Spirogyra, but with fewer and longer spines. But what makes that circumstance more especially worth noticing is that he had observed the slipping out of the smooth inner cell from the spinous outer coat by a rent, and this taking place still within the joint of the Mesocarpus; he had not, however, noticed any evidence of any further growth or of a self-division. Be, then, the nature of these curious bodies in the Penium, in the Mesocarpus, or the more common similar growths in Spirogyra, what it may, it is at least highly probable that they are all analogous structures, and, in our present want of knowledge as to their true nature, they must remain "asteridia."

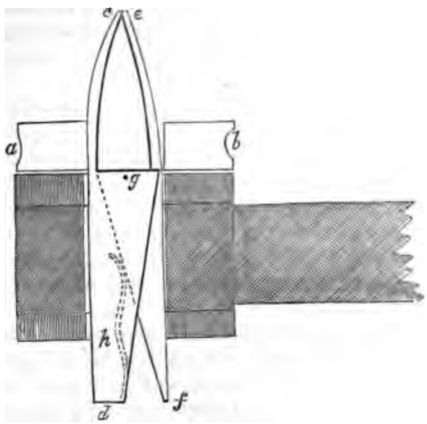
Mr. Archer likewise exhibited a Cylindrocystis (Menegh.) as yet undescribed, and for the purpose of comparison and contrast placed side by side therewith, under other microscopes, specimens of *Cylindrocystis Brébissonii* (Menegh.) and of *Cylindrocystis crassa* (De Bary), when the absolute distinctness of all three species was readily apparent; and not only was their distinctness striking when viewed microscopically, but the difference in their appearance in the mass to the unassisted eye was abundantly evident. The present plant Mr. Archer had as yet seen only in one locality, near Lough Bray, and there in several pools he had noticed it for three years past, but he regretted that, although he had annually taken specimens, he had not as yet been fortunate in finding this species conjugated. This plant formed a red stratum at the peaty bottom of the shallow pools, of some two or three inches in depth. It was greatly narrower and greatly longer than *C. Brébissonii*, the ends truncate, and a microscopical examination showed that its red colour was due to the tint of the cell-wall, and not to that of its contents. In this year's gathering it was mixed in some pools with *C. Brébissonii*, but these two very distinct plants side by side maintained their own characteristics absolutely. When Cleve's name, *Penium rufescens*, for a new species (in 'Öfversigt af Kongl. Vetenskaps-Akademiens Förhandlingar,' 1863, p. 493) first caught his eye, Mr. Archer imagined that the red colour rendered it likely that these two plants were the same, but an examination of the description and figure sets the point at rest—they are absolutely distinct, and could never be mistaken the one for the other; besides, Cleve admits the genus Cylindrocystis as distinct from Penium, thus precluding the likelihood of his describing the plant now exhibited (if, indeed, he had found it) under the latter genus.

Captain F. W. Hutton then brought under the notice of the club a small pair of forceps, manufactured for him by Messrs. Yeates and Son, 2, Grafton Street, Dublin, to be used in connection with Messrs. Smith and Beck's "opaque-disc-revolver."

He had found, when using the discs as supplied with the revolver, that great inconvenience resulted from having either to fasten the object on to the disc with some sort of cement, or else to place it in a drop of water to prevent its slipping off when the disc was inclined at an angle with the horizon. For practical working purposes both of these processes are very objectionable; the first on account of the time it takes and the trouble in changing the object, the second on account of many parts of the object being covered by a film of water with rounded surfaces, which completely alters its appearance, and also because when the object is under examination for some little time the water dries up and the object suddenly slips out of view, perhaps, in the middle of an observation.

To remedy this he asked Mr. Yeates last autumn to make a small pair of forceps to fit into the hole in the "revolver" like an ordinary disc, which he succeeded in doing, and which Captain Hutton had found to answer his purpose perfectly.

In construction it is very simple, and will be readily understood from the accompanying figure, which represents a section of the forceps drawn about four times the natural size, in order to make it clearer; the shaded portion representing that part of the "disc-revolver" into which the forceps fit, the unshaded part the forceps themselves.



a b Is a disc of brass of the same size and shape of the discs upplied by Messrs. Smith and Beck, a round hole of the same size as the hole in the "revolver" being drilled through the centre. *c d* Is an arm of the forceps fixed firmly into *a b*, and has a longitudinal groove cut in the inside, into which the movable arm *e f* fits, and turns on the pivot *g*. The lower part of the groove is occupied by a small spring (*h*) which keeps the points of the forceps closed.

The pivot should be placed below the disc so as to admit of the points of the forceps being brought as near as possible to the upper surface of the disc, and yet allow them to open sufficiently wide to be practically useful.

He found that if the points of the forceps project about an eighth of an inch above the disc the whole of an object held in them (except, of course, that part actually covered by the forceps) can be viewed with a $\frac{2}{3}$-inch object-glass without any difficulty.

The advantage of this little piece of apparatus will be obvious to any one who has fumbled for half an hour or more over a common pair of forceps, a pin, and a piece of cork, without, perhaps, in the end obtaining a good view of his object in the required position. But it has more important uses than simplifying manipulation, for it enables the same specimen to be viewed and drawn in any number of positions and aspects, while by the old method several specimens must generally be employed when different views are required, on account of the difficulty attending the taking of a minute and delicate object out of the forceps and replacing it in another position without damaging it, thus often, perhaps, leading to error.

Mr. Woodworth showed a considerable number of excellent photographs of microscopic objects on various enlarged scales; amongst these were tongue of cricket, saw of saw-fly, jaw of spider, butterfly scales, &c., &c. These all showed the minute structure beautifully. Mr. Woodworth stated his intention to continue his experiments in this direction.

Dr. Moore showed illustrations of Dr. Seemann's characters for distinguishing the British, Canary, and Asiatic species of ivy, by the hairs on their calycine segments and petioles of the flowers. The common ivy, with its varieties, were shown to have the hairs with eight rays, which is very constantly the case. The hairs on *Hedera Canariensis* have as constantly from eleven to fifteen rays; whilst the Asiatic ivy, *Hedera colchica* (Koch) has the hairs on the calyx and pedicles in two-lobed scales, each lobe having from seven to ten rays. Dr. Moore, however, stated that he could not reconcile his views with those expressed by Dr. Seemann, in considering the large-leaved ivy, cultivated as *Hedera Rægneriana* in gardens, and the very rare, small-leaved, yellow-fruited one from the Himalayan Mountains, *Hedera chrysocarpa* (Wallich), being states of one species.

Dr. Moore drew attention to the rapid growth in the Victoria Tank, in the Botanical Garden, of a species of Spirogyra, seemingly *S. longata*. In eleven days, since the tank was filled, this plant had covered surfaces of many feet.

Mr. Archer further exhibited some rare minute algæ, amongst which were *Œdogonium Itzigsohnii* (de Bary) in fruit (*vide* de Bary, 'Ueber die Algengattungen Oedogonium und Bulbochæte,' p. 56, t. iii., f. 29-32). This minute species Mr. Archer had picked up several times, and often showing its peculiarly-lobed oogonium, but he had never found the male fructification; he believed the plant must turn out to be a diœcious species; he had sometimes noticed a minute notch-like depression on the upper outer margin of the oogonium, probably indicating the "micropyle." He drew attention to the character, not adverted to by de Bary, that the apical or terminal joint of the filament possessed a short acute spine or mucro. This, in old plants, frequently is not to be seen, as the terminal joint, or, indeed, considerable portions of the filaments, often become detached, and chiefly in a young condition only are the plants found entire.

Mr. Archer likewise showed specimens of *Leptocystinema Kinahani* (ejus). This well-marked plant he had but once found since he ventured first to describe it ('Proceedings of the Dublin University Zool. and Bot. Association,' vol. i, pp. 94, 105; also Nat. Hist. Review,' O.S., vol. v, p. 234.) The present specimens were gathered by Captain Hutton on a late visit to the County Donegal, and kindly given to him by that gentleman. Mr. Archer had never seen this plant conjugated, but, beyond doubt, it must so reproduce itself, and it would be interesting to note any minor peculiarity which it might present during that process.

There was also shown by Mr. Archer the form called *Pleurococcus superbus* by Cienkowski (see 'Botanische Zeitung,' No. 3, Jan., 1865, p. 21). He likewise exhibited *Ophiocytium apiculatum* (Näg.) and *Polyedrium tetraedricum* (Näg.).

June, 15th 1865.

Dr. Moore exhibited a Sirosiphon=*Hassallia compacta* (Hass.).

Dr. Moore also showed specimens of *Chroolepus Arnottii*, obtained by Admiral Jones in Scotland. Dr. Moore had himself taken this plant in Ireland, but he regarded it as very rare.

Mr. Archer mentioned that Admiral Jones had kindly given him a specimen of the plant shown by Dr. Moore. Mr. Archer had never met it near Dublin, and could only refer it to Chroolepus, but was afterwards informed by Admiral Jones that it was *C. Arnottii.* In looking over the specimens Mr. Archer thought he could perceive the torulose filaments formed by this plant to be accompanied by slender cylindrical filaments, attached to the former, and apparently of the same nature as those appertaining to *Chroolepus ebeneum.* Now, in this latter Mr. Archer was quite disposed to regard these accompanying filaments as part of the organization of the plant, as he had mentioned at the meeting of the club on the 19th January last; and it seemed to him at least probable that here, too, they bore a relationship to the torulose filaments corresponding to that of the similar threads in *C. ebeneum;* that is, that *C. Arnottii* may be, in truth, when found in fruit, proved to be a lichen, the slender accompanying threads representing the fibrous element in a typical lichen, and the torulose filaments themselves, here the marked and conspicuous part of the plant, the gonidial element. This, of course, until one or both of these plants be found in fruit, is but a conjecture, but one not without foundation, as Cœnogonium, in its fruit a true lichen, is quite as aberrant in its thallus, the structure of which latter seems essentially to agree with that of the plant under consideration.

Dr. Moore exhibited the seeds of *Disa grandiflora* by reflected light. The reticulated outer skin of these formed very pretty objects.

Mr. Archer showed fine specimens of *Sciadium arbuscula* (Al. Braun) new to Ireland. This remarkable little alga had been recorded from several localities on the Continent, but only once before in Britain. The record in Britain was founded on three minute imperfect specimens, discovered by Currey in a pool on "Paul Cray Common," in Kent ('Quar. Journ. of Mic. Science,' Vol. VI, p. 212); but although those specimens were not fully developed, they were quite enough to determine the plant. The specimens now exhibited showed the most varied stages of growth, from a simple, nearly cylindrical cell, mounted on a slender peduncle, by which is was attached (and in this stage it might be readily mistaken for a Characium), up to a complete tree-like structure, with tertiary umbels. Very frequently the cells were very elongate, and sometimes considerably curved, in this respect unlike the figures given by Braun in 'Algarum unicellularium genera nova et minus cognita,' t. iv. But in length and breadth, and in general outline of the cells, in the different specimens great variety occurred; and Mr. Archer thought that there was no ground for assuming more than one species, although Braun had described three forms as distinct (loc. cit., pp. 106-7). There is undoubtedly great affinity between Sciadium and Ophiocytium, a young Sciadium, if detached before forming the first umbel, being very like some individuals of *Ophiocytium apiculatium* (Näg.). But no plant of Sciadium presented itself so much curved as is the case in Ophiocytium (in which the cells are mostly spirally contorted, often forming many coils); not to speak of the umbellate mode of growth of the former, by the gonidia remaining in the form of an umbel at, and becoming developed around, the opened apex of the parent cell, and in the latter the gonidia becoming wholly free and developed as separate, isolated individuals. These specimens were taken in a pool near Bray, and were attached chiefly to *Œdogonium tumidulum* and to *Vaucheria.*

Dr. E. Perceval Wright exhibited the dental apparatus *in situ* of a tubicolar Annelid, which in all probability is the *Nereis tubicola* (O. F. Müller), as described in 'Zoologia Danica,' but which does not belong to the genus Onuphis (Milne-Edwards). The teeth are like those commonly met with in that section of the family Eunicea distinguished by having teeth, and they consist of a pair of sickle-shaped and three pairs of serrated horny teeth, in addition to a pair of well-developed teeth containing carbonate of lime.

Dr. John Barker showed fine examples from a copious gathering made in the Phœnix Park of the always beautiful *Volvox globator*.

Mr. Archer wished, while Volvox was before the meeting, to mention that he had lately made some observations on the amœboid condition of the gonidia of this organism, largely confirming Dr. Hicks's interesting statements.

Mr. Archer then exhibited fine and beautiful fresh examples of *Mougeotia glyptosperma* (de Bary) in every stage of conjugation, from the first approach of the parent filaments up to the fully formed and remarkably grooved zygospore. He showed de Bary's figure of this plant ('Untersuchungen über die Familie der Conjugaten,' t. viii, figs. 20, 21, 22, 23, 24, 25); also living conjugated examples of *Mesocarpus parvulus* and *M. scalaris*, in order to draw attention to the distinctions between *Mougeotia glyptosperma* and the latter—distinctions surely correctly regarded by de Bary as of generic value. This plant, as accurately identified, must be called new to Britain; but it is not impossible that it may have been before met with, and recorded under the name of *Mesocarpus intricatus*; but Mr. Archer had never seen authentic specimens of the plant known by the authorities under the latter name. Professor de Bary does not himself seem to have seen living examples of his *Moug. glyptosperma*, as his descriptions are drawn up from dried specimens from Professor Alex. Braun's herbarium; therefore it would seem as if this plant must be accounted rare. But the present remarkably pretty plant, as De Bary well points out (loc. cit.), is not truly a Mesocarpus, but in its mode of conjugation more nearly approaches certain Zygnemata. In a systematic point of view, it presents double affinities, but it is nevertheless *per se* at once readily and unmistakably distinct, especially when seen conjugated. It is, no doubt, related, on the one hand, to Mesocarpus (Hass.); like it, the endochrome forms a compressed longitudinal band, and like it, too, the zygospore is formed half-way between the two conjugating joints. But it is distinguished strongly by the fact that here the whole cell-contents, "primordial utricles" and all, of the two conjugating joints, completely coalesce, leaving the old cell-walls wholly empty, in order to form the zygospore; whilst in Mesocarpus the contact of the "primordial utricles" of the two conjugating cells is not followed by a complete coalescence of the two into the zygospore, but, by a concentration of the principal part of the green and solid contents ir [illegible] necting canal half-way between the two joints, and the shutting off thereupon of the residue of the pale granular contents remaining in each parent joint, the denser central portion becoming the spore, and that cut off on each side eventually becoming effete and lost. Hence, in *Mougeotia glyptosperma* (de Bary) the spore is the actual result of the complete fusion of the entire cell-contents of the two conjugating joints—it is the true zygospore; whilst in Mesocarpus the ultimate spore is a daughter-cell, as it were, of the zygospore. Therefore, on the other hand, the present plant shows an affinity to Zygnema; but it is, of course, completely distinct in the flattened band of endochrome, not doubly stellate, as in that genus—not to speak of the extremely different comparative length of the cells, which, within the limits of each, is constant. The complete emptying out of the conjugating cells in this plant imparts a peculiar smooth, almost shining appearance to the filaments, which, coupled with the curious elliptic, grooved, and ridged spores, gives this plant, in this state, a very pretty appearance. The peculiar keeled form of the spore just alluded to can hardly be regarded as more than of specific importance. Other forms of the genus may present themselves possibly without this character, and the genus must rest on the peculiar plan of conjugation. Mr. Archer thought it was to be regretted that Professor de Bary had revived the name "Mougeotia" in a new sense, as it may lead to confusion, he having proved that *Mougeotia genuflexa* (Ag.) is properly to be regarded as a Mesocarpus. In fact, when the genus now drawn attention to is mentioned, in order to avoid ambiguity it must be written Mougeotia (de Bary, non Ag.)—Mougeotia (Agardh) being in part equal to Mesocarpus (Hass.), de Bary. The differential character of the two genera were well exemplified by the specimens exhibited, contrasted with *Mesocarpus scalaris*, which species, so far as it goes, agrees with *Mougeotia glyptosperma* (de Bary) in having an elliptic spore, and in both the longer diameter thereof running at right angles to the conjugating joints. But, notwithstanding these resemblances, no one could examine them even for a moment without at once perceiving that they were quite specifically distinct, though they might at first sight, perhaps, be thought to be of the same genus. But in this regard, too, a brief inspection would show, as above detailed, that the characters appertaining to each were of abundant importance to separate generically Mesocarpus (Hass.) from Mougeotia (de Bary, non Ag.).

Mr. Archer laid on the table a number of very rare Desmidiaceæ which he had lately been so fortunate as to encounter. The rarest was *Staurastrum pungens* (Bréb.), new to Ireland. This pretty little gem has only two localities mentioned by Ralfs, but it is recorded by de Brébisson at Falaise and by Bailey at New York. The present specimens were taken from a pool at the margin of "Callery Bog," top of the "Long Hill," near "Sugarloaf" mountain. The spines were finer and rather longer and not quite so divergent as in the figure in Ralfs, but there could not be a doubt but that the present plant was the same species.—Another rare form was *Staurastrum oligacanthum* (Bréb. in herb.); this, however, Mr. Archer had once gathered here before. The present specimens came from the same pool as *St. pungens. Staurastrum oligacanthum* is an unpublished species of M. de Brébisson's; that skilled algologist had sent specimens and drawings thereof to Mr. Archer a couple of years ago. Of the identity of the present plant with the French specimens there could be no doubt, nor of the species being in itself exceedingly well marked and quite distinct. He supposed it would be presently figured and described.—Another rare species exhibited by Mr. Archer was one he was inclined to regard as *Staurastrum* (*Phycastrum*) *Griffithsianum* (Näg.); of this form he, of course, had never seen authentic examples, and he had long been disposed to regard *Phycastrum Griffithsianum* (Näg.) ('Gattungen einzelliger Algen,' p. 128) as identical with *Staurastrum spongiosum* (Bréb.). But *Staurastrum spongiosum* (Bréb.) occurs, too, as a somewhat great rarity near Dublin, and, comparing the present plant therewith, especially in the end view (best seen in an empty frond), it seems to agree much better with Nägeli's figure (op. cit. t. viii, c. 2). In *St. spongiosum* the end view shows the sides convex, the spines evenly distributed, whilst in *St. Griffithsianum* there is a somewhat deeply rounded concavity, destitute of spines at the middle, on each side. These two seem, therefore, distinct. Their rarity, however, prevents a due examination and comparison.—Mr. Archer also showed specimens of *Closterium prælongum* (Bréb.), this being, so far as recorded, the second time it had occurred in this country. On the first occasion it was met by Mr. Dixon in a stream running into the Grand Canal near the city, mixed amongst attached filamentous algæ (*Bangia atropurpurea* and *Ulothrix zonata*), but exceedingly sparingly. The present specimens occurred amongst Spirogyræ and other Closteria in a ditch close beside the Royal Canal, also near the city. The examples now found were not quite so long as those which presented themselves on the first occasion, nor as De Brébisson's figure ('Liste des Desmidiées observées en Basse-Normandie,' t. ii, 41), but this notwithstanding they both represented one and the same species, one exceedingly elegant and well characterised.

Mr. Archer likewise laid on the table fine examples of *Coleochæte scutata* in all stages of growth, from young plants of two cells up to the largest discs, the latter showing the oogonia fully developed.

July 20*th*, 1865.

Mr. Archer showed a large Œdogonium, which he felt inclined to regard as exceedingly closely related to, if not identical with, Vaupell's *Œdogonium setigerum*, described in his 'Iagttagelser over Befrugtningen hos en Art af Slægten Oedogonium.' It seemed, however, so far as Mr. Archer could judge, to become a question whether this plant might not be identical with Pringsheim's *Œdogonium apophysatum*, described in his 'Jahrbücher für wissenschaftliche Botanik' (i, p. 71). Pringsheim does not, indeed, describe his particular plant in all its details, as Vaupell does, but the characters, so far as given, seem in the main to coincide. But opposed to this supposition is the consideration that Vaupell, when he wrote, must have had Pringsheim's memoir before him. The plant now exhibited had been found for three successive years in the same pool, in the "Featherbed Bog," and last year Mr. Archer had been disposed to regard it as *Œdog. apophysatum* (Pringsheim), but he had not then seen Vaupell's memoir. With the plant described and figured by the latter writer, so far as Mr. Archer had been able to see the characters, the present one best accorded; yet it disagreed in other points, which if, indeed, but comparatively of secondary importance, were yet sufficiently striking. The plant now brought forward has egg-shaped oospores; the oogonium opens about the middle by a lateral aperture, which is minute, and bounded by a slight but evident projecting rim; fructification "gynandrosporous;" dwarf male plants elongate, somewhat curved; always seating themselves near the lower end of the cell, immediately beneath the oogonium, and with "foot" and "outer" antheridium; antheridium one or several-celled.

Now, all this accords so closely with Pringsheim's description that one might be justified in taking it as the same plant. But so far as the characters mentioned are concerned, and comparing them rather with Vaupell's figures, this plant seemed best to agree with the latter. However, as Pringsheim is silent upon some points in connection with his plant upon which, in regard to his own plant, Vaupell dilates, the question as to the identity of the two is not rendered more certain. And in regard to the plant now exhibited, the difficulty is enhanced, as it is precisely the very points referred to by Vaupell that could not in the present instance be accurately made out. Vaupell describes the mother-cells of the androspores as forming nearly square or quadrate joints of the filament, and in direct succession, mostly four to eight, but sometimes as many as eighteen, which are separated by thick-walled septa; thus, as it were, as if an enlarged sporangium had become many celled. The lateral walls are described as of various thicknesses, indicating that they are developed both from "sheath-cells" and "cap-cells," the lowest of the series being always a "sheath-cell," the highest a "cap-cell;" whilst some of the intervening cells may be, he thinks, formed without the (circumscissile) bursting of the parent cell, characteristic of ordinary growth. The androspores find their way out of these cells by a minute parietal aperture, not by a dehiscence. Now, the origin of the androspores is a point not dwelt upon by Pringsheim, as especially regards his *Œdogonium apophysatum*.

In Mr. Archer's plant instances of such series of quadrate cells were frequent, but in no instance were they found empty, nor could he see any indication as to which he would feel at all satisfied that in his plant these peculiar cells were the mother-cells of androspores. Yet it is probable they may have been, for, although he had not been able to perceive the origin of the androspores, the dwarf male plants were present in abundance, and the androspores from which they were produced must have originated somewhere, although this was, unfortunately, failed to be made out.

Again, Vaupell lays great importance on the terminal hair-like prolongation to the filaments, and he names his plant *setigerum* accordingly. Now, this character is one met with in other forms, and Pringsheim attaches little weight to it, and Vaupell himself mentions (loc. cit., p. 20) that even in his plant they were not always, but only mostly, found. Perhaps, however, like the terminal mucro, which in *Œdogonium Itzigsohnii* (de Bary) is certainly a special character, and seemingly always present in young plants (as pointed out by Mr. Archer at last meeting of the club), it may often become detached, and thus many of the filaments seem as if destitute of this prolongation. But be this as it may, and its presence or absence worth what it may, in the plant now exhibited it may be most safely said that it does not exist at any time, which circumstance, so far as it goes, serves to remove it from Vaupell's. And the presence or absence of these hair-like attenuated prolongations may, perhaps, be of more value than Pringsheim supposes, inasmuch as Vaupell believes that the vegetative growth of this part of the filament follows another plan from that of the ordinary Œdogonium-plant, in that here, he says, the growth is like that of ordinary Conferveæ, and that no "cap-cells" exist. If this be true, these hair-like prolongations exhibit a perhaps noteworthy differentiation of structure from the rest of the plant.

With the foregoing exceptions, the present plant seemed quite to agree with Vaupell's plant, the form, structure, and position of the dwarf male plants being alike, as well as that of the antheridia, spermatozoids, and oogonia. Two oogonia sometimes occurred, indeed, in direct succession.

By a fortunate coincidence, Mr. Archer was able to place on the able living fruited examples of some other species of Œdogonium, as to which he thought no doubt could exist as to their identity with certain of Pringsheim's species, though he had unfortunately been unable to preserve any specimens. These were *Œdogonium tumidulum*, *Œ. gemelliparum* (?), and *Œ. Braunii*. He was unable to lay hands on *Œ. echinospermum*, though he had met with it lately. He took the opportunity to mention that he had lately taken an Œdogonium which he could not but refer to *Œ. Rothii*, which presented the peculiarity of the oogonia being developed in direct succession to the number of eleven and lesser numbers. Although the number of *eleven* was not infrequent, it was perhaps singular that he had never once seen a greater. This peculiarity gave the filaments a remarkable and exceedingly pretty moniliform appearance.

In continuation, Mr. Archer dilated at some length on the characters which seemingly hold good as specific marks in this interesting genus, thanks to Pringsheim's masterly researches; expressing his regret likewise that authors continue to describe species on the false characters of length and breadth of cells, and such like. It would seem far better wholly to omit them from descriptive works than to insert these spurious species, or at least, species some of which may be good, though inadequately characterised, owing to the real, though more recondite, specific characters being ignored. It is to be regretted that Rabenhorst's in most respects so exceedingly valuable work, 'Kryptogamen-Flora von Sachsen,' &c., is, as regards this genus and Bulbochæte, no exception to this fault. But, in expressing this opinion, Mr. Archer would not wish to be supposed to hold the characters deducible from the comparative dimensions of the joints in this genus to be quite valueless. Within certain limits, and in a secondary point of view, they are doubtless of importance, although here, as is well known, varied comparative dimensions of cells occur in one and the same filament. For instance, even any isolated joint from a barren filament of the present plant could never be supposed to belong to, nor be mistaken for, a joint of *Œdogonium Itzigsohnii*. The former is amongst the largest, both in length and width (which, indeed, vary amongst themselves within their own limits); the latter is amongst the smallest, the joints not varying greatly in width, which is always very slight.

Mr. Archer would quite coincide with Professor Pringsheim's opinion, that the genus Psichohormium (Kützing) was likewise founded on false characters, and that the mineral incrustation of the filaments on which this genus was founded, is, as a character, quite untenable. He thought *Œdogonium tumidulum* very prone to this condition; and it does not seem impossible that other forms not belonging to Œdogonium might acquire this extraneous coating, and so be by Kützing placed under his false genus Psichohormium.

In two places in his beautiful memoir Professor Pringsheim promises to give a more detailed systematic description of the species known to him of the two genera Œdogonium and Bulbochæte, and it is greatly to be wished that he should redeem that promise; however, what he has given beautifully shows the plan which should be followed in studying these forms; and though they are more recondite than those superficial characters usually had recourse to, he has shown us the points upon which the true specific characters seem to depend, albeit one must trust to mostly a rare good fortune in finding the specimens in the condition in which those characters are fully displayed.

Mr. Archer exhibited specimens of a Desmidian which, as far as he was aware, had not been found in Ireland—*Cosmarium curtum*

(Ralfs) = *Penium curtum* (Bréb.). Mr. Archer had but once before seen living specimens, and they were brought by Mr. Crowe from Wales. The present specimens occurred in considerable quantity by the road-side in a little shallow pool—almost a puddle—close by the foot-path just before you come to the bridge over the Dargle-River on the road between Bray and Enniskerry. This very habitat might indicate that this species may be more common with us than might at first sight appear; occurring where one might almost least expect to find it, and far removed from the situations where other Desmidiaceæ abound, it may be overlooked. Alex. Braun, in his 'Rejuvenescence in Nature' (p. 203, note), adverts at some length to this pretty species, and he blames Ralfs for placing it in the genus Cosmarium, remarking that a regard to the arrangement of the cell-contents should have saved him from the error of placing it in that genus, and not in Penium, to which Braun thinks it properly belongs. But if the endochrome being arranged in fillets (radiately in end view) should remove this plant, notwithstanding its possession of a distinct constriction dividing the frond into two segments, from Cosmarium to Penium, the same reason should hold good as regards *Cosmarium Ralfsii*, a very large and very deeply constricted form. That pretty and, with us, rare form, *Cosmarium moniliforme*, likewise shows an arrangement of the endochrome in fillets. However, in making these remarks, and in drawing attention to the fact that Braun's reasoning must apply to other forms than *Cosmarium curtum* (Ralfs), Mr. Archer would by no means aver that the disposition of the endochrome in these plants may not be of even greater importance than the outward figure, and there can be no doubt but that it is at least equally constant and characteristic, in its way, of certain species. Thus, the genus Pleurotænium may be very good, containing, as it does, forms referable in outward figure on the one hand to Cosmarium, and on the other to Docidium. But, again, characters drawn from the arrangement of the endochrome are under the disadvantage of not being available unless the specimens are quite fresh and recent; in mounted preparations the cell-contents become so altered that such characters mostly become quite irrecognisable. Moreover, if this course were fully carried out it would seem almost as if Penium and Closterium should be united, as the endochrome in both genera is in fillets (radiate in end view), a step which Braun and those who hold with him do not adopt or sanction.

Mr. Archer likewise presented specimens of *Closterium linea* (Perty), common here, but the peculiarity consisted in the numerous examples having become aggregated in greater or less numbers into bundles or fascicles, the individuals closely approximating and cohering, sometimes juxtaposed side by side into long-drawn-out chains, more or less overlapping. The central pair of each bundle, closely encompassed by numerous other fronds, had become conjugated, and the subcruciate zygospore (elliptic in side view) was fully formed. The whole mass thus assumed a most remarkable appearance. It would be hard to guess why each conjugating pair became so closely embraced by so many other fronds, seemingly themselves with no intention to conjugate, or how they were held together, no common mucous investment or matrix being evident. It was only by pressing them out and so separating the fascicles of fronds, that the conjugated pair with its zygospore could be fully disclosed, although without doing so the dark central zygospore could be seen through the mass. These specimens occurred as a thin floating film on the surface of a pool in "Feather-bed Bog," exposed to the warm sun, and almost looked to the eye as if dry on the upper surface. Some of this thin stratum was easily made to flow into a small bottle, when it was readily seen that it was composed of quantities of this species, to the naked eye, in this aggregated state, somewhat like the little clusters or fascicles formed by *Aphanizomenon flos-aquæ*, but, of course, of a different hue and on a scale considerably reduced.

Mr. Archer also showed specimens of the minute Palmellacean plant, *Nephrocytium Agardhianum*, var. *minus* (Näg.). Be this a form or a species, it must be counted new to Britain, for, even as may be contended, that it is but a developmental stage of some higher plant, it is at least one which has not before been detected in this country. Nägeli, indeed, himself considers the two forms described by him as varieties of one and the same plant; and the fact that in the present gathering both forms—that is, *Nephrocytium Agardhianum majus* (Näg.) and *N. Agardhianum, minus* (Näg.)—occurred, seems, so far as it goes, to strengthen this view, but Mr. Archer had not as yet seen any forms that could be regarded as intermediate. The former occurred very sparingly in the gathering, the latter tolerably abundantly. On the other hand, the former ("majus") had occurred to Mr. Archer once before in a pool near Lough Bray (the present gathering was made in the "Rocky Valley"), and again in a gathering made by Captain Hutton, in spring, in the County of Donegal, and in neither instance did the latter ("minus") make its appearance. The plant now exhibited agreed very well with Nägeli's figure; there was the same elongate, elliptic, or somewhat reniform outer envelope—the same elongate figure of the contained cells—the same spiral arrangement of these, and seemingly the same dimensions. The greatest difference seemed to be that in the present plant the cells immemediately after division appeared to be somewhat attenuated towards the ends turned towards each other where division had just taken place, lending to such a somewhat cuneate figure. But this difference may arise from Nägeli's drawing being taken some time after division had been accomplished, when the cells seem to acquire a like figure at both extremities, thus losing the attenuated ends, and as they grow in length assuming a slight curvature, as it were adapting themselves to the form and adjusting themselves to the confinement of the outer, somewhat firm, common investment. Families occurred with two, four, eight, and sixteen cells; specimens with a greater number did not present themselves. Families also presented themselves, to the number of eight, contained within a very large reniform common hyaline envelope—that is the individual cells of an old family had given rise each to a new young family without becoming freed from the original investing envelope, which thus became inordinately distended for the accommodation of the new young families, still however retaining its original reniform figure, a condition not mentioned by Nägeli.

Specimens of the zygospore of *Euastrum elegans* and of *Staurastrum orbiculare*, in a fresh condition, Mr. Archer likewise laid upon the table.

MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY.

The following observations on Foraminifera were made at a meeting of the Microscopical Section, held November, 28th, 1864:

Notes on Natural History Specimens lately received from Connemara. By THOMAS ALCOCK, M.D.

The series of specimens which I have now to lay before you is so extensive, and I believe so interesting, that parts of it might properly form the material for several distinct communications; but at present I propose to show them as a whole, and, with the specimens, to hand in as complete lists as I can of the species in each class.

The richness of the coast of Galway is well known to every student of British marine zoology; for to whatever branch of the subject he devotes himself he finds alike that here some of his rarest treasures are to be obtained. It is not with the hope of making known to you much that is new that I am led to introduce this subject to your notice, but chiefly because I am convinced that natural history work amongst ourselves is best promoted by the formation of exact lists of the species which we actually know to have been found at some particular localities; and such lists of Connemara specimens, imperfect as they must necessarily be at first, I have now to lay before you. It is, however, no more than might be expected that, in the course of careful examinations of so many objects, some points have occurred to me which I think worthy of notice, and these I shall mention as I come to them in their natural order.

In the first place I have to show specimens of three species of Nullipore—namely, *N. polymorpha*, *N. calcarea*, and *N. fasciculata;* also *N. calcarea*, var. *depressa.*

The list of *Foraminifera* is an extensive one, especially considering that all my specimens are from shore-sand and from one locality. This sand is from Dogs Bay, Roundstone, and consists of many kinds of small shells of Mollusca, among which Rissoæ and Lacunæ are more noticeable at first sight, fragments of Lepraliæ and other Zoophytes, spines of Amphidotus, and sponge-spicula, while the finer parts are made up entirely of Foraminifera. Of these I have found fifty-eight species and named varieties, and also six very distinct forms which are not mentioned in Professor Williamson's 'Monograph on Recent British Foraminifera.' Specimens of these, and of all the other forms contained in the list, are mounted for inpseetion.

In the course of my frequent examinations of these objects I have made a few observations on several of them, which may perhaps be interesting.

I find *Orbulina universa* common in the Dogs Bay sand; that is, I have picked out some hundreds of specimens. They vary greatly in size, the largest being four or five times the diameter of the smallest. They have the surface frosted with larger and smaller tubercles, arranged with a certain kind of regularity; but, though thus rough externally, the texture of the shell does not appear to be arenaceous, as stated by Professor Williamson—at least, if by that term is meant that it is formed of agglutinated grains of sand, as is the case with some other species. When examined with a high power and transmitted light, the larger and smaller tubercles show black from their density, and the spaces between them are partly occupied by objects like very transparent thin plates, of a uniform size and an imperfectly squared figure; the impression these convey being that they have been produced by a kind of crystallization of the material of the shell at the time of its original formation. I conclude that the colourless condition of my specimens depends on the perfect manner in which all animal matter has disappeared, and I think for an examination of the mere structure of the outer case this must be an advantage. It may be interesting to note that among the specimens are a few with one or more protuberances of parts of their surface, destroying the regular spherical figure, and indicating an incipient budding before the shell hardened; there is also one large and very handsome double specimen.

Besides the Orbulinas, I have an example of another kind of spherical object, which for convenience I will mention here, though I do not suppose it to belong to the Foraminifera at all. It looks like a sphere of the most transparent glass, and is without colour or markings of any kind.

I have found all the forms of Lagena, excepting *L. vulgaris* *typica* and *L. gracilis*. *Lagena striata* and *interrupta* are abundant; and these, with very few exceptions, have the costæ passing forward to the extremity of the neck, in which case it is only one half of the whole number which do so, each alternate one stopping short at the base. Specimens where the costæ wind spirally around the neck are equally common with those in which they take a straight course. These Lagenæ have the appearance of old coarse shells, but they do not seem to have suffered from attrition; they are scarcely ever found with the neck broken short, though it may perhaps be almost equally rare to meet with one absolutely perfect. The varieties *clavata*, *perlucida*, *semistriata*, and *substriata*, are comparatively rare, and all of them have forms and characters very distinct from *striata* and *interrupta*, while the two latter agree perfectly excepting in the matter of the costæ, which are found in different specimens to be interrupted in a great variety of ways, those with the costæ perfectly continuous being the least common; so that the conclusion I am inclined to come to is, that they need not be separated even as varieties, and that, whatever doubts may remain as to some of the other named varieties, the great abundance of these two and the constancy of their general characters make it certain that together they will form a good species under the name of *Lagena striata*. A few specimens of this species have a mucro at the base, and deformed ones are not uncommon; these, besides having the body variously misshapen, often have the neck bent, sometimes even so much as to give the specimen the form of a retort.

The Dogs Bay sand contains many forms of Entosolenia, some of them agreeing with those described by Professor Williamson, but others distinct; and of these latter I have ventured to name two, which may be described as follows:—1. *Entosolenia Williamsoni*, a very abundant form, might pass at first sight for *Lagena striata* with the neck broken away, but a close examination shows it is a perfect shell, the body like *L. striata*, but rather less full in proportion to its length than is usual in Connemara specimens, and the texture a little more glassy; its chief peculiarity, however, is in the neck, which is short and formed of two distinct portions, the first directly continuous with the body and having an outline similar to that of the lower part of the neck of Lagena abruptly cut short, and the second a cylindrical tube of comparatively small diameter continued from the middle of it. The first portion is ornamented with three circles of hexagonal reticulations, which are continuous below by their inferior angles with the longitudinal costæ of the body, and present an interesting combination of the superficial characters of *E. costata* and *E. squamosa*.—2. *Entosolenia Montagui* is a squamous form, but differs from the named varieties of *E. squamosa* in having its surface really covered with a pattern like scales instead of with raised reticulations. Well-developed specimens are not all flattened, though many are found as if crushed, and they then present an appearance resembling a dried fig; the true sh[illegible] however, is a perfect oval, full and well rounded at the smaller end, and from the middle of this projects a short, smooth, cylindrical tube. With a low power of the microscope the whole surface of the body appears to be made up of small, almost square facets, arranged in distinct longitudinal rows, but when these are more highly magnified each flattened surface is seen to rise a little anteriorly, and to have the front border rounded so as to give exactly the appearance of a covering of scales.

So far as I have yet seen, the forms of Dentalina and Cristellaria are very rare in this sand, *Nonionina Jeffreysii* and *elegans* are also scarce, but *Patellina corrugata*, which is described as a rare species, is not very uncommon, and some remarkably fine specimens have been met with. All the forms of Rotalina occur excepting two, and there are several undescribed ones in addition; at present I have seen only one specimen of the rare species *R. inflata*. There are two distinct varieties of Globigerina, one with the chambers globular, the other having them considerably flattened, which gives quite a different character to the shell. *Trunuatulina lobata* is by far the most abundant species, and with *Miliolina seminulum*, constitutes the chief bulk of the sand. The two forms of Cassidulina are equally common, and specimens have not been met with presenting intermediate links. *Polymorphina lactea* occurs in profusion, and, though the forms which are distinguished as *typica*, *oblonga*, and *commuuis*, are well marked, a considerable proportion of the whole number of specimens collected seem to indicate an absence of any definite plan in the arrangement of the segments, the chambers being evidently thrown together without order, and in some cases producing an irregular nodulated mass, with two, three, or more distinct and perfectly formed open mouths on different parts of the surface. I find also specimens consisting of nothing more than the primordial segment, and these might be mistaken for a form of *Entosolenia globosa* but for the peculiar texture of the shell and the radiating grooves around the mouth; they are worthy, I think, of particular notice, as possibly capable of furnishing some more reliable marks of distinction than are found in adult shells, though at present all I have seen are of one character.

The forms of Textularia are numerous, and among them are four which can readily be separated, but may still pass for varieties of *T. cuneiformis;* one of them, however, differs considerably in having the texture of the shell much finer, and the chambers full and rounded. *Textularia conica* is abundant, and its character in these Connemara specimens, is so distinct from *T. cuneiformis* that it seems impossible to admit it as only a variety of that species. In many of the specimens the apex of the cone is broken, exposing always three chambers, which are arranged like a trefoil and are placed almost on the same plane.

An examination of the specimens before you of the two forms of Biloculina, named respectively in Professor Williamson's work *B. ringens typica*, and *B. ringens*, var. *carinata*, will suggest, I think, a doubt as to whether it is correct to throw them together as one species, the texture of the shells as well as the form of their mouths being very different.

All the named varieties of Miliolina occur in abundance, and among them are great numbers of evidently distorted and misshapen specimens, which appear to me to give no help whatever by the way of supplying inosculating forms, but may prove useful in indicating facts bearing on the general development of the animals. Specimens with the last chamber, not broken, but clearly left incomplete, are by no means uncommon.

ORIGINAL COMMUNICATIONS.

On the ANATOMY *of* ASCARIS (ATRACTIS) DACTYLURIS. By ALEXANDER MACALISTER, F.R.G.S.I., L.R.C.S.I.*

As the attention of the Members of the Natural History Society of Dublin has been of late directed to the consideration of the group of Entozoa, I think it might not be uninteresting to communicate a few anatomical facts with regard to the structure of a species of intestinal worm which has lately fallen under my observation. While engaged in examining the anatomy of *Testudo græca*, I was surprised to find that the alimentary canal in all the individuals which I dissected was filled with worms in large quantities, in fact, that entozoa constituted more than half their fæcal contents; of these there were several species, but that which was most numerous was the small, white, usually straight, and somewhat shuttle-shaped *Ascaris dactyluris*, first discovered by Bremser, and named by Rudolphi. The species is described by the latter naturalist in his 'Synopsis Entozoorum,' pp. 40-272, as "Ascaris dactyluris capite nudo, corpore utrinque æqualiter attenuato, caudo fæminæ longa subulata, maris apice brevis obtuso depresso ante quem spicula passim substantia passim egressa vasa in vaginam fimbriatam." In his subsequent description he refers to it as being found in great abundance; he obtained "multa millia specimina ut maxima fæcum pars iisdem constaret," exactly according with my own experience as stated above; he likewise describes it as being from two to two and a half lines long, with a three-valved head; a straight, narrow œsophagus, which is longer in the male than in the female, a subglobose stomach, and elliptic oblong ova, each with a large and obscurely divided nucleus. There are several points of greater or less importance which he has omitted in his description, but on the whole these characters are very distinct. Dujardin, in the appendix to his work on 'Intestinal Worms,' refers to this animal, and states his opinion that it should be separated from the genus *Ascaris* on account

* Read before the Natural History Society of Dublin, 2nd June, 1865.

of its obscurely bi- or trilobate mouth and its unequal spicula; he does not enter into any further details respecting its structure, but expresses his regret at not having been able to fulfil his original intention of thoroughly examining its internal organization. A few notices of this species likewise occur in Siebold's 'Anatomy of Invertebrates,' but, with these exceptions, I am not aware of there being any special anatomical description of this creature extant.

The specimens which I have been enabled to examine are whitish in colour, mostly straight, though at times a little curved at the distal extremity, and measuring as an average about two lines and three fifths in length, the range being from one line and a quarter, as a minimum, to five lines as a maximum; the breadth in the centre varies from one tenth to one quarter of a line, and in some of the largest exceeded that amount. The males, which are very much fewer than the females (at least among those that I examined not one in fifty were males), are much smaller, and average in length a line and seven eighths; they are more curved than the latter, and sometimes exhibit a partial dorsal constriction at the junction of the anterior and middle thirds. The females are usually about two and a half to three lines in length.

The integument is transparent, wrinkled tranversely or annulated; but this appearance is not always distinct in recent specimens, or in those kept in aqueous solutions; when, however, they are immersed in any dense fluid, which will cause a rapid exosmosis, the animal becomes slightly shrivelled, and the annulations are then seen with the utmost clearness; when placed in spirits of wine the integument becomes firmer and less transparent, and the annulations also seen with considerable distinctness. A few longitudinal striæ are visible on the outer layer, but they do not seem to be regular in their position or arrangement. Towards the tail a considerable number of distinct oblique lines are occasionally seen radiating from the anus to the dorsal aspect, but they do not seem to be deeper than the superficial tegumentary layer; they commence at the ventral line and extend symmetrically on either side of it towards the dorsal surface, but stop short about the middle of that aspect. Two lateral lines can be traced with great facility, commencing narrow at the head, widening slightly in the centre, and passing backwards to the posterior extremity or tail, where they also taper a little, and end near its tip by gradually diminishing; but whether these lines be muscular, as Rudolphi thought, in other species of Ascaris, or vascular, as supposed by Eberth, or nervous, as imagined by Cuvier, Willis, and Cobbold, I could not even conjecture in such a minute species. These lines appear to be made up of longitudinal striæ, with dark granules in their intervals. Anterior and posterior lines are also visible, but less distinct in general than the lateral. The tail is very variable in shape; in the female it sometimes is short and rapidly acuminated; in other specimens it is long, attenuated, and occasionally even uncinated at its extremity; near the tip small papillæ or elevations are obvious, and in some individuals these give an obscure appearance of serration to its margin. The tail of the male is much shorter, blunter, and more rapidly narrowed to its rounded end, which is more bevelled in its ventral than on its dorsal aspect, to accommodate the masculine organs of reproduction.

The head presents three tubercles, which are nearly equal in size, but they are not so distinct as they appear to be in other allied species; they exhibit several small irregular granulations on their inner or oral aspect; on using gentle compression I was able in several individuals to see a fine, slightly curved tube projecting between the three tubercles; this, I think, is similar to the tube referred to by Bremser in other species of Ascaris, which he takes to be the true mouth, but which appearance Wedl considers to be due to the protrusion of the everted lining of the cleft proboscis. Through it I was enabled to evacuate, by gentle pressure, currents of granules from the œsophagus.

In a few of my specimens two lateral alæ exist, one on either side of the head; but this appearance seemed rather uncommon, as I could only find it in about eight per cent. of the examined specimens; when present these wings commence immediately outside the tubercles by a raised or prominent circular collar, behind which the flat, slightly wrinkled alæ start and extend backwards and outwards for a short distance, when they rather suddenly contract until their margins become continuous with the wrinkled integument. Though this appears the usual disposition of the wings, it is sometimes departed from; as in one individual I saw the wings extending down the anterior part of the body for a considerable distance, and gradually diminishing until they were lost about half a line behind the head; in one case, also, the naked subglobose head was united to the trunk by a narrow neck, which was bordered by a slight ala. These variations show, I think, how little these appendages, *per se*, are to be valued as marks for the distinction of species. I could not associate their presence with any conditions of age or sex, for though I only saw them in females, they were by no means frequent in that sex, and seemed completely irrespective of youth or maturity.

From the head the œsophagus passes backwards, and is variable in position and length. It is usually curved, with its concavity directed forwards, and it forms about one third of the entire diameter of the animal's body; it is not, however, uniform in calibre, for in some individuals it exhibits slight constrictions, while in others it was dilated into shallow pouches. Its cavity seemed to be like that of other ascarides, rather triquetrous than cylindrical, and its walls were marked with longitudinal striæ; but whether these were due to muscularity or no I could not positively pronounce, though, from the thickness of the coats, it is most probable that it is a muscular tube. As remarked by Rudolphi, it is much longer and straighter in males than in females, and varies from one third to one tenth the length of the entire body, being shortest in those females which were crowded with eggs, and longest in the adult males. Its lower end, after a slight constriction, became suddenly dilated into a globose stomach, called by Rudolphi the proventriculus, which is very thick in its coats, and filled with a greenish-coloured mass. Its cardiac orifice is rather narrow and constricted, while the pyloric aperture is wider, and when compressed seems somewhat valvular, the granular contents passing more freely from the stomach to the intestine than in the contrary direction. In some individuals this cavity was perfectly globular, in others it was slightly conical and flattened; its usual shape is that of an oblate spheroid, to the poles of which the œsophagus and intestine are attached. A similar globose cavity in *Ascaris infecta* is described under the name of gizzard by Dr. Leidy, in the first part of the 'Smithsonian Contributions,' page 43. From the inside of the body-wall three or four apparently solid curved processes pass to the wall of the stomach, and serve to suspend it in the animal's body-cavity. The intestine commences by a clavate dilatation, which gradually narrows, and passes in almost a straight course back to the anus, which is a slit-like orifice, situated a little in front of the tail. Shortly before it reaches this point the gut exhibits a slight enlargement, below which the narrower subcylindrical or pyriform rectum turns off at an obtuse angle, and terminates the canal. Around the constriction, which marks the origin of the rectum, are arranged four small pyriform sacs, one in front, one on either side, and one posteriorly, granular in appearance, and having their narrow peduncles or necks continuous with a duct which opens into the gut immediately above its termination. In one specimen a spur was seen distinctly passing backwards to the body-wall from the anterior extremity of the cœca. Concerning the nature of these bodies we may hazard several conjectures; they might be the representative of such a compound or branched alimentary canal as is found in other Entozoa and in Annelida, or they might be special secreting organs. With regard to the first of these theories, it is known that intestinal cœca do occur in other species of Entozoa. Mehlis, in 'Isis,' for 1831, p. 91, describes several of these in various species of Ascaris; and Leidy (loc. cit., p. 49, and Pt. vii, of art. 2) figures a large cœcum in *Thelastomum appendiculatum.* In these, however, the diverticula arise high in the digestive tract near the point of junction of the stomach and œsophagus, and often directly below the œsophageal constriction, which is far from being the case in the subject before us. Their granular nature, narrow necks, and constant low position, as well as their number, and the length and distinctness of their ducts, have led me to think that they might perhaps be organs of excretion; mayhap the earliest traces of renal organs in the animal kingdom. It may be remembered, with regard to this, that the presence of distinct secreting glandular organs in Nematoid Entozoa is no new fact, for Professor Owen has described salivary cœca as existing in *Grathostoma aculeata.* Other glands also have likewise been described, which I will notice more particularly hereafter. From the side of the intestine, below these cœca, fine lateral threads pass off, and are lost on the body-wall above the anus; these seem to suspend the gut and the cœca, and might be named retinacula.

The nervous system, if any existed (which we may suppose to be the case from analogy), completely eluded my search. There are, as I have before stated, dorso-ventral lines, and in some individuals the ventral was much the larger and more distinct; it may be nervous in its nature, but presented no distinct character by which I could recognise it as such.

On the ventral aspect of both sexes, corresponding to a concave and well-marked sinuosity or depression of the superficial abdominal line, a very small bilobate aperture was visible on the body-wall opposite, or a little above the level of the upper dilated end of the intestine; in one or two, however, it was much below this point; from this a small tube passed for a very short distance inwards, and then gave off four small prolongations, two of which pass forward, and are lost in the anterior part of the lateral lines, while the other pair pass back into the posterior portion of the same lines, where they expand into very small dilatations, beyond which they are not traceable.

It was with very considerable interest that I detected this structure, which is similar to that described and figured in the appendix to Bagge's 'Dissertatio de Evolutione *Strongylus auricularis*,' and which has been traced by Diesing in other Nematodes. Mehlis, in his paper in 'Isis,' 1831, p. 81, describes a similar organ as existing in *Strongylus hypostoma*, but imagined he saw it passing as far forward as the mouth, in which he thought that it terminated; but this error was corrected by Von Siebold; and in many of my specimens the character of the external foramen is seen with extreme clearness. This undoubtedly is a glandular organ, but of what nature it is hard to say. Mehlis (loc. cit.) has put forward a not improbable hypothesis regarding its use, and imagines that it pours out an irritating secretion, which stimulates the wall of the intestine of the host, and so causes it to pour out an increased amount of pabulum for the animal's wants: such may be the case, but we have no evidence on the subject.

Enveloping in its convolutions the intestinal canal in the female, a tortuous elongated ovarian tube can be traced, usually single, though in three of my specimens I found it to be double; it commences by a narrow but not very sharp-pointed extremity, which is apparently attached slightly to the deep surface of the body-wall, near the lower end of the œsophagus; from this point it courses tortuously, measuring, when extended, twice or three times the length of the entire body of the animal. At its commencement it contains a finely granular, almost homogeneous, mass, which shortly becomes consolidated into oval vitelline masses, which soon, at a small and very imperfectly marked dilatation in the tube, become perfect ova of a narrow elliptic shape, composed of a dark granular, at first obscurely divided, vitellus, which occupies one half of the bulk of each ovum, and is surrounded by a transparent albuminous fluid enclosed in a hard casing or shell. These ova are arranged in a single row in the lower or uterine portion of the oviduct, and occasionally from a rupture of this tube they may be seen floating free in the body-cavity of the parent.

The perfect ova are not so numerous as they are described to be in other species of Ascaris. I have found them to range between twelve and fifty-five in number. The uterine tube or oviduct terminates at a small and oblique opening on the ventral aspect of the animal, and usually at a point midway between the stomach and the anus. In case the oviducts be double, they coalesce shortly before they arrive at the vulva. Siebold refers to this opening as being a transverse slit with swollen margins, but it certainly seemed to me to be roundish and bordered by a slightly prominent lip or margin. The coats of the duct thicken, and the cavity contracts immediately before it ends at this aperture. When some of these females were left immersed in water for a week the ova commenced to become developed. At first the eggs were filled with the finely granular, irregularly divided vitellus, which regularly segmented. Its first stages of segmentation escaped my observation, and many ova presented six, nine, or more globules of the parted yolk when first I examined them. Soon the mass became finely granular, and assumed an elliptical shape, which in some became curved or arcuated. The two extremities then begin to be differentiated, and from the posterior end a lateral turn or projection extends, at first short, but soon considerably elongating, until it becomes remarkably like the tail of the adult, twisted to one side. The anterior end becomes blunt and somewhat flattened, and no granules appear in it. At this stage, in some of the more perfect, a moniliform thread appears to pass down the centre of the body from the mouth to the root of the tail projection, forming the primitive trace of the alimentary canal.

I was not able to observe the development of the reproductory apparatus, but it is probable that it does not appear until the young animal has become liberated from its shell. All the changes which I have noted took place inside the oviduct of the mother, but I also observed ova floating in the surrounding fluid in similar conditions of development.

The male sexual organs are made up of, first, a testis, tubular and elongated, but not as long as the ovary; this begins small and rapidly thickens, until it rivals the intestine in size; this is at first filled with an indistinct granular material, but afterwards contains more perfectly elaborated spermatic fluid. These tubes are not easily unravelled, and in some males (probably those which are immature) the whole glandular mass seems as though it were a lobulated indivisible structure. Near the posterior extremity of the body the testicular tube ends in a large dark, rough, bilobed, seminal vesicle, which lies on the ventral surface of the intestine, and sends off below a narrow duct to the root of the intromittent organ. In front of the blunt bevelled tail projects the spiculum, a slightly curved body with a pointed pen-shaped extremity; half of it is included in a canal in the animal's body, from which it passes by a small opening, whose projecting margins overlay its sides for a short distance.

A little in front, and to the side of the large spiculum, a smaller one is seen, much more acute, and communicating with the spermatic vesicle by a small canal. This second smaller organ did not escape the attention of Dujardin, and it was noticed by that naturalist as a character marked enough to separate this species from Ascaris, and to elevate it into a genus by itself. To this distinction I think we will be able to confirm its claim after our careful examination; first, on account of its unequal spicula; second, from its rudimentary cœcal secreting appendages; thirdly, from the comparative indistinctness of its oral tubercles; and so, following the great French helminthologist, I think we are justified in naming it *Atractis dactyluris.*

I cannot close these remarks without taking the opportunity of recognising my obligation to Dr. John Barker for his invaluable assistance in the course of my investigation, in verifying from independent observations almost all the results which I have tabulated in this paper.

ADDITIONAL STOP *recommended for oblique illumination with the* ACHROMATIC CONDENSER. By B. WILLS RICHARDSON, F.R.C.S.I., Surgeon to the Adelaide Hospital, Dublin.

IN the January number of this Journal I drew the attention of microscopists to some advantages which I had derived from the use of peculiar-shaped stops delineated in that communication. After my paper had been printed I further experimented on oblique illumination with stops, one of which I found so particularly useful that I have had the accompanying illustration made of it.

It might be thought that with this stop and high powers, such as the $\frac{1}{8}$th and $\frac{1}{12}$th, the light would be too much intercepted. It is not so, however, for at the present moment I have before me the markings of *P. Fasciola* beautifully displayed by it, and a $\frac{1}{8}$th of T. Ross's make. I can, therefore, also speak as highly of this stop as I did of those recommended in my last communication. In the short paper just referred to, I mentioned that at the time of writing it, the highest powers I had used with the stops were the $\frac{1}{5}$th and $\frac{1}{8}$th objectives. Since then, I have tried them with Nachet's objective 7, which is equivalent to about the $\frac{1}{12}$th of English makers, and have found that it performs excellently with some of the stops; best, however, with the second of the former illustration, the stop with the largest circular holes. The Nachet's 7 I use, is without a covering glass adjustment, so that it is really wonderful the definition it gives with the aid of the stop I have described.

QUARTERLY CHRONICLE OF MICROSCOPICAL SCIENCE.

GERMANY.—**Kolliker's und Siebold's Zeitschrift.** No. 1, 1866.—The first part of the sixteenth volume of this most satisfactory journal appeared in March. It contains the following papers:

1. "*Researches on Connective Tissue and its Ossification,*" a valuable paper by Dr. Leonard Landois, which may be compared with Dr. Waldeyer's essay on ossification in Max Schultze's 'Archiv.'

2. "*Larval Eyes* (*Ocelli compositi, mihi*)," by Dr. Hermann Landois.—Malpighi was the first anatomist who recognised these eyes, of which he speaks in his essay on the silkworm. Dr. Landois here goes thoroughly into their structure and form in various insects, treating of them under the following heads:—1. The situation of the eyes. 2. The larval eye. 3. The cornea. 4. The lenses. 5. The iris. 6. The so-called crystalline body. 7. The envelopes. 8. The muscles of the larval eye. 9. The two enveloping membranes. 10. The optic nerve. 11. The tracheæ of the eye. 12. The innervation of the eye. 13. Morphological and physiological remarks. 14. Comparison of the larval eye with the facetted eye.

3. "*The Metamorphoses of Corethra plumicornis,*" by Dr. August Weismann.—This is one of those able memoirs on insect anatomy for which the Professor of Zoology at Freiburg is so well known. The *Corethra-larva* has already furnished anatomists with interesting facts relative to the natural history of the Diptera, its excessive transparency and abundance rendering it a ready object for study. Dr. Franz Leydig some few years since published some observations made on these larvæ, in which he demonstrated the relations of the tegumentary hairs to the nervous system, and gave other important details of structure. Dr. Weismann's paper is a most extensive essay, illustrated by five large and carefully executed plates. He commences with a very detailed description of the various organs of the larva, and then traces

the changes undergone by each part through the pupa to the imago stage. The little air-sacs which are so noticeable in the *Corethra-larvæ* are, Professor Weismann considers, to be regarded as a hydrostatic apparatus rather than respiratory. The type of metamorphosis presented by *Corethra* is contrasted with that presented by *Musca*, and is thus briefly stated:—The segments of the larva are changed directly into the corresponding segments of the body of the imago; the appendages of the head are changed into those corresponding in the head of the imago; those of the thorax commence at the last larva-moulting as outgrowths of the hypodermis round a nerve or a trachea, from which cellular integument the formation of the tissues in the interior of the appendage proceeds. The larval muscles of the abdominal segments remain unchanged in the imago; the peculiar thoracic muscles of the imago, as also some further abdominal muscles, are developed in the last larval period from indifferent cell-strings already sketched out in the egg. The genital glands date from the embryo, and develop steadily; all other systems of organs pass without any or with little change to the imago. Not any or only an insignificant *corpus adiposum* exists. The pupa state is short, and presents an active life.

4. "*Researches on the Embryology of the Hemiptera,*" by El. Mecznikow.—This is the record of some observations on the ova of various insects, made in the laboratory of Professor Leuckart at Giessen. The genera studied were *Corisca, Coccus, Aspidiotus, Chermes,* and others; also *Phryganea* and *Simulia*. The author combats Professor Huxley's view with respect to the rudimentary abdomen of *Aphis*.

Max Schultze's Archiv fur Mikroskopische Anatomie. Fourth Part, 1865.—The concluding number of the first volume of this valuable journal has at last made its appearance, and a very beautiful number it is, with eight plates, excellently executed, and much interesting matter in the form of original papers.

1. "*On the Spermatozoa and their Development,*" by F. Schweigger-Seidel.—This is a somewhat extensive essay on the subject, the author reviewing the work of his predecessors in this field, and remarking on the development of the spermatozoa in the frog, newt, barn-door fowl, finches, and various mammalia. He finally states his results as follows: —1. The spermatozoon is not a simple nucleus structure (Kölliker), but answers to a whole cell. The spermatozoa are modified flagelliferous cells. 2. In accordance with this, the spermatozoon is developed, not, as Kölliker makes out, in the inside of a cell. Cells with spiral rolled-up sperm-threads

do not occur as normal structures in the contents of the testicular canals. (Henle, 'Handb. d. System Anat.,' ii Bd., s. 356, makes the same objection against Kölliker relative to the rolled-up sperm-threads.)

3. In the testicular canals occur two sorts of cells (Henle), not only in mammalia, but also in birds and amphibia. Only the one kind, with smaller clear nuclei, enter upon the change into spermatozoa. Many peculiarities in the form of the sperm-elements are, without doubt, dependent on their sometimes quick, sometimes slow, sometimes complete, and sometimes imperfect development.

4. The relations of the parts in their formation appear in the simplest way in the frog. In semen taken from the testis long-shaped cells may be observed, in one end of which the rod-like nucleus has located itself, while the other grows out to a hair-like cilium. The peculiar cell-substance disappears more and more in further development, until there is only a small compact piece between cilium and nucleus left remaining. It is this which is the middle-piece in the complete spermatozooid, and we can therefore draw the parallel—the head, the nucleus; the middle-piece, the modified cell-substance; and the tail, the hair-like cilium formed from the material for a cell. (Ankermann also regards the spermatozooids of the frog each as consisting in itself of a nucleated cell, but he assigns to them a somewhat different mode of development.)

5. The main features are the same in the mammalia as in the frog, only that here the "middle-piece" undergoes a more peculiar modification. The nucleus of the sperm-cell is intimately connected with the head of the spermatozooid. In quadrupeds the head is characteristic in its form, as in the mouse one can see lying at the edge of the yet round sperm-cell the nucleus already transformed, whilst from the side, more or less directly opposite, the tail sprouts forth. Thus also the three segments in the spermatozoa of the mammal find their explanation in the manner of their development.

Herr Schweigger-Seidel's paper is illustrated by a plate containing drawings of the spermatozoa of the frog, triton, house hen, finch, sheep, field mouse, house mouse, hedgehog, pig, guinea pig, and rabbit, in various stages of development.

2. "*On the Alveolar Gelatinous Tumours,*" by Professor Franz Eilhard Schulze.—This is apparently a valuable paper on the histology of the disease called Carcinoma alveolare by J. Müller, Cancer aréolaire gelatiniforme by Cruveilhier, Gelatiniform cancer by Carswell, and Gelatinoma, Gum cancer, &c., by others. It is illustrated by a clear and well-drawn plate.

3. "*On Darwinella aurea, a Sponge with star-shaped horny Spicules,*" by Fritz Müller.—This is a detailed description of the structure of a sponge of which Fritz Müller had previously sent a fragment from Desterro to Max Schultze. Professor Schultze gave it the name *Darwinia,* which, however, had been already applied by Mr. Spence Bate to an amphipod crustacean. Herr Müller therefore changes the name of the sponge to *Darwinella.* Its fibres are dendroid, and not conjoined into a network, while the spicules are large and numerous and soluble in caustic soda. The chief interest attached to this sponge lies in its stellate horny spicules, which Herr Müller considers as presenting an important piece of evidence in connection with the Darwinian theory, since they serve to bridge over the gap between sponges with siliceous and sponges with calcareous spicules.

3. "*On the Process of Ossification,*" by Prof. Dr. Waldeyer, of Breslau.—In this paper the subject of ossification is treated at some length, and a plate illustrating Dr. Waldeyer's views is attached. The views of H. Müller, Gegenbaur, Max Schultze, Sharpey, Beale, Landois, Virchow, and others, are discussed.

5. "*The Movement of the Diatomaceæ,*" by Max Schultze.—The movements of the Diatomaceæ still continue to puzzle microscopists, and various explanations of this phenomenon have been advanced. Professor Schultze has carefully studied a number of species—*Pleurosigma angulatum, Pleurosigma fasciola, Nitschia sigmoides, Surirella bifrons,* and others—making various experiments and observations upon them. He is led from these researches to conclude that a glutinous organic substance, which is concerned in rapid movement, is spread over the external surface of the Diatomaceæ. It is by this protoplasmic sheath that the *Bacillariæ* become adherent to one another. Professor Schultze does not consider that this view affects the question of the animal or plant nature of diatoms. He considers that they must be left with some other unicellular beings, as of "uncertain kingdom," until we know more of what constitutes the boundary, if there be any, between plants and animals. Professor Schultze's paper is illustrated by an elaborate coloured plate.

6. "*On the Formation of the Spermatozoa,*" by V. la Valette St. George.—This is the first part of an essay on the seminal corpuscles. The author gives many careful observations, and states that his researches lead him to confirm Kölliker's statements, and with him and Henle to regard the bodies or heads of the spermatozoa as changed nuclei.

7. "*Experimental Studies on the Fatty Degeneration of Muscular Tissue,*" by Alexander Stuart.—According to the author,

in this disease, the muscular fibres become the seat of a thorough change, which, pursuing its various stages of development, presents, as a final result, the conversion of the protein substance of the muscular fibre into fat. The changes are carefully traced, and a plate illustrating the structure of the diseased tissue is given.

8. "*Echiniscus Sigismundi, an Arctiscoid of the North Sea,*" by Max Schultze.—In the first number of the 'Archiv' was a very valuable paper by Dr. Richard Greef on the nervous system of the Tardigrada, and here we have a no less interesting paper by the editor on a new species of these very curious little "bear-beasts." Though Arctiscoids are to be met with in moss on the roofs of houses, on trees, and in dykes and ditches—everywhere (so says Professor Schultze) in great numbers—yet the sea has only as yet furnished one species to the observations of zoologists. This form, called *Lydella,* was discovered by a pupil of Dujardin's, while crawling on the side of a glass vessel containing sea water, and was described and named by the French savant. Professor Schultze, while at Ostend, searching the weed-grown piles of the harbour for *Anguillula, Amœba,* and *Infusoria,* was fortunate enough to discover a new form of Tardigrade living on the sea-weed, and belonging to the genus *Echiniscus.* Dr. Richard Greef at the same time observed this form in Heligoland, in various positions, but especially among the weed subjected to tidal action. The greatest length of the specimen observed was ·08‴ to ·09‴, so that the extreme minuteness of these animals may well explain the paucity of marine species known to us. Professor Schultze names this form *E. Sigismundi,* in honour of his father, who did some valuable work in connection with the *Arctiscoida.* The œsophagus and intestinal canal appear to be the only organs which are conspicuous when the *Echiniscus* is placed beneath the microscope, the curious little legs and eye-spots, and a few dermal hooklets, being also noticeable. Professor Schultze's paper also contains some general remarks on the genus *Echiniscus,* and is illustrated by a coloured plate.

9. There is also a notice of the compendious little microscope constructed for Dr. G. Harley, of University College, by Mr. Collins, of Great Tichfield Street, and a few words from Herr H. Frey "*On Good and Sound Microscopes.*" The microscopes of Oberhausen of Paris, Merz of Munich, Zeiss of Jena, and the cheap instruments of Pillischer and Smith and Beck, are noticed. The finer instruments of our three great London houses are not known to Herr Frey, nor is he able to give an opinion on Messrs. Powell and Lealand's $\frac{1}{50}$th, on account of its great expense.

FRANCE.—**Comptes Rendus.**—In the number for December 18th we observe a paper, by Dr. Lacaze-Duthiers, "*On the Circulation of the Inferior Animals.*" The author observes that it is impossible to take up any ordinary mollusc and examine it without observing that a fluid exudes from its body in sufficient quantity generally to thoroughly wet the hands of the observer. The answers to the questions as to what is this liquid, whence it comes, and how it escapes, are the object of the present memoir. There is no doubt that a great number of the lower animals deprive themselves of the liquids of their economy by voluntary bleeding; but this does not take place in the same way in all groups. With regard to the Mollusca, positive facts demonstrate beyond doubt that there is a communication between the circulatory apparatus and the external world. It has been shown by MM. Langer and Gegenbauer in Pteropods and Lamellibranchs, and by Dr. Duthiers himself in the Gasteropoda. In the *Thetys leporina* of the Mediterranean, between each pair of branchiæ (numbering from fourteen to twenty on each side) which it carries on its back, is an oval fossa, containing a little projecting body pierced by an orifice. An injection carefully introduced at this orifice passes into the veinous system, or, if merely made to play on it, will be rapidly taken in. There are thus, then, in the *Thetys* from twenty-eight to forty orifices by which water can be introduced into the circulatory system or the blood be expelled. It is not, therefore, surprising that when one handles this animal the hand becomes inundated with fluid. The orifices are here provided with two nerves, regulating sphincter muscles. In some cases the contraction of a mollusc may be so violent as to cause the blood to rupture the tissues and escape without the use of the normal exit. In *Dentalium* and *Pleurobranchus* M. Duthiers has described a valve and two muscles which regulate the passage of the liquid. In the Gephyrians (Sipunculus, &c.) M. Duthiers compares the "perivisceral fluid" to the blood of the Mollusca, since it can be expelled by the generative orifices and by the canals of the renal glands. We may add, that in the Oligochæta (earthworm, &c.) a constant communication exists between the perivisceral fluid and the exterior, both by the *segmental organs* and by the *dorsal pores* discovered by Mr. Busk, and figured in Mr. Lankester's paper on the earthworm ('Quart. Journ. Micr. Science,' Jan., 1865). In the cœlenterate zoophytes the author considers the mouth itself as representing these orifices of exudation. In the solitary forms, however (*Actinia*, &c.), we have the tips of the tentacles perforated for the egress of the perivisceral fluid. M. Duthiers concludes, from the facts which he adduces, that the blood of the Mollusca, Gephyrea, and Zoophyta must be very different from that of Vertebrata, on account of the direct connection which it has with the external world.

M. Balbiani, in a later number, records some remarkable observations on "*Animal Cells.*" Some time since, the author described contractile vesicles which he had noticed in the unimpregnated ova of various animals, and he now adds some observations on the existence of canals communicating with these contractile vesicles. His observations have been made principally upon the egg of *Geophile longicornis*; but he has also studied the ova of various Vertebrata, of Annelida, and Turbellaria. The facts which M. Balbiani describes seem to indicate a sort of circulatory system in these cells similar to that of the Infusoria; but some confirmation of his opinion will be required before such a remarkable structure can be accepted as an undoubted truth.

Annales des Sciences Naturelles.—In the number of this journal for last November is a paper by Dr. Lacaze-Duthiers on "*A new Genus of Ascidians.*" The remarkable little molluscoid described in this paper presents characters which will doubtless render it the type of a new group of Ascidia. While presenting the usual anatomical structure of that class, it possesses a bivalved shell, not unlike that of some sessile Brachiopoda, and affords a further confirmation to the views of Messrs. Huxley and Hancock, who have associated the Polyzoa, Truncata, and Brachiopoda. Dr. Duthiers proposes to give this Ascidian the generic name *Chevreulius*.

The first number for this year is devoted to a part of a memoir by M. Jules Chéron, entitled "*Researches to serve for the history of the Nervous System of the Dibranchiate Cephalopods.*" This is a very extensive and valuable essay, and is illustrated by two plates, illustrating the nervous system of *Eledone*, and another.

Journal de l'Anatomie et de la Physiologie (Robin's). 1, 1866.—Among various other valuable physiological papers in this journal is a microscopical one by Dr. J. F. B. Polaillon, entitled "*Studies on the Texture of Peripheral Nervous Ganglia.*" The present paper is the first part of an essay on this subject, and consists of a very able historical review of the literature of peripheral ganglia. The author claims for Ch. Robin the merit of first propounding the view of "bipolar nerve-cells" which is now generally current.

ENGLAND.—**Annals and Magazine of Natural History.**—In the March number of this magazine is a translation of

Professor Leuckart's paper on "*The Sexual Reproduction of the Larvæ of Cecidomyia.*" In our last Chronicle we referred to this paper, and noticed Herr Hamin's essay on the same subject. Professor Leuckart describes very carefully the germ-stocks and germ-balls of the larvæ, and makes some valuable remarks on the homological aspects of this curious case of agamic procreation. He points out that the germs which are developed in the larvæ, while possessing many of the characters of eggs, and occurring in the position which is usually occupied by the ovaries, are yet but *pseud-ova,* since they are not under any circumstance capable of receiving impregnation. The name *pseud-ovum* Professor Leuckart considers would be well applied to such bodies as these, had it not already been used by Professor Huxley for true eggs capable of being impregnated, which develop spontaneously without *coitus.* The case is regarded as quite parallel with that occurring in *Aphis,* the germs in the latter case being arranged in such a manner as to make them approach more closely in character to ovaries. These larvæ may be sought for in most decomposing vegetable matters, such as dead trees, rubbish heaps, &c., with a fair chance of meeting with them, though they are liable to escape observation on account of their exceeding minuteness.

"*The Histology of Rhynchopora Geinitziana.*"—Professor King returns to the contest on this subject in the last number of the 'Annals.' He has now made examination of various specimens with a good compound microscope, and still maintains that the valves of this Brachiopod are punctured through and through, and not merely pitted. He explains away the evidence brought forward by Dr. Carpenter (noticed in our last Chronicle) by the supposition that, although the sections made by Dr. Carpenter were vertical, the perforating tubes do not run vertically, but take a slightly oblique direction. If this were the case, as Mr. King maintains, a vertical section would, of course, truncate the tubes, and produce the appearances given in Dr. Carpenter's figures.

"*On the Structure of the Mouth in Pediculus,*" by Professor Schjödte.—This paper is translated from the Danish, and deals with its subject in a most vigorous and interesting manner. Dr. Landois, whose "Researches on the Pediculi of Man" have lately been published in 'Kölliker's Zeitschrift,' maintains with others that the mouth of these animals is provided with a pair of mandibles. Swammerdam and other old observers described it simply as a sucking apparatus. Professor Schjödte now comes forward to support the latter view. He believes that Landois and others have been misled by their method of examination, which consists in cutting off the head of the insect and placing it between two pieces of glass. The pressure destroys the natural arrangement of the parts, and rupturing the integument brings into view two small chitinous bodies which are mistaken for mandibles. The form of the head, narrow and pointed, is not adapted to supporting the muscles necessary for moving jaws; and, moreover, when the head is examined without pressure by reflected light, no jaws or mandibles are to be seen, but simply a sucking mouth. The author obtained several *Pediculi* from a workhouse, and kept them shut up in a box until they were hungry; he then placed one on his hand and carefully watched its movements. No bite was inflicted; but a long delicate tube was protruded and passed into one of the sweat-pores of the skin, and a rapid rhythmic motion was observed in a sacular body near the mouth, whilst peristaltic movements were seen in the intestine. In this way the little animal was soon gorged with blood, when the author cut off its head quickly and examined the apparatus by which its operations had been effected, which he minutely describes. The mouth is simply a modification of the true *Rhyncote* type, and the *Pediculi* should merely be considered as bugs modified to suit their circumstances. The instances of "lice-blanes," &c., brought forward by Dr. Landois to support the view of the biting-power of *Pediculus* and *Phthirius*, can, says Professor Schjödte, readily be explained by other facts, and should rather be attributed to disease than any peculiar powers possessed by the parasites.

"The Chevreulius Callensis of Dr. Lacaze-Duthiers."—Mr. Joshua Alder has written a letter to the 'Annals' (March) relative to the little Ascidian whose description by Dr. Duthiers we have chronicled above. It appears that the genus is *not* new, but has already been named three times previously—once by Professor Stimpson, whose name *Schizascus*, has priority, and twice by Mr. Mac Donald, who first called it *Peroides*, but afterwards changed this name. Neither of the earlier descriptions, however, are at all complete, and do not in any way detract from the value and interest of the paper by M. Lacaze-Duthiers.

Miscellaneous.—*The so-called "spurious Entozoa" of Diseased Meat.*—A large field of inquiry has lately been opened by some researches on the microscopic character of the flesh of animals that have died from the cattle plague. Minute bodies, varying from $\frac{1}{200}$th to $\frac{1}{4}$ of an inch in length, have been met with among the ultimate muscular fibres of such meat, and it was at first supposed that they had some connection with the cause of the disease. Before proceeding any further, however, we must at once state that they have nothing whatever to do with it, as a cause; the interest attached to them is, nevertheless, very great to the zoologist, since the study of them promises to add some valuable facts to the knowledge we at present possess of that most interesting group of Protozoa—the *Gregarinæ*. The bodies observed in the flesh of oxen are described by Dr. Lionel Beale, who has carefully examined them, as elongated spindle-shaped sacs, containing granular reniform bodies arranged horizontally, and apparently capable of multiplying by division. The investing sac is covered with minute, motionless, hair-like bodies. No nucleus is present in the sac; but the reniform granular masses are stated by Dr. Cobbold to possess nucleoli. The structure thus presented is not far removed from that of many *Gregarinæ*, particularly of the larger individuals occurring in the earthworm, though the hair-like processes sometimes observable on these are considered as extraneous by Dr. Lieberkühn.* The compacted reniform masses may be considered as the results of a process of segmentation, similar to that by which the pseudo-naviculæ are formed. The bodies thus described are by no means peculiar to diseased cattle; they are met with in the healthy muscles of the ox, sheep, pig, deer, rat, mouse, mole, and perhaps other animals. Dr. Cobbold, in an article in the 'Lancet,' gives an excellent *résumé* of the case.

Miescher, in 1843, described such bodies from the muscles of a mouse, and a very good account of them, obtained from the muscles of a pig, is given by Mr. Rainey in the 'Philosophical Transactions' for 1857, though he erroneously regarded them as the young stage of cestode entozoa. They have been described under a variety of titles, such as worm-nodules, egg-sacs, eggs of the fluke, young measles, *corpuscles produced by muscular degeneration*, &c. When considered in connection with the minute cysts described by Gubler, Virchow, and Dressler, from the human liver, they have an especial interest; and the observations of Lindemann on the psorospermial sacs obtained from the hair of a peasant at Nischney-Novgorod, and in the kidneys of a patient who died from Bright's disease, bear very strongly on the nature of these bodies. The people of Novgorod are believed to get these parasites from washing in water in which *Gregarinæ* abound. The most interesting inquiry which is placed before us by these various facts is whether, as Professor Leuckart

* See our last "Chronicle."

has observed, the psorospermiæ (and we may add the "spurious entozoa" of cattle, and even many so-called *Gregarinæ*) are to be considered as the result of a special animal development, or whether they are the final products of pathological metamorphosis.

REVIEWS.

On the Development and Fat-corpuscles of the Marine Polyzoa. By F. A. Smitt. (Om Hafs-Bryozoernas utveckling och fettkroppar.) Stockholm, 1865. 6 plates.

Under the above title we have to welcome the appearance of an extremely interesting communication on the subject of the development and several points in the life-history of the Polyzoa, or as the author terms them the marine Bryozoa.

Unfortunately this essay is written in one of the almost unknown tongues, and we have consequently found so much difficulty in its perusal as to be at present prevented giving such a full abstract of its contents as we could have wished, and hope to be enabled to afford, with some assistance as to the language, at a future opportunity. On this occasion we will content ourselves with giving a summary of the contents of a former, as it would seem preliminary paper, on the same subject, which was published as an Inaugural Dissertation at Upsala in the year 1863, under the title of "Bidrag till Kannedomen hafs-Bryozoernas utveckling."

For the following summary of the chief points noticed by M. Smitt in this Dissertation we are indebted to Professor Leuckart's Report on the Natural History of the Lower Animals for the year 1863—just received.

In the Bryozoa the author distinguishes six different forms of cells, viz.:—animal-cells, ovicells, avicularia, vibracula, radical fibres, and stem-cells; but all of these, it should be stated, are never found existing together. In the Cyclostomata the animal-cells are found either alone or in conjunction with ovicells (*Crisia*); in the Ctenostomata, these cells are often met with conjoined with radical fibres (*Vesicularia*) into a common stem, whose cells contain the colonial nervous system, which has repeatedly formed the subject of the author's observation; and amongst the Cheilostomata are found species, as *Cellularia*, which exhibit a still greater diversity of individual forms.* All these parts arise in exactly the same way, by budding, and when incompletely developed are indistinguishable from each other. The germ-capsules arise from animal-cells, whose tentacular apparatus and alimentary organs are aborted. The embryonic development of the Bryozoa, is, speaking generally, very diverse, since it may be effected not only by fertilized ova and statoblasts, but occasionally also as in Lepralia, by gemmules springing singly from the inner wall of the animal-cells, or of the ovicells. The formation of the rest of the contents of the cell (the digestive and respiratory apparatus, the sexual organs, and the statoblasts) also takes place, according to M. Smitt, by gemmation, so that he is disposed to assign to the Bryozoa (Polyzoa) a double polymorphism, an external and an internal, the former having reference to the cells and the latter to the viscera, which also may be more or less individualised, as has already been pointed out by Allman."

In the paper of which the above is a summary, the author' investigations were conducted in *Crisia aculeata*, *Alcyonidium gelatinosum*, *A. parasiticum*, *Flustrella hispida*, *Œtea truncata*, *Eucratea chelata*, *Scrupocellaria scruposa*, *Canda reptans*, *Flustra truncata*, *Fl. membranacea*, and several species of *Membranipora* and *Lepralia*.

In the memoir whose title heads this notice, M. Smitt describes a new species of Œtea in the following terms :—

Œ. argillacea, n. sp.

Œ. elongata, recta, punctata, basi constricta.

Hab. In mari Bahusiensi, nullo alio loco, ut videtur, adhuc reperta; per *Modiolam oculinæ*, affixam serpens inventa est. (Mus. Holm. Lovén).

Species Œteæ ligulatæ (Busk), maxime affinis, a quâ tamen facilè basi sua constricta dignoscitur. Longitudo testæ erectæ circ. 1·5 mm., cujus dimidiam partem superiorem, tenet apertra testæ obliqua.

On the Development *of* Ascaris nigrovenosa.

In our last number we gave a notice of some late researches on the development of *Ascaris nigrovenosa*,† by Herr E. C. Mecznikow, who at the same time claimed to be the original

* In this class, all the six forms of cells (so termed) are certainly, not unfrequently, co-existent in the same polyzoary.—G. B.

† 'Quart. Journ. Mic. Sci.,' Jan., 1866, p. 25.

discoverer of the curious circumstance that that nematode is capable of sexual reproduction, both in the parasitic and its free state, in which latter condition it resembles the genus *Rhabditis*.

This claim on the part of Herr Mecznikow has, as might be expected, called forth a reclamation from Professor Leuckart, who was thus, as it were, inferentially charged with having appropriated to himself in his previous communication some of the results of his pupil's independent researches. In a recent paper* Professor Leuckart indignantly repudiates this charge, and, although he allows that the particular fact with respect to *A. nigrovenosa* was first noticed by Herr Mecznikow, this only happened in the course of an investigation into the life-history of the Nematoda which was carried on by that observer under his own immediate auspices and directions, and in his own laboratory and with the aid of his own materials. A reply to this reclamation of Professor Leuckart has been published in a separate form† by Herr Mecznikow, and, upon consideration of the whole case, it appears to us that, although Professor Leuckart, might, perhaps, have been more liberal in his acknowledgment of the assistance afforded him in his researches on the subject of the Nematoda by his quondam pupil, still that the latter has claimed rather more originality than he is entitled to, seeing that, although he actually observed the fact of the dimorphic sexuality of *A. nigrovenosa*, he was led to this observation during an investigation directed in a course pointed out by his distinguished teacher. But leaving this very unpleasant and unprofitable subject, we would draw attention to some of Professor Leuckart's observations upon the other contents of Herr Mecznikow's highly interesting communication.

With respect to the "cuticular lip" mentioned by Mecznikow in the embryo of *A. nigrovenosa*, Professor Leuckart remarks that it is not a continuous structure or border around the oral orifice, but composed of three distinct papillæ, as in all other nematode embryos hitherto observed by him. The rudimentary sexual organ, whose considerable size and high degree of development forms so characteristic a feature of this Ascaris-embryo, is an elongated body about 0·08 mm. in length, and 0·012 mm. broad, and containing, not a protoplasm filled with *nuclei*, but distinctly isolated, though membraneless cells, 0·007 mm. to 0·008 mm. in diameter, and

* 'Archiv. f. Anat.,' No. 6, 1865, p. 641.

† 'Entgegung auf die Erwiderung des Herrn.' Prof. Leuckart, &c. Göttingen, 1866.

furnished with a vesicular nucleus 0·0048 mm. in size. In the immature embryo these cells exactly resemble those of the intestinal epithelium, their only further change consisting in their eventually becoming more transparent.

With respect to the sexually mature Rhabditis-form, he observes that the pharyngeal walls are by no means muscular throughout their whole extent, as described by Herr Mecznikow. Radial muscular fibres can only be noticed in two situations in them, viz., in the hinder enlargement, where they serve for the movement of the three chitinous teeth; and more in front, almost in the middle of the more cylindrical œsophageal tube, at which point the chitinous covering is also developed into a sort of armature. The caudal papillæ also in the male are not hair-like, but tolerably thick and conical in form.

The larger-sized female, which in summer usually exceeds 1 mm. in length, has quite as distinct a nervous ring as the male, although this organ is by no means so distinctly defined in *A. nigrovenosa* as in many of the nematodes. The female organs are imperfectly described by Herr Mecznikow. They do not consist, as asserted by him, of a membraneless string of ova, but of two elongated sacculi, which stretch forwards and backwards from the genital opening; and at the time of copulation, besides the vagina, two other divisions of the sexual tube may be recognised, viz., a uterus and an ovary. The former represents a tolerably thick, short canal, of narrow calibre, and apparently having cellular walls, whilst the ovary is formed by a very delicate, but nevertheless distinctly demonstrable, structureless membrane; and its interior is filled with ova.

He further remarks that, although the description given by Herr Mecznikow of the embryos is in the main quite correct, that observer has overlooked the interesting fact that these embryos, whilst they are within the emptied body of their parent, present the Rhabditis-form of pharynx, possessing not only the two characteristic enlargements, but also furnished with three chitinous teeth, smaller, it is true, than they are in the preceding generation, but of the same form, and, like them, moved by distinct muscular fibres. When liberated from the maternal body these teeth are lost, the muscular striæ disappear, and the pharynx assumes a more Ascaridan form; the creature at the same time has become capable of being developed in the lungs of the frog into the well-known *A. nigrovenosa.*

Professor Leuckart then describes experiments with respect to the introduction of the liberated Ascaridan embryos into the lungs of the frog. This experiment, it would seem, is not always successful, but sufficiently often to show that the lungs are the true destination of the embryos, which, if swallowed, invariably perish after a time in the stomach. Professor Leuckart has carefully traced the development of the embryos into the perfect *A. nigrovenosa* in the frog's lung, and has found that they are all invariably females, so that there can be no doubt that the production of young in the parasitic *Ascaris* is entirely parthenogenetic. It is beyond doubt also, he says, that this mode of parthenogenesis is widely diffused among the nematodes, and cites as a tolerably certain instance of it the case of *Filaria medinensis*. With respect to which species, he remarks, that from Carter's observations, it would seem probable that *Filaria medinensis*, like *A. nigrovenosa*, exhibits two kinds of generations— a parasitic and a free, and that thus it would present an exact analogy with the parasite of the frog's lung.

He is of opinion, however, that this notion is erroneous. And he is led to think so from the circumstance not only of the slight degree of development of the embryonal rudimental reproductive system, but further, from the striking similarity between the embryos of *F. medinensis* and those of *Cucullanus elegans*. According to all analogy, the embryo of *F. medinensis* is equally destined to migrate as is that of *Cucullanus*, though whether this migration is confined to the human subject or not it is impossible to say.

At present, he says, notwithstanding his pretty extensive experience on the subject of the developmental history of the Nematoda, that of *Ascaris nigrovenosa* stands alone.

On this account it is the more interesting to record the same phenomena in other groups of the lower animals, amongst which he notices the extraordinary fact discovered by Häckel, of the production, within the visceral cavity of the mature *Geryoniæ*, by a process of budding, of Medusoids of quite another organization (*Cuninæ*), which also in their turn reach sexual maturity. He adverts next to the life-history of *Coccus* formerly described by himself.* In this case, as in *A. nigrovenosa*, two successive generations of different kinds are thrown off, both of which become sexually developed, and both of which exist under different conditions. It is true that the vital conditions in the *Aphis*-like winged and the *Coccus*-like wingless generations are not so strikingly different as in *A. nigrovenosa;* but the difference between the two cases is only one of degree, and as such points distinctly enough to the analogy which exists between them. It is remarkable, also, that in *Chermes* the dimorphism of the suc-

* 'Archiv f. Naturgesch,' 1859, p. 208.

sessive sexual generations is combined with the phenomena of parthenogenesis, which in this case is even exhibited in both generations.

For this mode of development, with the intervention of two sexual generations, which, on account of the sexual perfection of the intermediate generation, does not come under the same category with the usual form of "Alternation of Generation," Professor Leuckart proposes henceforth to employ the term—HETEROGONY, a word which, it is true, has been otherwise applied, but which, in its present sense, implies pretty closely what it was intended to express by its first employer, Johannes Müller. Whether Häckel's ALLÆOGONESIS should be included under Heterogony is at present doubtful, and can only be decided when we learn the fate of the offspring derived from the fertilised ova of the two generations. But, however this may turn out, we have clearly in this case, as in *Chermes* and *Ascaris nigrovenosa*, at any rate an instance of two different sexually developed generations which form links in the development of one and the same species.

Hitherto, he concludes by observing, we have been accustomed to regard sexual reproduction, not only as the end and aim of animal life, but also as the criterion of specific individuality. But neither of these assumptions is any longer admissible.

"Nature follows its course, and what at one time appears as an exception becomes a law."

NOTES AND CORRESPONDENCE.

Dr. Beale's Glass Reflector.—I have made several glass reflectors of various kinds and different thicknesses of glass, for drawing and measuring objects, after the plan of Dr. Beale. None of them were made, however, of neutral tint or coloured glass. There is a peculiarity attending them, to which I wish to direct attention, as I have not seen it noticed before. I had made several of glass from $\frac{1}{16}$ to $\frac{1}{8}$ thick, but I could not at first get quit of the double reflection from the two surfaces of the glass, which rendered it impossible to draw or measure objects satisfactorily. I found, however, after many trials, that with every piece of glass I used there are two positions in which it may be placed distant 180° from each other, in which the glass reflects only one image to the eye, and in this position, therefore, the glass reflector must be placed. This position may easily be found upon trial for each piece of glass, as upon looking at the reflected image of a window, for instance, by turning the glass round in the position it would be placed were it arranged for drawing, the two reflected images of the bars of the window will be found to converge into each other, and at the proper place disappear into one, and this will take place twice in one revolution. I understand the difficulty caused by the two images or double reflection suggested the use of thin glass for the purpose, but the method I have indicated is simple, and so perfect as to render it equal to, if not superior, to a *camera lucida*. I am not aware if any of your readers are cognisant of this peculiarity, but, perhaps, some of them may inquire into and explain it.—W. Forgan, 3, Warriston Crescent, Edinburgh.

Growing Slides.—The American growing slide described in the 'Annals of Natural History' for November, and mentioned in the discussion at the last meeting of the

Microscopical Society, is now made by Mr. Baker, of Holborn; the pattern has also been sent to Messrs. Claudet & Houghton.

For operations where a large quantity of water in reserve is wanted, and there is no necessity for the object to be nearly close to the stage, Mr. Beck's slide answers admirably.

Those who are able to cut glass with a diamond can easily make the American slide for themselves at the cost of a few pence; the best tool for drilling the hole is a small triangular file with the point ground to the form of a pyramid, used with turpentine; the glass being pressed against a piece of cork for support, the points can be made without heat by using thick gold size.—W. T. Suffolk, Claremont Lodge, Park Street, Camberwell.

Mounting Diatoms.—Can you or any of your readers inform me how to make microscopic objects (diatoms, for instance) stick on a slide after they are arranged? I have tried many ways, but none of them answered to my satisfaction when I compared my slides with the beautiful ones arranged by the London mounters. I find no difficulty in picking off and arranging the diatoms in any patterns, but what I fail in is to make them adhere to the slide after I have put the balsam on them. I am now engaged with some beautiful forms from the Montray and Les Angeloss deposits, and it is exceedingly annoying, when I have got the diatoms arranged nicely on the slides, to find them floating away; when the balsam is put on I have no doubt there is a very simple way of overcoming this difficulty, and perhaps you or some of your numerous subscribers can assist me to it.—W. Ward, Hull.

We have recently had an opportunity of examining two new forms of instruments constructed by Messrs. Murray and Heath, in one of which the great object of furnishing a stand at a low price, but which should yet be capable, if desired, of being adapted to the use of the highest powers, and fitted for the addition of all accessory apparatus, has, it seems to us, been very satisfactorily obtained. The stand itself is remarkably steady, and the objectives—which, we understand, are furnished with it for £5—are a $\frac{1}{4}$ inch of 75° and an inch of 15°, both, as tested by ourselves, of excellent quality.

The second instrument is one which has been contrived for use in the demonstration of objects to a class of students. It is but too well known to those who are engaged in teaching how liable the objects exhibited, and sometimes even the object-glass itself, are to be injured in the hands of those unaccustomed to use the microscope. In oder to avoid this risk, Messrs. Murray and Heath have constructed an instrument intended to combine an ordinary with a demonstrating class microscope. It consists of a small microscope, the body of which can be inclined at any angle, with a mirror on a ball-and-socket joint, and a universal movement to the stage-plate. When it is to be used as a class microscope the slide is placed in a shallow box, into which it is locked by means of a key. The same key locks this box firmly on the stage-plate. When the object has been found this latter can be secured firmly on the stage in the same manner. After focusing, the body is also locked in its place with the same key, the final adjustment being made with the eye-piece. The body is then placed in a horizontal position, and fastened with a screw. The instrument can now be passed round a class-room without possibility of injury either to object or object-glass. The illumination can be obtained either by holding the instrument against the window or by means of a small lamp similar to that employed by Dr. Beale, and which can be so adjusted as to be used either for opaque or transparent objects. This instrument appears to be very well adapted for the purposes for which it is intended, and, at the same time, if without the contrivance for locking, to be a useful portable form for general or professional purposes.

PROCEEDINGS OF SOCIETIES.

Microscopical Society.

December 13*th*, 1865.

James Glaisher, Esq., F.R.S., President, in the Chair.

The President read the 7th Rule of the Society, with respect to the retirement and election of certain members of the Council and other officers, and announced that the Council recommended to fill the office of President for the ensuing year, himself; as Treasurer, C. J. H. Allen, Esq.; and as Secretaries, G. E. Blenkins and F. C. S. Roper, Esqrs.; and that H. A. Freestone, R. Mestayer, Esqrs., Dr. Millar, and Samuel Charles Whitbread, Esq., should be elected members of the Council, in the place of Dr. Beale, H. Deane, Esq., R. Hodgson, Esq., and J. Newton Tomkins, Esq., who retired in accordance with the Bye-laws of the Society; and that the names of the gentlemen recommended would be suspended in the usual way.

Mr. Beck read a paper entitled "A Short Description of a New Species of Acarus, and its agamic reproduction." ('Trans.,' p. 30.)

Mr. Slack.—With reference to this interesting subject, I may mention a report, in the 'Archives des Sciences' for October, of some remarks made by Dr. Claparède at a meeting of the Société Helvétique des Sciences Naturelles. Dr. Claparède said that several of these acari were bimorphic; that is to say, the male and female present very different appearances as regards form and size. He said that the so-called genus Hypopus (I believe, a kind of acarus without mouth or digestive apparatus) were the males of a species in which the females were much larger and very different in aspect. His remarks are somewhat imperfectly given, but I gather from them that in these cases of dimorphism the male acari are so different from the female as to justify the apprehension that they belong to a totally different species. I find the Hypopus described in the 'Microscopical Dictionary' as without mouth or intestines; and if these organs are absent, they would resemble the male rotifers, the nature of which Mr. Gosse and others have elucidated. Mr. Beck was kind enough to show me his specimens, and I thought it would be as well to call attention to Dr. Claparède's remarks, because they show the importance, when experimenting on the agamic reproduction of acari, of excluding individuals of different shape that might prove to be males in disguise.

A vote of thanks was accorded to Mr. Beck.

A paper "On Cells and Cell Mounting" was read by James Smith, Esq., F.L.S. ('Trans.,' p. 34.)

Mr. Beck then read a paper "On Improved Growing Cells." ('Trans.' p. 36.)

Mr. Lobb (referring to Mr. Beck's paper) stated that he had received a letter from Professor H. L. Smith, of Gambier, Ohio, U.S., calling attention to an article on a new growing slide in 'Silliman's Journal' for September; and he had also received a slide from that gentleman.

Mr. Jabez Hogg.—I do not think Mr. Beck's cell will replace that of Mr. Smith, or the one that was shown by Mr. Suffolk. It seems to me that the great use of that cell would be in viewing very fine objects, that is, in using very high powers for the purpose of viewing them. If we use Mr. Beck's cell we have an interference with the light through the thick glass, but in viewing objects in Mr. Suffolk's ingeniously-contrived cell it appeared that we had obtained the long-desired use of the thin glass for objects in fluid, and I think there is very little to be gained by going away from the live-box that has been so long in use to the old deep, thick glass cells, and that the live-box will even be as serviceable as the one proposed by Mr. Beck. I do not think we should get the same good from his proposition that we do from the other. I rather differ from the view he has taken of the ingenious cell shown to us the other night by Mr. Suffolk. I should like to hear what Mr. Suffolk has to say about this cell, because he has had the opportunity of using it over and over again.

Mr. Suffolk.—The cell is not my own contrivance; I copied it from the description in 'Silliman's Journal.' Mr. Hogg, I think, mistakes the use of the cell, which is to keep a feeding-cell for the animal. I have seen Mr. Beck's cell to-night, and I think it will answer the purpose perfectly; but I am afraid it has the disadvantage of not allowing the parabola to work closely enough to the under glass.

Mr. Beck.—I have not altered in any degree the principle suggested by Mr. Smith, except that in Mr. Smith's cell we look through a considerable thickness of water, which would entirely prevent the use of the parabola, whereas here we look through a piece of glass. Mr. Smith has two thicknesses of glass and one of water, whereas I have only one of glass. It is the same principle, and I do not claim anything for this invention.

Mr. Hogg.—Mr. Smith's cells can be easily cleaned by taking off the front glass and cementing it down again. It may be done easily by any one used to cleaning glasses.

Mr. Hall rose for the purpose of making some remarks on Mr. Smith's paper cells, and bringing to the notice of the Society some of Mr. Lee's cells, made on the principle of pill-boxes. He said—I thought them very good when I received them, and the only possible objection to them is that they might be affected by damp. Mr. Brooke, our then President, thought that if they were made with cement instead of ordinary gum that difficulty would be overcome; I think I have overcome the difficulty by soaking them in Brunswick black. I wish to call special attention to these cells, which I consider better than Mr. Smith's, and for this reason—because, made in the way I have mentioned, they can be made as cheaply as 1*s*. a gross, or thereabouts. They can be cut any depth or size, and can be made very accurate. They have another advantage, and that is, that the edges of the paper in the pill-box cells are placed upon the glass slide, and the upper part is covered with the fine glass, which prevents any damp passing by capillary attraction. Now, if I understand Mr. Smith's cell, the reverse is the case, for, being punched out of flat card-board, the edges of the paper would be upwards, and thus render them liable to be affected by damp. I wish to call attention to these cells that I have soaked in cement, as I think the process will be found better and far less troublesome than to punch them on Mr. Smith's plan.

Mr. Henry Lee.—I beg to thank Mr. Hall for introducing to the notice of the Society the cell I mentioned some time ago; but, though it was very useful in its way, I think Mr. Smith's has an advantage which has not been mentioned, inasmuch as he is able to do a greater number on one sheet, and it is all done in one operation, by which a great saving of time is effected.

Mr. Shadbolt.—I object to paper cells of every description; I think them thoroughly bad. I never saw an object mounted on a paper cell that would last any length of time; and I am the more induced to call attention to that fact just now, because the gentleman whose paper has been read has alluded to a certain material for mounting his cells that, in my opinion, is better adapted for making them; I mean marine glue. Now, some fifteen or twenty years ago I was in the habit of mounting a large number of microscopical objects, some dry, some wet; and the mode I found most efficacious for the dry cells, and the most ready of application, was to make the cell itself of marine glue. I got a common iron spoon, into which I put my marine glue, and held it over a spirit-lamp until it was softened. I then threw it on a flat surface while soft, so that it might be squeezed or pressed to any degree of thinness. When that was done all I had to do was to place it on a card, and, with two or three gun-punches, punch out a number of discs of various sizes, and thus get smaller or larger rings of glue. I then simply take the glass slide, warm it over a spirit-lamp, pick up one of the rings of melted glue and drop it on, and it fixed itself. I could prepare 200 or 300 of them in the course of an evening, if necessary. If the object will bear a little warmth, we have only to heat the thin glass disc with which I cover it, put it on to the marine glue, and it cements itself. The whole thing is done without any difficulty.

Mr. Wenham.—I beg to confirm what Mr. Shadbolt has said as to the use of paper being unsafe in damp places, and I also wish to call attention to a substance for making cells which is not generally known. In mounting Podura scales and other similar objects on thin glass, it is generally my practice to put the scales on the thin glass covers, and fix them with common heel-ball, drawing a hot iron round the edge of the thin glass, which cements it perfectly.

Mr. Suffolk.—I have another material to mention—pure tin, which is a soft metal, and can be cut with a knife or pair of scissors, or punched. It is acted on by nothing but nitric or hydrochloric acid, and I have used it both for wet and dry objects. I have only obtained one thickness, but the metal will roll to any degree of thinness that may be necessary.

Mr. Brook.—I have to mention one other material for the mounting of dry objects, for which, as far as I know, we are indebted to Dr. Golding Bird, who used it extensively for mounting specimens of Bryozoa, viz., small vulcanized India-rubber bands cemented down to the glass with a solution of India rubber, and then the slide was cemented on with the same material. They certainly entirely obviate the difficulty of any moisture getting in, as they are wholly impervious to wet. I have frequently made use of card discs myself, especially for mounting dry objects. I merely punched out small discs on the card, and then, with a small punch, punched out the centre so as to leave an annulus. That has been attached to the glass slide, and the thin glass laid over that with any kind of adhesive material; but I have always taken the precaution of varnishing round the whole of the slide, to prevent the growth of Conferva. With that precaution, I think a cardboard cell safe; but to protect the edge from the transmission of moisture by a layer of varnish only is wholly insufficient.

The Rev. J. B. Reade, F.R.S.—I may mention that Mr. Waterhouse, of Halifax, has used sheets of ebonite for the purpose of making cells; and he approves of it very highly, and speaks of it in the strongest terms of satisfaction. It is better than paper, certainly.

Mr. Deane.—I think, where economy is an object, that there is a great advantage in the paper cell according to Mr. Smith's plan. Ebonite cells and glass cells, and many others, are very expensive; but if you can multiply paper cells and render them impervious to water in the way proposed by Mr. Smith, I think a very great service will be rendered to those who cannot furnish themselves with the more expensive descriptions of cells. I know Mr. Matthew Marshall used to mount a great many objects in paper cells, and he had a machine by which he could punch holes without leaving a burr; and I have now some dry objects mounted by him, and in no instance have I ever seen Conferva. With regard to Conferva growing on paper cells, I think it may be obviated by dipping the card, after its being punched, in a weak solution of corrosive sublimate and spirits of wine—one grain of sublimate to an ounce of spirits of wine, would be sufficient to poison the cardboard thoroughly; and instead of tin shells, when cells are made in sheets, I would have a contrivance something like a photographic bath full of the varnish (which might be easily made), so as to prevent evaporation, and dip them once or twice, or more, as occasion might require; and, if it were thought needful, a very small quantity of corrosive sublimate in the same proportion might be put into the varnish, and thus all the difficulty as to the growth of Conferva might be obviated. I think these economic methods of preparing cells the most convenient.

Mr. Jabez Hogg.—I think the great merit of Mr. Smith's cell lies in its cheapness; and I am also of opinion that the marine-glue method meets the Conferva objection. I have some dry objects which have been mounted twenty years, and they are perfectly good. Indeed, I thought that both in Mr. Smith's invention, and in that of Mr. Suffolk's, the chief merit was that these cells might be made for 2*d*. That being so, the objection as to cleaning the cells was easily disposed of, because if there was any difficulty of that kind the glass could be thrown away; and although Mr. Beck's plan might be an improvement, yet it would cost a sum of money, and I think with Mr. Deane that the great merit of these inventions is the cheap way in which they can be brought into use.

The Rev. J. B. Reade.—I admit that paper is cheaper than ebonite; but then "time is money," and you have to buy corrosive sublimate and spirits of wine, and spend time in mixing them and putting them on, before the paper (the cheap article) is fit for use, so that I think that time and paper, as against ebonite, would be the more expensive of the two.

Mr. Deane.—You may buy a pint of methylated spirit for a small sum, and twenty grains of corrosive sublimate for a penny. The preparation would not cost more than a shilling.

Mr. Hall.—In support of the Rev. Mr. Reade's remarks, I beg to call attention to vulcanite. I have placed vulcanite cells in the hands of Mr. Bailey, of Fenchurch Street, upon condition that he supplies them at 4*d*. per dozen.

Major Owen.—It would be a great desideratum to have something always procurable in the market, and at the same time very cheap. There are brass rings which you can purchase for, I think, 3*d*. per hundred. They are flattened on either side; and if these brass rings are put on in the form of cells with any cement, I think they are the cheapest and easiest to procure, and I have never found any objection to them.

Mr. Smith.—I have felt some difficulty, as a young microscopist, in bringing this subject before the Society. As I have before stated, I do not attach so much importance to the materials employed as to the method of preparing them. The method I propose has been found very good in many cases; Mr. Hall's proposed method of dipping would be excellent; and I think the two might be very well worked together. What I wish, however, particularly to say is, that in every case, after the cell has been mounted on the thin glass, it should be properly finished with marine glue or cement or gold size outside; and if that is done, I do not see how damp can affect it. I do not put the cell on and leave it, but always properly cement it, and in that case I do not think it can be reached by moisture.

The discussion was concluded, and a vote of thanks was proposed to Mr. Smith and Mr. Beck, which was duly carried.

A paper from E. Ray Lankester, Esq., "Notes on the Gregarinida," was read. ('Trans.,' p. 23.)

The thanks of the Society were voted to Mr. Lankester for his communication.

The President laid before the Society the subscription list of the "Quekett Medal Fund," which he recommended to their support.

The following communication to Mr. Suffolk from the Post-office authorities, with reference to sending microscopic slides by post, was read:

"G. P. O., 10th Nov., 1865.

"Sir,—In reply to your letter of 28th ultimo, I beg leave to state that, inasmuch as glass is not allowed to be sent by post, the microscopical specimens which you have furnished, being mounted on glass, cannot be forwarded at the pattern rate of postage.

"I am, Sir, yours obediently,

"J. Hill."

The meeting was then adjourned to the 10th January, 1866.

January 10*th*, 1866.

James Glaisher, Esq., F.R.S., in the Chair.

Mr. Lobb produced for the inspection of the meeting an illuminator referred to in a letter of Professor Smith's, of Kenyon College, Gambier, Ohio. He also explained, by reference to different parts of the instrument, the improvement which had been suggested therein by Mr. Beck and Mr. Lealand. He then read a paper "On Illuminating Objects with High Powers." ('See Trans.,' p. 39).

Mr. Beck read a paper entitled "The Object-Glass its own Condensor, or a new method for Illumination for Opaque Objects under High Powers."

The thanks of the Society were voted to Mr. Lobb and Mr. Beck.

Mr. Wenham.—Upwards of five years ago Mr. Hewitt suggested to me, and I believe to others, the principle of making an object-glass its own illuminator. I immediately gave the mode a trial, and I have here the reflector by which the experiment was made. It is a brilliantly polished speculum, with an aperture in the centre just sufficient to admit the pencil of rays from the object-glass. This I placed obliquely in the axis of the microscope, through the side of which was an opening for admitting the light from the illuminating source, and the rays from the object returned through the central hole. I got an extraordinary amount of light, but the internal glare was so great that I found it had obscured the object, which had a kind of fog thrown over it. Consequently I abandoned the trials. I informed Mr. Hewitt of the result. Mr. Beck informed me at the last meeting that the light might be too brilliant. He said that the partial reflection from the single disc of glass is of the proper degree of intensity, and that with the speculum, I did not make use of the most valuable or central portion of the rays. With a piece of plain glass it is known that the more oblique the incidence the greater the light reflected. On asking the question whether this might be put at a more oblique angle than 45°, he said that generally that did not answer, the light being over-abundant. Then, as regards the question of the application of a thin disc of glass for illuminating an object, that is an old idea. I have in my hand a micrometer eye-piece made by Troughton and Sims for a telescope in which the same plan is employed for illuminating the cross wires, and it is used to the present day. Mr. Wenham exhibited the eye-piece, and explained that the light was thrown in sideways upon a disc of glass, which, of course, must be perfectly ground and polished; the light is then thrown downwards on the wires. The first piece of glass was to prevent the access of dust.

The President.—I know this quite well.

Mr. Wenham.—I do not wish to disparage the idea at all, for, in my opinion, it removes a difficulty against which we have been labouring for years, in attempting to illuminate an object with high powers, where it is almost in contact with the front lens.

Mr. Slack.—I have had the opportunity of trying the illuminator of Messrs. Powell and Lealand, and also that of Mr. Beck. I have not had the opportunity of trying (although Mr. Lobb was kind enough to show it to me) the one devised by Mr. Smith, of America. On reference to 'Silliman's Journal,' it will be found that Mr. Smith speaks of using glass to reflect the rays of light downwards. The meaning of the passage is not very clear; but he says that the result of using the glass covers was that he did not get sufficient relief; that the field looked too flat, which was not the case when he used the small silver mirror. His allusion to using *several* thin discs is rather puzzling, because it is not to be supposed that he placed his one behind the other, and thus created a confusion of reflections. Mr. Slack then suggested that Mr. Lobb should state his opinion of the silver reflector, and said that he was inclined to suppose that, at all events, for some purposes, the silver reflector would be best. In Messrs. Powell and Lealand's plan a piece of glass of noticeable thickness, perhaps a sixteenth of an inch, occupies the place of this thin disc of Mr. Beck's. With as high a power as $\frac{1}{50}$th, this sloping piece of glass, not used as an illuminator, but simply looked through, allows the Podura scale to be seen so as to exhibit those marks that are so beautifully shown in Mr. Beck's drawings. Thus, it does not introduce any noticeable errors, although it makes a slight difference in the adjustment. With respect to the comparative advantage of a noticeably thick glass and a thin one, my opinion is rather in favour of the thin glass, except that it is so easily broken. Mr. Beck, however, used a size of disc that is very common amongst covering glasses, and, when broken, it is easily replaced. With reference to the diaphragm which Messrs. Powell and Lealand have copied from the American pattern, it will be found useful in cutting off the glare from parts of the field not absolutely in focus. Messrs. Powell and Lealand fix their piece of glass, which acts as a reflector; but Mr. Beck makes it movable. I believe the movable arrangement exists in Mr. Smith's instrument. The power of motion is a decided advantage, and therefore I cannot say that I am entirely satisfied with their illuminators, as it is exceedingly difficult, with some objects, to get rid of a kind of milk-and-watery appearance of the field. This milkiness sometimes accompanies very good definitions of minute objects; and I suggested to Messrs. Powell and Lealand that, possibly, introducing a condensor, to get a very small pencil of light, might obviate it. Mr. Smith, of Bow, showed me an illuminator he had fitted up with a small condensor, and whether from this cause or from contracting the aperture, his instrument was more free from milkiness. Professor Smith seemed to think that by his arrangement he gets a more slanting illumination; and if so, it would have a decided advantage, for most purposes. Diamond-beetle scales come out beautifully with Messrs. Powell and Lealand's or Mr. Beck's illuminator. In addition to a number of vertical lines, some curiously arranged groups of curved lines will be seen. I tried to trace a relation between the character of the patterns formed by these lines and the colours exhibited, but did not succeed. Great importance is to be attached to a remark of Mr. Beck, "that you want a means of slightly changing the angle of the object when under view." It must be remembered that objects are seen with these illuminators under nearly vertical illumination. The effects of this mode of illumination may be advantageously studied with lower powers and Mr. Beck's Sorby illuminator. With this instrument a brilliant slanting illumination may be instantly changed for a vertical one; and it is most instructive to witness the great alteration that takes place in the appearance of the object.

Mr. Brook.—I have not yet had the opportunity of using this instrument, and therefore I cannot speak of it from my own experience; but I think it would be an advantage if this reflecting disc were made of parallel glass, that is, glass the surfaces of which are accurately parallel to each other. I am hardly prepared to say whether the glass should or should not be of the ordinary thickness, but I am not aware that it makes much difference. It is a fact that, if we take any number of ordinary rounds for covering objects of the usual diameter—$\frac{1}{2}$ or $\frac{5}{8}$ inch—we find some of them to be of sensibly different thicknesses in different parts; and when high powers are used I cannot help thinking that if any portion be wedge-like it will to a certain extent interfere with the perfect definition which can be obtained from the best-constructed glasses of very high powers. If these glasses are parallel glasses, of course, in the passage of rays from the object-glass up to the body of the microscope, the rays will all be refracted equally. If the two surfaces are accurately parallel to each other every ray will be refracted parallel to itself, that is, the direction of the rays will not be in the slightest degree altered; but if, on the contrary, this glass be wedge-like, of course a different amount of refraction will take place, and there will be a certain amount of chromatic dispersion of every ray transmitted through the wedge to the eye-piece, and that, I think, might be found sensibly to interfere with the definition.

Mr. Beck.—With reference to Mr. Brooke's remarks, I would state that any variation of thickness in the glass of the illuminator would be far more evident with the lower than with the higher powers. It is well known that in the case of binocular prisms for the microscope a bad prism will give a greater amount of error with low powers than with high ones. In connection with this illumination, I found, when examining some of the Diatomaceæ, that the definition was much improved by cutting off half of the aperture in the side of the illuminator; and it then struck me that a piece of semicircular glass with its diameter across the field of view would answer best of all, but I found the loss of definition to be very great. Definition is also lost by cutting off any considerable portion of the aperture of the object-glass; and if I rightly understand the American plan, an opaque substance comes over a portion of the aperture of the object-glass.

Mr. Lobb.—Very little indeed—scarcely perceptible.

Mr. Beck.—Then I cannot understand how sufficient illumination is obtained.

Mr. Roper.—I have tried Mr. Beck's and Messrs. Powell and Lealand's new illuminators, and I quite concur with the observations already made, that the plan will be a useful one, especially for the examination of the Diatomaceæ, the minute structure of which is in many cases difficult to make out, by ordinary methods of illumination. With respect to the difference between the plan proposed by our English opticians and the American method, I have been told, that half the field was cut off by the opaque mirror which is interposed between the object-glass and the eye-piece in the American plan, which I consider to be a great objection, and it was this defect that induced Mr. Lealand to introduce glass as a reflecting medium. My own impression is that the glass being movable, as in Mr. Beck's arrangement, is an advantage, but I am unable at present to give any positive opinion. Both plans will, I think, be useful; and we are greatly indebted for the improvement made on the American plan, and to Mr. Beck for having brought the subject before the Society.

Mr. Bockett.—I have worked with both these instruments. I applied myself to Messrs. Powell and Lealand's, but my first trial was anything but successful. There appeared to be too much glare; indeed, so much that I took back the instrument and asked that the cause of this might be explained. I was informed then that the glass was really parallel glass, and that, in all probability, my manipulation would be found to be at fault. I studied the matter very closely, until I found that my great fault lay in using too much light. When too much light is used a glare is produced, and the very best way to get rid of that glare is to use just sufficient light for the purpose of illuminating the object. I found, by using the Sorby instrument, and getting the light just to fill the aperture of the diaphragm at the side of the illuminator, and no more, and then stopping it down with the next-sized stop, I nearly got rid of the glare, and that often the second aperture got rid of it altogether. I cannot say that with Mr. Beck's illuminator I could entirely control the light in the same way that I could with Messrs. Powell and Lealand's. I mention this because I think the glare of light is often the cause of fault being found with the instrument, when it really lies with the parties using too much light. I also observed another important fact—that by introducing a small piece of light thin glass between the orifice, if there was any milkiness, it was so absorbed by the altered nature of the light that really the object was pleasant to look upon.

Mr. Beck.—I should like to say a few words in reply. I have found the best mode of proceeding to be as follows:—Place the light on the left-hand side, and obtain a distinct image of the flame across a portion of the field of view; it is then evident that, if you have the illuminating rays in focus at the same time as the object, you must also secure the best possible definition. The effect of a diaphragm at the side is merely to limit the area of the illuminated part, a result which may readily be obtained by interposing a condensing lens between the light and the illuminator. By slightly altering the position of this lens the whole of the field of view or any part of it may be illuminated. Mr. Beck then sketched the appearance of the fine "tenent hairs" on the foot of a fly as seen under this new mode of illumination, clearly indicating the same structure as those on some of the beetles which have been so admirably illustrated in Mr. Tuffen West's paper on the feet of insects, published by the Linnean Society; and he mentioned, what might not be known to all, that the true action of these hairs is still a point of discussion between Mr. West and Mr. Backwall.

Mr. Ladd suggested that much of the milkiness might be owing to the refraction of the light, because nearly one half of the light was reflected on the object, and the other half was reflected through and would strike the side of the object. It was difficult to destroy the whole of the light from the surface, and a great deal of the milkiness was, he thought, due to this cause.

Mr. Hall said that, in using Messrs. Powell and Lealand's reflector, he had got rid of part of the milkiness by covering up the back portion with a piece of black paper as a temporary expedient, with a hole in the middle of it as a diaphragm.

A Member thought a better plan would be to use a piece of black velvet, with a hole through the opposite side; and if the milkiness proceeded from the cause supposed, the light would then die away.

Mr. Lobb expressed the pleasure he felt at being made the medium by which Professor Smith introduced his plan to the notice of English microscopists, and felt confident that, in the end, good results would be obtained from it, though it was yet in its infancy. He did not wish to object to any method, nor was he prejudiced in favour of the American plan, but certainly it had the advantage of possessing a motion for turning the silver reflector at any angle, and putting it at any distance that might be necessary, when using different powers. Mr. Lobb then referred to the objection that the reflector covered too much of the field, and explained Professor Smith's diagrams with a view to show that it really covered very little of it. As regarded parallel glass, he thought with Mr. Brooke that this was a very important point, and that Mr. Lealand's idea of placing a piece of perfectly parallel glass at the proper angle might be carried out with the best possible results. Mr. Lobb proceeded to explain an object-glass for the polariscope he had some time since invented in order to look at crystals above the eye-piece, and explained, by a reference to the various parts of the illuminator, the way in which it had been applied to that instrument.* The field was beautifully illuminated, and the object came out without cloud or milkiness, and by using a $\frac{1}{4}$ object-glass the whole field might be easily illuminated without any fog. There was a fog which partly arose, as Mr. Slack had explained, from using high powers, but then with high powers a small portion only was in focus. That portion, however, was perfect, and no more than this was wanted. Mr. Smith, of Bow, had called upon him (Mr. Lobb), and communicated to him a very ingenious idea. Mr. Smith used a binocular instrument, the prism being the illuminator; there was a reflector placed at a certain angle above the left-hand tube of the binocular body, and the eye-piece being removed, and the light sent down from this reflector and by the prism, the object was illuminated; and this, it was stated, answered admirably. The objects must all be uncovered, and some study was necessary to determine the best ground to put the object on. At present the best ground was perfectly

* To give this in detail diagrams would be necessary.

parallel glass, though different modes might be necessary for different objects. Another matter he should mention was, that Professor Smith had informed him that Messrs. Powell and Lealand's object-glasses worked the best. This was because they were all black inside, and there was no double reflection. His own $\frac{1}{12}$ object-glass did not work well; Mr. Powell suggested that this might be caused by the brass inside, and blacked it, after which it worked excellently.

A MEMBER thought it would be necessary to have a horizontal stop, so as to cut off, when necessary, different proportions of large-angled glasses. He could not find any object that worked well with extravagantly angled glass.

Mr. GRAY spoke in favour of Mr. Smith's arrangement, which, he thought, left nothing to be desired. It provided a means of modifying the light to any extent, and thus preventing the milkiness complained of.

Mr. BECK objected to that arrangement—first, because it cut off part of the aperture of the object-glass, and, secondly, because the microscope could not be used with the binocular. He (Mr. Beck) had worked with $\frac{1}{20}$th with the illuminator, which showed the scales, &c., with the binocular.

Mr. WENHAM said that the binocular was suggested more than five years ago by Mr. Hewitt, and he ignored it then because in the high powers it cut off half the aperture of the object-glass. This was a defect, inasmuch as it cut off half the field.

Mr. GRAY suggested that this disturbance might be remedied by a piece of glass placed between the object-glass and the eye-piece. They would then have one half the object-glass entirely unobstructed, and the illumination thrown upon the other half was what was required.

The PRESIDENT thanked the gentlemen who had spoken, in the name of the Society, for having given the results of their experience, and announced that at the next ordinary meeting papers "On a Brass Slide" would be read by Dr. Maddox, and "On a Small Holder for a Clip" by Mr. Smith, and a further paper by Mr. Tuffen West.

Adjourned to 14th February, 1866.

QUEKETT MICROSCOPICAL CLUB.

The Monthly Meeting of this Society was held by permission of the Council at University College, Gower Street, on the 23rd ultimo, (March); a removal to more commodious rooms having become necessary from the rapidly increasing number of its members.

Mr. M. C. Cooke, V.P., who occupied the chair, read an interesting paper on "Universal Microscopic Admeasurement," the object of which was the advocacy of the universal adoption of the French measurement with the "millimetre" as the standard for microscopical objects. A discussion ensued, after which the proceedings terminated with a conversazione. Eight members were elected and seven candidates proposed.

[The Offices of the Club remain at 192, Piccadilly, where letters addressed to Mr. Bywater, Hon. Sec., will have prompt attention.]

Dublin Microscopical Club.

August 19th, 1865.

Read the minutes of the preceding monthly meeting, which were confirmed.

Dr. John Barker exhibited specimens of *Œdogonium Itzigsohnii* (de Bary), which showed the remarkably lobed oogonia of this species fully formed.

Mr. Crowe showed specimens of *Carchesium polypinum*, in active vigour, forming a fine object.

Mr. Archer showed specimens of *Spondylosium pulchellum* (ejus). This was the first time he had had an opportunity to exhibit this well-marked little plant to the club, as hitherto he had not found it except in pools close to Lough Bray, where it seemed to be very rare. Indeed, he had himself seen it but once or twice since he first ventured to describe it in the 'Proceedings of the Dublin University Zoological and Botanical Association' (vol. i, pp. 116-7), and he was glad again to find it maintaining all its characters. This little Desmidian, so far as is known, is the only British representation of its genus, one founded by de Brébisson to receive forms which, but for the absence of any "glandular processes," would fall under Sphærozosma. Indeed, when Mr. Archer first found this well-marked little plant he was unaware of the genus Spondylosium (Bréb.), and, while drawing attention to the discrepancy as regards the point referred to, unavoidable without constituting a new genus, had described it under Sphærozosma (Corda). Dr. Wallich also, in his paper on "Desmidiaceæ collected in Bengal" ('Annals of Natural History,' 3 Ser., vol. v, p. 184), two only of which have been as yet published, likewise unaware of de Brébisson's genus, instituted an identical genus for the reception of certain Bengal forms, which he called Leuronema. De Brébisson's Spondylosium, however, has the priority; therefore several forms which had been referred to Sphærozosma and Wallich's species and varieties of Leuronema must be called by de Brébisson's name.

Mr. Crowe exhibited specimens of *Atropos pulsatorius*, or Death-watch, taken by him from behind a picture which had been undisturbed on the wall for some time. A discussion followed as to whether this little insect or *Anobium striatum* should enjoy the title *par excellence* of the Death-watch, both insects possessing the power of producing the ticking sound so well known and so like that of a watch. It was generally admitted that the latter was the creature to which that *sobriquet* was originally given.

Mr. Archer exhibited the, with us, rare *Cosmarium moniliforme*. This species, well marked and very pretty, he had not seen for several seasons. He mainly drew attention to it now for the purpose of pointing out the arrangements of the cell-contents in "fillets," as bearing on his remarks on *Cosmarium curtum* (Ralfs), at last meeting, especially, as on that occasion he had not a specimen of *C. moniliforme* to exhibit side by side therewith. This plant seems to have a quite similar arrangement of the cell-contents to *C. curtum*, and therefore equally to fall under A. Braun's remarks as to its properly holding a place in the genus Cosmarium at all. If, indeed, the very faint constriction of *C. curtum* would *nearly* shut it out of the genus Cosmarium, what of *C. moniliforme*, in which the constriction is so deep as that the species may be best called to mind by conceiving two absolute spheres in contact and held together by an isthmus so narrow as to appear reduced to a minimum? It may be replied that *Pleurotænium Cosmarioides* (de Bary) is deeply constricted, and externally a Cosmarium, yet by that author it is placed, owing to its parietal chlorophyll-contents arranged in bands, side by side with certain Docidia; therefore why not *C. curtum* (Bréb.), Ralfs, (and *C. moniliforme* (Turp.) Ralfs, and *C. Ralfsii* (Bréb.) too) be separated from Cosmarium? Mr. Archer would not be prepared to argue that they should not, nor that the mode of arrangement of the contents, being equally constant, may not be equally of value as the outward characters, but only to urge that, so long as the genus Penium is characterised as it is, without constriction, plants with a constriction should not be forced into it. Hence, if it be held that the species here adverted to *must* go out of Cosmarium, there should be a new genus, Cosmarium-like as to outward form, and Penium-like as to the internal arrangement of the contents. Will observers (de Brébisson, Ralfs, Nägeli, de Bary, Wallich, Cleve, Grunow, and others) agree to this? Mr. Archer would venture to urge here, in reply to possible objections, that a question like this, as to the generic location of the species alluded to, nor any difference of opinion thereon, in no way speaks for the want of permanence or individuality of the forms themselves; and the difficulty is not that of recognising and identifying forms which constantly present the same idiosyncrasies whenever met with, but that of making their individual specialities tally with the genera as laid down in our books, whose limits may be, perhaps, either too wide or too narrow, and whose diagnosis cannot be expected to meet every possible contingency.

Mr. Archer drew attention to a Bulbochæte which he could not but regard as new, inasmuch as it is not described by Pringsheim in his memoir "Morphologie der Œdogonien," published in his 'Jahrbücher für wissenschaftliche Botanik,' Band i, p. 1, for, with the exceptions of the species described by Profs. Pringsheim and de Bary, Mr. Archer, so far as he could judge, felt necessitated to regard almost all the forms both of Œdogonium and Bulbochæte to be found in books of any other authors as of less value than if they never had been described, and that it would be greatly the more advisable course quite to ignore them; but inasmuch as the distinctions put forward in Œdogoniæ are founded, not in the essential characters presented by the fructification, but simply on comparative dimensions, it would be quite impossible to be certain, therefore the proper course seems to be to follow Pringsheim and name the present plant, for previous naming and previous description, not being available, must of necessity, as it appeared to Mr. Archer, be wholly discarded. The fact is that it is quite probable that the true species in Œdogonieæ are by no means so numerous as are the pseudo-species recorded on unessential characters in books. The following may, perhaps, serve as a description of the plant now brought forward.

Genus BULBOCHÆTE (Agardh).

Bulbochæte Pringsheimiana, Sp. nov.

Oogonium elliptic; dwarf male-plants ("Zwergmännchen," Pringsheim) straight, multilocular, in length nearly equal to the length of the oogonium, nearly always seated on the oogonium about the middle, rarely close under it, with "foot" and "outer" antheridium; mother-cells of androspores immediately above the oogonium; septum of the cell immediately below the oogonium (the supporting cell, "Stützzelle," Pringsheim) very high up (or absent?); micropyle of oogonium very close to its upper end; oospore elliptic, orange-brown when mature, seemingly not filling the oogonium, but leaving a hyaline border; whole plant rather slender, cells averaging about twice as long as broad, growth unilateral.

It will thus be seen that this species falls under the subdivision of the genus with elliptic oospores, all which are characterised by Pringsheim as having the dwarf male plants, which are always here of the structure called by him "outer" and with a "foot," seated always *near to*, but never *on*, the oogonium. Now, the present plant is well characterised by having mostly a single dwarf male plant seated *on* the oogonium, upon which it stands vertically; sometimes there are two upon one oogonium. Thus, this plant presents a striking exception in this respect to the characters laid down by Pringsheim, and this circumstance alone would seem to mark it out as distinct. It agrees, indeed, with the other elliptic-spored species in the dwarf male plants having a "foot-cell" and "outer" antheridium; but it differs from them by the circumstance of the oogonia being immediately surmounted by the mother-cells of the androspores, all the other elliptic-spored species described bearing above the oogonia either ordinary vegetative cells or simply a bristle. Further, no species seems to possess the septum dividing the cell supporting the oogonium so high up therein as is the case in the present plant. Indeed, when seemingly absent, Mr. Archer was inclined to think that this was due to its being so close up under the oogonium as to be obscured by it, and to be made appear as if absent.

It is, indeed, much to be desired that the promised descriptions of all the species known to him in this genus and in Œdogonium should be published by their able exponent, Professor Pringsheim; at least such a desirable additional contribution to the knowledge of these interesting algæ had not met Mr. Archer's observation. Should this description of a form, probably, indeed, already well known to Professor Pringsheim, though seemingly not described by that distinguished observer (and should he approve of the same), ever meet his eye, Mr. Archer trusted that, in token of the great gratification he had enjoyed from several of his (Professor Pringsheim's) beautiful researches and masterly writings, he might not quite disdain the compliment intended to be conveyed by so humble an individual in this far-off western island, in calling this plant *Bulbochæte Pringsheimiana.*

Mr. Archer drew attention to a peculiar condition of *Dinobryon sertularia* (Ehr.), and he mentioned that he had just happened to meet with a notice of what seemed to him to be a similar condition of this organism. This was by Dr. Hermann, who, in a paper "Ueber die bei Neudamm aufgefundenen Arten des Genus Characium" (in Rabenhorst's 'Beiträge zur näheren Kenntniss und Verbreitung der Algen,' Heft i), incidentally mentions a state of Dinobryon doubtless quite identical with that observed by Mr. Archer. Although neither, indeed, threw much light on the question as to the development of this organism, yet the present observation would be a confirmation, so far as it went, of that of Dr. Hermann, and both went to indicate that Dinobryon passes through a phase not apparently generally known. The change in the present specimens consisted in the living part of the individuals comprising the colony becoming encysted, not, indeed, within the "lorica," but at its mouth, into a globular green body, smoothly bounded, and contained within a hyaline globular inflation, whose bounding wall passed off into, and seemed a continuation of, the somewhat expanded mouth of the well-known campanulate colourless "lorica." This encysted portion, the original lorica being left out of view, had somewhat the appearance of a minute form of Chlamydomonas, though, of course, quiescent, and contained some pale green granules. Many specimens were to be seen empty, the hyaline, original, campanulate lorica and its globular inflated addition having become vacated by the globular green *spore-like* body; but Mr. Archer had never been able to perceive the moment when these were set free. In the water in which these specimens pretty plentifully occurred there abounded a number of minute Chlamydomonas-like active bodies, in vigorous movement, quite globular, of the same size and exceedingly like the green bodies near them, still held within the round inflated expansions of the Dinobryon, and, although with denser and greener contents, their great similarity seemed to suggest the possibility of their being further stages in the development. Here this very scanty observation, *quantum valeat*, ceases; nor does that of Dr. Hermann, of what is, doubtless, the same phenomenon, throw any additional light on the matter. This author describes also a very similar encysting and formation of a "resting spore" in a Characium, called by him *Characium epipyxis*, which he compares with the phenomenon in Dinobryon; and he then goes on to say—"The supposition of some affinity between *Characium epipyxis* and Dinobryon pressed itself upon me at each observation more forcibly, although I could gain nothing certain upon the point. Dinobryon resembles a colony of *Characium epipyxis*, or as budding-off; Dinobryon occurs, besides, very frequently in company with our Characium." Mr. Archer, however, remarked that Dinobryon occurs frequently where no Characium at least presents itself; although it cannot be omitted to be mentioned that, in the very gathering in which the present specimens of Dinobryon were noticed, a Characium was present in considerable numbers; but he could not make himself satisfied that it was the form called *C. epipyxis* by Dr. Hermann.

September 21*st*, 1865.

Read the minutes of the preceding meeting, which were confirmed.

Mr. Archer exhibited specimens of a Staurastrum (Kütz.) Näg., new to Britain, which he now referred to *Staurastrum spinulosum* (Näg.), though, before he had been able to see a specimen with the constituent cells well spread out, so as to display accurately their form, he had been in some doubt as to the actual identity with Nägeli's plant, though there could be none as to the genus to which it belonged. Although no mode of reproduction is known for this genus, it can hardly be doubted but that it, as well as Cœlastrum, belongs to Pediastreæ. Inasmuch as the well-marked form in question had been ignored by the authors of the 'Micrographic Dictionary,' it may be well here briefly to describe the plant. It consists of a definite number of cuneate compressed cells, united by their smaller ends in a radiate manner into a solid family; the outer margins with rounded angles, and concave at the middle, in the present plant, or in Kützing's species, *Sorastrum echinatum*, bifurcate. In the present plant, *S. spinulosum*, the cells bear, at each of the outer rounded angles, two minute, rather acute, short spines; thus, each cell bears four spines, but as these are placed in pairs opposite one another, not in a single line, when a cell presents its broad or cuneate side to the observer it often happens that only two spines seem to exist, as one is behind and hidden by its companion spine. When an oblique view of a cell is towards the observer, then the four spines can be at once seen. This plant is exceedingly minute, even the largest families; and, unless when few-celled, the form of the individual cells, and their mode of combination, is not readily, at first sight, made out. This appears to be a rare little alga; Mr. Archer had, indeed, met with it but on two or three occasions. The present gathering was made in the "Rocky Valley," near Bray.

Dr. John Barker showed a fine specimen of *Amœba villosa* (Wallich). Some months previously, in company with Mr. Archer, he had seen examples of this rhizopod; but as the character of the specimens did not then appear to him (Dr. Barker) as sufficiently well marked, and as only a comparatively few had been found in the gathering, he had thought it better to wait until some more numerous specimens should present themselves, to become quite satisfied as to the identity of this form. The present were taken from a pool in the Rocky Valley, near Bray, and in the usual reptant state he had found them to average $\frac{1}{150}''$ in length, and about $\frac{1}{800}''$ in breadth. The anterior extremity is broadly rounded, the motion reptant, continuous, and rapid. The posterior villous enlargement appeared to Dr. Barker to be, as it were, made up of tubes radiating from a space clear of motile granules, and containing one or more small vesicles. This villous patch was of a gray colour, and small foreign objects appeared to adhere markedly to it, and were carried along during the progression of the Amœba through the surrounding *débris*. The contractile vesicle appeared generally in the neighbourhood of the villous patch, and the nucleus was also well seen. The villous appendage sometimes appeared to be trilobed; that is, the villous portion seemed to radiate from three centres. When meeting with an obstacle in front, the organism often put forth pseudopods from the neighbourhood of the villous appendage. There were specimens of *Amœba diffluens*, as well as other reptant Amœbæ, without pseudopods or any villous appendage in the same gathering. The specimens kept for upwards of a month, and gradually disappeared. Dr. Barker regarded these as all but varieties of one and the same ordinary Amœba, influenced by peculiar conditions of growth, &c.

Mr. Archer believed there could not be any doubt at all but that the Amœba alluded to by Dr. Barker as having been seen by both in company some time ago was truly none other than *A. villosa* (Wallich); just as little, indeed, as that the form now shown by Dr. Barker was actually the same.

Mr. Archer, sufficiently opportunely along with Dr. Barker's exhibition of *A. villosa*, was able to show one of those remarkable polymorphous conditions of the gonidia of *Volvox globator* first drawn attention to by Dr. Hicks in the 'Microscopical Journal.' The present specimen was, indeed, languid and sluggish, as compared with those he had seen at an earlier period of the year, and which he had mentioned at a previous meeting; but he was not on that occasion able to exhibit to the Club any actual specimens, yet the polymorphous condition, and slight locomotive power of the gonidia now exhibited were sufficiently evident.

Dr. J. Barker could confirm the truth of these observations; he had himself, on a previous occasion, seen the transformed gonidia of some specimens of Volvox move reptantly about, seemingly to all intents and purposes as veritable Amœbæ.

Dr. Frazer exhibited two specimens of diseased hairs; the first example of hair growing on a patch of baldness caused by *Tinea tonsurans*, the upper part white, the shaft gradually acquiring a dark colour towards the base; the second being a diseased hair, with atrophy of the bulb, taken from a bald patch resulting from *Alopecia areata*, and intended to show the state of extremely impaired nutrition of the hair.

Mr. Archer showed fruited examples, with oogonia and the dwarf male plants, of *Œdogonium Braunii;* also the seemingly rare, minute little plant, *Polyedrium tetraedricum* (Näg.). (See 'Gattungen einzelliger Algen,' p. 83, t. iv, B. 3.)

Captain Hutton exhibited fruited specimens of *Metzgeria furcata*, rarely met with in a fertile condition, although the plant is common. He showed the fruit nicely under the binocular.

Dr. Richardson showed various Desmids in good condition, mounted five years ago in glycerine and a trace of liquor potassæ.

Mr. Yeates exhibited Smith and Beck's new metallic reflector for opaque objects, which seemed to be very satisfactory.

October 19*th*, 1865.

Read the minutes of last meeting, which were signed.

Captain F. W. Hutton presented a list of Diatomaceæ found by him in the washings of a small portion of seaweed from China. The material had not been boiled, but steeped in weak acid. The specimens shown were very clean, and many very pretty. The following is the list:—*Himantidium* ——*?; Amphicampa mirabilis; Licmophora*, sp.; *Grammatophora serpentina; Grammatophora marina; Grammatophora hamulifera; Melosira*, sp.; *Coscinodiscus limbatus; Arachnoidiscus Ehrenbergii; Biddulphia pulchella; Cocconeis pseudomarginatus; Cocconeis scutellum; Cocconeis pretexta; Achnanthes?* sp.; *Navicula didyma; Navicula*, sp.; *Pinnularia*, sp. This seaweed had been obtained by Captain Hutton in February, 1864, but he felt satisfied that it could not be assumed to be the source of the *Arachnoidiscus Ehrenberghii* noticed by him as occurring in a gathering made at Malahide, Co. Dublin, in December, 1864, and recorded in the Minutes of the Club for that month, and this for the conclusive reasons then advanced. (See 'Quart. Journ. Mic. Science,' vol. xiii, p. 132 and p. 167.)

Mr. Archer showed a minute alga which formed a new species of the genus Dictyosphærium, Näg.; and, for the sake of comparison, he showed along with it the tolerably common but remarkable little plant, *Dictyosphærium Ehrenbergianum*, Näg. Before, however, describing the present form, inasmuch as the genus Dictyosphærium, as well as many others of the "unicellular" algæ (*quantum valeant*) have been ignored by some—for instance, the authors of the 'Micrographic Dictionary'—it might be well here as briefly as possible to give the generic characters, following as closely as possible Nägeli's own words ('Gattungen einzelliger Algen,' p. 72):—"Cells elliptic, with thick confluent mucous investment, combined in numbers into free-swimming, one-layered, hollow-globular (microscopic) families, one always at the ends of delicate threads which proceed from the central point of the family and which become repeatedly branched towards the periphery; division at the commencement of a series of generations in all directions of space; afterwards, as regards the middle point of the aggregate family, as a rule, alternating only in the two tangental directions." As will be presently seen, the three forms otherwise referable to this genus, possessing cells which in each are respectively elliptic, reniform, and constricted, renders it necessary that the foregoing characters be modified so far as relates to this particular. In this palmellacean genus the cells form little definite families or colonies primarily originating from a single cell by constant division, each new cell being supported on the summit of a slender thread or fibre-like stipes of extreme delicacy, which thus during the increase in number of the constituent cells of the family becomes usually dichotomously divided, the whole family being imbedded in a definitely bounded mucous or gelatinous investment. The form on which the genus was founded by Nägeli (*Dictyosphærium Ehrenbergianum*, Näg.) is very minute, and, in suitable places, common, the families in the aggregate forming a globular or broadly elliptic, or sometimes subcubical figure; the rate of growth of the delicate thread being equal all round, the cells at the ends of each of its dichotomous ramifications stand at nearly equal distance from the original centre—hence the regular figure of the aggregate family. In this species the individual cells are elliptic, as in Nägeli's original diagnosis of the genus founded on this as the then only known type, and are very minute. Another species in this genus has been described by Rabenhorst (in 'Kryptogamen-Flora von Sachsen,' &c., p. 132) under the name of *Dictyosphærium reniforme* (Bulnheim in Hedwigia, 1859). This plant possesses larger irregularly shaped families, seemingly owing to the development of the delicate supporting fibre not going on in the same regular manner as in *D. Ehrenbergianum*; and the cells themselves are much larger, and are reniform. In the form now exhibited by Mr. Archer the aggregate family is larger than in either of the foregoing, and the branching of the fibre less regular than in *D. Ehrenbergianum*, and seemingly more so (to judge from the figure) than in *D. reniforme*. The total family sometimes acquires a divergent or lobed character, owing to the fibre or thread, on the subdivision of the original cell of the family, becoming drawn out to a greater extent than during subsequent growth, thus the cells of the second generation becoming further pushed away from one another than is the case in the subsequent generations. Thus, the aggregate family may appear like twin families, or, as it were, as if certain portions or branches of it had started from two or sometimes more fresh centres. The cells themselves, moreover, were neither elliptic, as in *D. Ehrenbergianum*, nor reniform, as in *D. reniforme;* but they are somewhat irregularly figure-of-8-shaped, that is, constricted at both sides, the ends tapering in a somewhat triangular manner to the bluntly rounded extremities; they are, besides, larger than either of the preceding, much larger than those of the first. This plant is, indeed, wholly different from, yet congeneric with, both. It might, indeed, suggest itself, from the fact of the cells being seated at the summits of the branches of a delicate thread-like stipes, and their being constricted, that this plant might belong to De Brébisson's genus Cosmocladium; but in that plant the stipes is thick and broad, and the aggregate colony forms a dendroid structure seated epiphytically on Confervoids, not freely swimming, and the growth radiating from a common original centre. Still, there must, perhaps, be a certain amount of affinity; yet there can be no doubt but that Mr. Archer's plant far more properly belongs to Dictyosphærium (Näg.) than to Cosmocladium (Bréb.). Be, then, this growth a species or a form, be it *sui generis* or but a transitional state of some other species—a question which it would be at present impossible to decide—the present plant is quite as well marked as either of the two previously described, and therefore quite as worthy of a record. As to the nature of the curious dichotomous, extremely delicate, fibre-like stipes in this genus on which the cells are borne, Mr. Archer found it impossible to throw any light. So delicate is it that it often requires a peculiar illumination to perceive it properly; but so constant and so peculiar a character must have some signification, and seems to give the minute algæ possessing it a special generic type, and, pending more knowledge as to their origin and nature, a claim to be accorded a special generic rank.

Dr. John Barker exhibited a minute Cosmarium gathered by him on the occasion of the Club excursion to Lugnaquilla, which, with the information at disposal, he was inclined to regard as *Cosmarium quadratum*, or a small variety of that species. It is minute, oblong; constriction deep and linear; segments rather longer than broad, quadrate; all the angles rounded; sides and ends rather deeply concave; frond compressed; side and end view elliptic; empty frond minutely punctate.

Mr. Archer was quite disposed to regard this plant exhibited by Dr. Barker as not *Cosmarium quadratum*. It is a good deal smaller, and wants any notable inflation at each side at the base of the segments; besides, the ends are concave, and not convex, as in *C. quadratum*. It might, perhaps, by those who had not seen *Cosmarium sublobatum* (*Euastrum sublobatum*, Bréb.), be mistaken for that species, which it most decidedly is not. The present form is often seemingly quite or nearly as much expanded at the ends as it is at the base, whereas in *Cosmarium sublobatum* the segments very considerably taper towards the ends, and that species is also larger than the present, and wider in proportion to its length. *Euastrum pusillum*, Bréb., appears to have some affinity with Dr. Barker's plant, but Mr. Archer had not seen specimens of that form; it appears, however, to be smaller, the upper angles to be acute, not rounded, and the concavity at the ends with a well-defined obtuse angle at the centre, not gradually curved. On the whole, Mr. Archer was himself quite disposed to regard the present plant as undescribed; the somewhat punctate empty frond would form a further distinction.

Mr. Woodworth exhibited a great variety of photographs of microscopic objects, some of them high-power objects, and all very excellent.

Mr. Archer showed in fructification specimens of a diœcious Œdogonium, which, pending, indeed, information on one point as regards it, he would refer to *Œdogonium gemelliparum*, Pringsheim. The present plant showed the oogonia, its lateral aperture (micropyle) high up, the oospore nearly filling the oogonium, the separate male plants with their antheridia forming series of very short cells, more or less numerous. But the point requiring elucidation as to the identification of this plant with Pringsheim's species, just mentioned, was whether there were two spermatozoids evolved from each antheridial cell by a division taking place in the direction of the length of the parent filament, or whether only one spermatozoid was produced from each daughter antheridial cell, the division taking place, as ordinarily, transversely; and it was just this point he had been unable to make out. He had found this plant for some weeks in a pool hard by the "Rocky Valley" near Bray, and had on several occasions taken specimens always showing oogonia, but not until now had he found the male plants, which, indeed, had been first detected in these specimens and pointed out by Dr. J. Barker.

Dr. E. Perceval Wright exhibited some specimens of a beautiful pink Podura. Various species of Nullipora grow in great quantity in Bantry Bay, and they are dredged up for the purpose of being used as manure. The Nullipore remains are collected in large heaps, and, by exposure to the air and sun, soon become quite bleached, presenting the appearance of coral sand. Running over and jumping upon these mounds, Dr. Wright discovered those pretty apterous insects. So far as he could determine, they belong to an undescribed species of the genus Heterotoma.

Mr. Tichborne exhibited some crystals of creatine found in Liebig's extract of beef. They were recognised by their form and by their reaction with chloride of zinc.

Manchester Literary and Philosophical Society.

MICROSCOPICAL SECTION.

October 16*th*, 1865.

A. G. Latham, Esq., President of the Section, in the Chair.

This being the first meeting of the session, the President delivered an address reviewing the past proceeding of the Section, and referring with satisfaction to the proposal to extend its objects to subjects of natural history generally.

Mr. Sidebotham read "Notes on Atlantic Soundings."

He said that in the unsuccessful attempt made to raise the Atlantic Cable after it had unfortunately parted, the ropes and grapnels brought up from the bottom small portions of ooze or mud, some of which was scraped off and preserved, as stated at the time in the newspapers. Believing that a careful examination of this deposit might prove of considerable interest, he wrote on the subject to Dr. Fairbairn, who, after considerable trouble, obtained for him a fine sample, mounted specimens of which he now presented for the cabinet and to each member of the Section. In appearance the deposit resembles dirty chalk, and under the microscope reminds one much of the chalk from Dover; indeed, it has all the appearance of being a bed of chalk in process of formation. It is composed entirely of organisms, chiefly in fragments. In the short examination he had made he observed several forms which give promise of interesting results, and he thought it would be desirable to frame a complete list of the species found, which would be best accomplished by two or three members taking temporary possession of all the slides, and preparing a report on their united observations. The sample now distributed was obtained at Dr. Fairbairn's request by Mr. Saward from Mr. Temple, one of the Engineering Staff, who states that it was got in grappling for the Cable, August 11th, 1865, Lat. 51° 25′ 15″ N., Long. 38° 59′ W.

November 20th, 1865.

A. G. Latham, Esq., President of the Section, in the Chair.

Mr. Parry read a paper on "Collecting Foraminifera on the West Coast of Ireland." He said that in June last he visited the coast of Connemara, for the purpose of collecting Foraminifera, more especially at Dogs Bay; he was accompanied by Mr. Burns, of Doohulla Lodge, who gave him much assistance. After he had procured a considerable quantity of the shell-sand in the usual way, he noticed some white floating material on the surface of the advancing tide; he collected a quantity of it by means of a muslin net, and on examination found it nearly all composed of perfect dead shells of Foraminifera. On the second visit to the bay Mr. Burns discovered a pool near high-water mark, covered with the floating shells, and of these Mr. Parry collected a large quantity, portions of which he had since distributed to members of the Section. He observed that the underside of the rocks forming the pool were covered with Foraminifera, and he therefore concluded that these minute creatures live there, and from what he saw he was led to believe that Dogs Bay is a breeding-ground for them, and that they may also be found living in "Burns' Pool."

Mr. Dancer, F.R.A.S., read a paper "On the Illumination of Opaque Objects under the High Powers of the Microscope."

The author's attention was drawn to a paper on this subject which appeared in the 'Scientific American,' and was copied into the 'Mechanics' Magazine' of October 20th, 1865.

Mr. H. L. Smith, of Kenyon College, had contrived a plan for the illumination of opaque objects, by placing a small mirror in a rectangular box, which could be attached to any ordinary microscope; this mirror was made adjustable immediately over the opening of the back of the objective; a light was placed at the side of the box and reflected down through the objective on to the object. In this manner the object could be illuminated when the high powers were used.

Mr. Hurst suggested that a discussion on this subject would be of interest to the members of the Microscopical Section. The author, not having time to make one of Mr. Smith's apparatus, thought it possible to arrive at similar results by the employment of the binocular microscope, an instrument which is now more common than a monocular instrument. The trial quite answered his expectations. The simplest method, and one which gave good results, is to remove the eye-piece from the oblique body and fix a reflector on the top of the body in such a manner as to throw the rays of light down to the Wenham's prism, and thence through the object-glass on to the object.

If a plane mirror is employed a lens of suitable focal length should be placed in the body, in order to get the field of view entirely illuminated.

A concave mirror or lenticular prism can also be used for the same purpose, provided the focal length is adapted to the length of the body and object-glasses.

Various modifications can be adapted so as to vary the character of the illumination to suit the particular object to be viewed. In some cases the Wenham's prism may be withdrawn a little, to produce the proper effect.

Uncovered objects only can be seen to advantage, owing to the light reflected from the surface of the covering glass. The surface on which the objects are mounted should reflect as little as possible, and be a marked contrast in colour to the object.

Ordinary Meeting, November 28th, 1865.

R. ANGUS SMITH, Ph.D., F.R.S., &c., President, in the Chair.

Mr. Francis Hampson, solicitor, was elected an Ordinary Member of the Society.

Mr. Dancer, F.R.A.S., said that in a paper "On the Illumina-of Opaque Objects under the High Powers of the Microscope," read before the Microscopical Section of this Society, November 20th, he had described a method of employing the oblique body of the binocular microscope with Wenham's prism, for illumination of opaque objects, and he had also exhibited an instrument fitted up for this purpose, giving the members present a practical demonstration of the advantages which this mode of illumination afforded under certain circumstances. He wished now to describe another method of illuminating opaque objects, and, as it is equally applicable to monocular and binocular microscopes, it appears worthy of some consideration.

In the method of Mr. H. L. Smith, of Kenyon College (which was briefly described in the paper before mentioned), and also in the use of the Wenham's prism, there is a considerable loss of angular aperture (which is a very important consideration). It occurred to the author that by modifying Mr. Smith's contrivance this loss might be diminished in some degree; this has been attempted in the following manner.

Instead of placing the mirror immediately over the opening at the back of the object-glass, a small speculum $\frac{1}{8}$th of an inch in diameter is introduced into the front of the body of the microscope, $2\frac{1}{2}$ inches above the top of the objective. A lateral opening is made in the body at right angles to the speculum, for the admission of light to be reflected down through the objective to the object below.

The interposition of the small speculum does not produce any disagreeable effect in the field of view, and in the examination of objects it is easy to use that portion of the field which is between the centre and the edge. With proper manipulation very good definition can be obtained by this method when the speculum is of the proper curvature. This contrivance can always remain attached to the microscope without interfering with the general appearance of the instrument, and when the use of the speculum is not required it can be withdrawn or turned aside out of the field of view, and the aperture at the side of the body may be closed by a small shutter. It is obvious that the use of the binocular body is not interfered with by this arrangement.

A binocular and a monocular microscope with this arrangement were exhibited to the members at the close of the meeting.

December 18*th*, 1865.

J. B. Dancer, F.R.A.S., in the Chair.

Mr. Parry exhibited some sections of fossil wood and Echinus spines, most beautifully cut by Mr. John Butterworth, of Oldham, and presented some of the slides to the Section.

Mr. Parry also presented to the meeting, for distribution among the members, mounted slides of the contents of a shark's stomach, from the Madras coast, consisting almost entirely of Diatomaceæ.

Mr. Hurst then made a few remarks on late improvements in illuminating opaque objects under the higher powers of the microscope. He said they consisted of three different methods. Firstly that of H. E. Smith, of Kenyon College, America, described in the English 'Mechanics' Magazine' of the 20th October, 1865, in an extract from the 'American Journal of Science and Arts.' This gentleman employed a box, or adaptor, between the object-glass and the Wenham's prism of the binocular, with a side perforation, opposite to which was a small silver reflector or a common thin glass cover, acting as a mirror and capable of adjustment to any angle, thus enabling it to throw the rays of light admitted by the side aperture through the object-glass down on to the object itself.

The disadvantage of this method is that all adaptors cause unsteadiness, and, however skilfully constructed, injure the accurate centering of the object-glass; and while, on the one hand, the thin glass cover appears to produce some distortion of the image, the reflector so near the object necessarily casts off a number of the rays proceeding from it. This plan also seems to require lamp-light and the use of a condenser. Messrs. Smith and Beck appear to have patented the use of the thin glass cover.

Secondly, a modification of the foregoing by Mr. Dancer, of this Section, who places the thin glass or reflector between the eye-piece and the Wenham prism, cutting an aperture in the body of the microscope to admit the light. This dispenses with the objection inherent to adapters, and theoretically seems the most perfect of these new methods; but Mr. Hurst's experience in its use was as yet too limited to form an opinion. He hoped, however, to report on the subject at the next meeting.

Thirdly, that invented by Mr. Dancer, who places a circular mirror over the oblique tube of the microscope, previously removing the eye-piece; the light is thrown down to the Wenham's prism, and thence through the objective on to the object. The only disadvantage of this method was that of not admitting of binocular vision; otherwise its simplicity, cheapness, and great facility of adjustment, render it far preferable to the others, while its effects are fully equal to theirs. It answers, moreover, equally well by day- or lamp-light, and does not require a condenser to be used. Mr. Hurst thought every binocular microscope would be fitted with it when their owners had seen its working.

Mr. Hurst wished meanwhile to draw the particular attention of the members to the extraordinary beauty and clearness with which opaque objects—hitherto the despair of microscopists—were displayed by these methods of illumination, some being shown as clearly as if enlarged into a relatively gigantic model and viewed by the naked eye. Another peculiarity connected with them is that, as the object-glass itself acts as a condenser, the amount of light is increased with the magnifying power of the object-glass, contrary to the effect of other modes of illumination.

Mr. Hurst thought the subject was in its infancy and that great improvements would yet be made, but that the idea of Mr. H. E. Smith, of making the object-glass its own illuminator, would prove to be one of the greatest steps in modern microscopic science; and, as improved upon by Mr. Dancer, it was one so costless in price and rapid in its adjustment, that every microscopist, however economical either of time or money, could readily avail himself of its assistance.

Mr. Coward then exhibited some interesting plants from India, illustrating abnormal forms of different natural families, especially of Leguminoseæ.

January 17*th*, 1866.

A. G. Latham, Esq., President of the Section, in the Chair.

The minutes of the last meeting were read and confirmed.

The following donations were announced:—Roper's 'Catalogue of Microscopic Works,' by the Author; Kölliker, 'Manual of Human Microscopic Anatomy;' 'Beck on the Microscope,' by the Secretary; six slides of Seeds and Fungi, by the Secretary; several slides of sections of a Cidaris from the Indian Ocean, by Mr. Parry. The following purchases by the Section were exhibited:—A mahogany cabinet; Pritchard's 'Infusoria.'

The Secretary reported that he had made a catalogue of the collection of microscopical objects belonging to the Section.

Mr. Sidebotham exhibited a design for a ticket and covering-paper, to be used for the Section's collection of slides, which, with a trifling alteration, met the approval of the members, and the Secretary was ordered to take the necessary steps to have it engraved.

Mr. Sidebotham remarked on the best cement to use in forming cells for fluid preparations, and stated that gold size appeared to prevent the entrance of air-bubbles better than Japan varnish or Brunswick black, which latter in time became porous, and also, from the evaporation of its turpentine, brittle. He said he and Mr. Thwaites were, perhaps, the first to use this method of mounting objects, and that he possessed slides of gold-size cells, which were still quite perfect, while those he and mounted with Japan black ink were most of them spoiled, that he had again reverted to the use of gold size for the formation of the cell, using Japan varnish for its final closing only.

The Secretary said gold size remained viscid for a long time, and that if the cells formed of it were not well dried for a considerable time, or even baked in an oven, the size was very liable to "run in" and spoil the preparation. He had re-varnished the Section's collection with a mixture of Japan varnish and gold size, and thought the gold size would prevent the Japan varnish from becoming brittle or porous, while the Japan varnish would prevent the gold size from running in; but he strongly recommended that all collections should be re-varnished every five years, and deprecated the use of covering papers on slides of fluid preparations, as it prevented this.

Mr. Latham recommended the addition of a solution of India rubber, and Mr. Parry of wax, to Japan varnish, to obviate its tendency to become porous and brittle.

The Secretary exhibited Messrs. Smith, Beck and Beck's side Lieberkuhn for illuminating opaque objects under the medium powers of the microscope, such as $\frac{2}{3}$ to 1 inch.

Mr. Heys showed a well-mounted specimen of the exuvium of the larva of a dragon fly, and stated he found these insects were easily brought to cast off their skins by changing the water in which they were kept; if soft, to hard, and *vice versâ*; or if muddy, to fresh.

Mr. Parry exhibited mounted sections of an Ammonite.

Dr. Alcock said that among Foraminifera from Dogs Bay which he had lately mounted he thought there were some slides likely to interest the members. Many of the deformed specimens of *Lagena striata* (Williamson) were very curious, and a double one, having the neck as well as the body double, deserved particular notice. He said that he was quite convinced the striated Lagena with a mucro at the base is not a mere sub-variety of *Lagena striata*, but is very distinct from it; there were many specimens of it, all agreeing in their peculiar characters, and he proposed for it the varietal name of *L. mucronata*. The Lagena with a collar at the base of the neck, described by him in a previous paper, was undoubtedly distinct from any of the named forms, and he proposed to call it *Lagena antiqua*. In his examinations of the Dogs Bay sand one specimen only of *Lagena vulgaris typica* (Williamson) had occurred, though *L. clavata* was comparatively common. Perhaps the most interesting kind was a perfect and characteristic specimen of *Lagena crenata*, a form lately described and figured by Parker and Jones, from Australia, but he believed not hitherto observed as British in the recent state. The very magnificent specimens of *Entosolenia mels* also deserved notice; and the curious specimens of *Truncatulina lobata*, with the later chambers "run wide," and various monstrous forms of Miliolina, would be examined with interest.

Royal Society of Tasmania, Hobart Town.

Microscopical Soirée, June 13th, 1865.

Agreeably to a resolution passed at the last monthly evening meeting, the Museum and Library of the Society were this evening thrown open for a Microscopical Exhibition; and as each Fellow had the privilege of introducing two ladies, the rooms were soon thronged with visitors.

Seventeen microscopes were arranged on tables, and to each instrument a card was attached, containing the name of the exhibitor, with a list of the objects for examination. The instruments were by Ross, Pritchard, Smith and Beck, G. Oberhausen, Varley, Eden, &c. &c.

Of the Fellows of the Society, Mr. F. Abbott, Mr. F. Abbott, jun., Dr. Agnew, Mr. M. Allport, Dr. Butler, Colonel Chesney, Mr. W. Johnston, Mr. F. Giblin, Mr. Napier, Mr. Roblin (Curator), and Dr. Turnley exhibited instruments; and Dr. Bright, Mr. Stone, and Mr. Legrand kindly acted as volunteers for the occasion. The microscope (by Smith and Beck) belonging to Mr. Stone attracted attention, as being the only one present of the binocular construction.

With so many good instruments, and with powers ranging from 50 up to 1000 diameters, a great variety of objects were submitted for examination. Amongst others might be noticed the circulation of the blood in animals (tail of tadpole); circulation of sap in plants (Nitella); animal tissue; vegetable tissue; method of measuring accurately microscopic objects; diatoms in great variety from this colony, England, and elsewhere; infusoria; crystals; photographs; and a variety of other objects of a miscellaneous character.

The evening was far advanced before the various objects were exhausted; and, on retiring, the visitors expressed so much satisfaction with the exhibition that it is probable a similar meeting will be held at the close of the session, at which period of the year (summer) many natural objects which cannot now be procured will be obtainable.

J. W. AGNEW, M.D., *Hon. Sec.*

OXFORD MICROSCOPICAL SOCIETY.

On the CRYSTALLIZATION, *at* VARIOUS TEMPERATURES, *of the* DOUBLE SALT, SULPHATE OF MAGNESIA *and* SULPHATE OF ZINC. By Mr. THOMAS.

AFTER making experiments according to Mr. Davies's method, as explained in the 'Microscopical Journal' for July last, I left one of the slides, with which I had been working, on my table for about half an hour. The sun was shining on the table at the time. On looking at the slide I found that crystallization had taken place; and, on examination under the microscope with a 2-inch object-glass, I discovered what seemed to be a remarkable change in the form of the black cross, viz., that instead of running straight across the axis, as is generally the case in crystals with one axis, the two arms appeared to approach the centre, and then suddenly curve back, much in the same way as in a crystal of nitre. Also I noticed that, in other crystals on the same slide, each arm of the cross on approaching the centre made a slight curve, then passed through and formed a similar curve on the other side. It was from seeing accidentally this arrangement that I was induced to make a series of experiments at various temperatures with a Bunsen's gas-burner and a stand on which I could arrange the slides at various distances, a thermometer being placed as close as possible to the slide under observation.

At about 75° Fahr. I find that the arms of the cross are curved in the singular form here represented (see diagram 1). It seems also that the two salts combine at this temperature in two proportions, to form two distinct crystals, one having a distinct axis with a considerable amount of double refraction, which may be called crystal A (see diagram A); the other being in the form of rounded masses with small foliations and a less amount of double refraction, which may be called crystal B (see B). The latter, whose details come out more slowly, and, as a rule, from the circumference to the centre, constitutes a limit or boundary, as it were, to the former, which radiates invariably from the centre to the circumference. This, it seems, shows clearly that the two last joints had a rounded, club-like extremity; in others they were singularly short and stout. The palpi and parts about the mouth were not well defined with a high power. In some a faint line extended across the body between the third and fourth pair of legs.

Professor Westwood exhibited a species of Acarus that had been found in the unopened buds of the black-currant tree, and sent him for examination. He stated that, inasmuch as the animal only possessed four instead of eight legs, the number proper to the Acari, he was in doubt whether it was merely an undeveloped form (which would account for the absence of some of the legs), or really a fully grown four-legged species.

He also showed some small pieces of wood from a dog-kennel which were riddled with holes. In these holes were contained, in great number, the ova and six-legged young of the dog-tick.

ORIGINAL COMMUNICATIONS.

Microscopical Researches *on the* Cattle Plague.
By Dr. Lionel Beale, F.R.S., &c.

In the third report of the Cattle Plague Commissioners Dr. Beale's observations bear particularly upon the facts of diseased conditions in general, and open out in a very special manner what may be called tissue actions as contradistinguished from blood alterations. Dr. Beale's researches, if true in their inferential aspect, must very materially modify present pathological notions as to the nature of fevers and inflammatory conditions. Dr. Beale takes as his starting-point the congested state of the capillary vessels so constantly seen in rinderpest, and proceeds to show that as this is "by no means uniform in all different textures, or of equal degree in every part of the same tissue, while the capillaries of some organs (those between the uriniferous tubules of the kidney, those of the lobules of the liver, those of the mammary, and probably some other glands) are not as much congested as they are often found in healthy animals killed suddenly, it cannot be referred *to any general impediment in the circulation;*" but, on the other hand, the congestion would seem to have a local origin, for there are patches of various sizes, but distinctly separated from one another by uncongested, or only slightly congested, portions of tissue . . . . the patches are of an intensely dark red colour, of circular form, as though the congestion had commenced at and radiated from a central spot. The result of the congestion is an increased pouring out of nutrient matter and a growth of the germinal matter (usually termed nuclei) of the vessels and tissues. *Dr. Beale thinks that whatever causes the local congestion is the cause of rinderpest.*

1. *Changes in the vessels and in the blood.*—The small vessels, arteries, and veins, of congested spots are distended with blood-corpuscles; the arteries are at first relaxed, but become subsequently more or less contracted, so that their outline is more or less uneven, the diameter varying very much in the smallest distance; the coats are granular; oftentimes, indeed, there is considerable atrophy. These changes

FIG. 1.—Surface of mucous membrane of fourth stomach, corresponding to a thin depressed circular spot like an ulcer; superficial capillary vessels, varying very much in calibre, filled with granular matter and minute particles of germinal matter. The orifices of several gastric glands are seen, and the deeper vessels also obstructed are on a lower plane. × 350.

are seen in the annexed illustration (Fig. 1), showing the capillaries encircling the mucous glands from the mucous membrane of the fourth stomach.

In addition to these changes, there is another alteration of most striking character present in every case—viz., *a large increase in the size of the masses of germinal matter in the walls of the vessels.* This is well seen in Fig. 2, which represents a capillary from the connective tissue of the alimentary mucous membrane.

The vessels are sometimes distended with red corpuscles (more or less altered), sometimes filled with a colourless or slightly yellowish fluid; the white corpuscles are always increased in the small veins and capillaries; and in additi myelin masses are seen, with minute particles of germinal matter in large number.

FIG. 2.—The masses of germinal matter of the capillary are very much enlarged, and are dividing and subdividing to form new masses. × 700.

Fig. 3 represents some of the contents found in a vein in one of the congested spots. The germinal matter also of the *epithelial lining* of the vein is augmented so much that oftentimes it forms projections into the interior which interfere with the circulation through the vessels. This germinal matter may actually plug up a capillary, as is represented at *b* in Fig. 4.

FIG. 3.—Very small masses of germinal matter, interior of small vein. × $\frac{1}{50}$.

FIG. 4.—Small artery from connective tissue beneath depression of mucous membrane of fourth stomach. Cattle plague. *a*, Small cells with numerous oil-globules; *b*, a large mass of germinal matter obstructing capillary. × 700.

Dr. Beale discusses the origin of these masses of *germinal or living matter*, and thinks they may be enlarged white corpuscles; or caused by the adhesion together and subsequent growth of other particles, perhaps from the growth of germs derived from without; or, lastly, an outgrowth from the lining membrane. The congestion is probably due to the impediment offered by the increase of material just noticed. Dr. Beale notices that inflammatory lymph is not frequently met with, and thinks this is due to the fact that the capillaries become completely obstructed before time has elapsed for the outpouring of liquor sanguinis. In inflammation, however, the stage of dilatation is more prolonged, and the arrest less sudden; as a consequence of this, the thin walls allow the passage of fluid more readily. It would appear, then, that the local congestions produced by the increase of germinal matter lead in turn to an alteration in the composition of the blood and the tissues around.

2. *Changes in the tissues.*—A like increase of germinal matter is observed in the tissues generally, as well as upon the free mucous surfaces, as a consequence of the congestions.

The papules which project above the level of the skin, in

FIG. 5.—Fibrous tissue of the corium or true skin from the softened part of the papule. The intervals between the fibres are occupied with germinal matter, "contagium," growing and multiplying rapidly. × 215.

the seat of the "eruption," are due to the increased growth of the germinal elements of the derma and the cuticular cells, as well as of germinal matter derived from without. These minute masses of germinal matter multiply with great rapidity, and extend amongst the bundles of the fibrous tissue, making their way, in part, to the surface, in fact, separating the bundles of the areolar structure, and even causing thin atrophy. The fibres soon become replaced by "an amorphous mass of minute masses of germinal matter, varying much in form and products resulting from the decay of some of these particles."

The connective-tissue-corpuscles increase in size. These changes are well seen in Fig. 6, contrasted with the healthy state shown in Fig. 7.

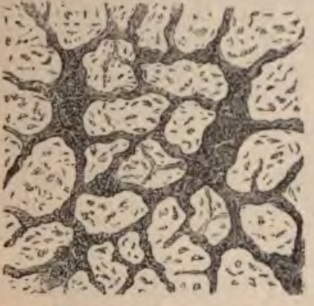


FIG. 6.—Enlarged connective-tissue-corpuscles. Surface of mucous membrane over epiglottis—cattle plague just beneath the epithelium. × 700.

FIG. 7.—Connective-tissue-corpuscles. Surface of healthy mucous membrane over epiglottis, just beneath the epithelium. × 700.

The same increase is found in the cuticle, especially about the middle layers, the true epithelial cells being invaded and often replaced by the nuclear bodies, which invade from the exterior, as seen in fig. 8, so that there are two processes taking place at the same time, both, however, consisting of the growth of germinal matter; but the germinal matter is of *two kinds*—1, that belonging to the normal tissues, which grows in consequence of being supplied with an increased amount of pabulum; and 2, particles of germinal matter which have invaded the tissues from the blood. The last are alone considered to be *contagious*. These are seen in fig. 8, in the *outer* part of the cuticular cells.

FIG. 8.—Cuticular cells under scab. Eruption on mamma, showing how the cells are invaded by the growth and multiplication of the minute particles of germinal matter (contagium?). × 700.

Dr. Beale gives full details of the special changes of a similar kind in the various secretions and in the alimentary tract, but we have not space to give them here. After some remarks upon the general increase of germinal matter found throughout the tissues of the body, Dr. Beale notices the bearing of this matter upon the question of the rise of temperature so constantly noticed in this and other fevers:—"It will have been remarked that the changes which I have demonstrated in connection with the germinal matter of the tissues generally in *fevers* precisely resemble those observed locally in *inflammations*. In fact, the local phenomena of inflammation precisely correspond, up to a certain stage, with the general phenomena of fever. The former reach a degree to which the latter cannot attain, because, as it is scarcely necessary to observe, the death of the man or animal must occur long before *general* suppuration could be brought about.

"It is remarkable that, while this increase in the germinal matter is taking place, the temperature rises some degrees above the normal standard, and I think that the elevation of temperature in this disease, as well as in fevers and inflammations generally, can scarcely be due to increased oxidation, for both respiration and circulation are often seriously impeded, but attribute it rather to the phenomena occurring during the increase of the germinal matter and connected with this increase. If this is so, it is probable that an increase of germinal matter is *invariably* associated with the development of heat."

After discussing many other interesting points, Dr. Beale sums up thus:—"Without, therefore, pretending to be able to identify the actual *materies morbi* of the cattle plague, or to distinguish it positively from other forms of germinal matter present in the fluids on the different free surfaces and in the tissues in such vast numbers, I think the facts and arguments adduced tend to prove, first, that it is germinal matter; secondly, that the particles are not directly descended from any form of germinal matter of the organism of the infected animal, but that they have resulted from the multiplication of particles introduced from without; thirdly, that it is capable of growing and multiplying in the blood; fourthly, that the particles are so minute that they readily pass through the walls of the capillaries, and multiply freely in the interstices between the tissue elements or epithelial cells; and, lastly, that these particles are capable of living under many different conditions—that they live and grow at the expense of the various tissue elements, and retain their vitality although the germinal matter of the normal textures, after growing and multiplying to a great extent, has ceased to exist." But more than this, if we would still wish for some more definite answer, it is clear that we should be most likely to find the contagious material in the secretions of the vagina, the eyes, the nose, or intestines, which are admitted by all to hold the poison of cattle plague. Dr. Beale believes that such particles as he has represented in figs. 9 and 10, the one from the fibrous tissue of the skin, the other from the vaginal mucus, and also those observed amongst the bundles of fibrous tissue already shown in fig. 5 and those in the cuticle, fig. 8, constitute the active living contagious material.

FIG. 9.—*Contagious particles* from the vaginal mucus of a cow. Cattle plague. *a*, Bacterium amongst these. *b*, A mass of germinal matter containing minute particles like fungi. These are seen in the white blood- and pus-corpuscle, &c. × 2800.

FIG. 10.—Minute particles of germinal matter (contagium?) from the fibrous tissue of the skin, beneath the eruption. (Fig. 8.) × 1800.

FIG. 11.—A small portion of one of the smallest vessels represented in fig. 1, showing particles of germinal matter coloured deep red by carmine, amongst a quantity of débris. × 2800.

We take it that these particles are the nuclear corpuscles noticed by Dr. Bristowe and Dr. Sanderson, especially in the skin eruption. Such particles have been found in the breath and surrounding air of diseased beasts. Hence, though the normal nuclear elements are increased in quantity, there is a large addition of new living matter resulting from the growth of particles derived from without the organism. Dr. Beale, therefore, considers that the "poison," "virus," "contagium," "materies morbi," consists of the germinal or living matter constituting the cell-like or nuclear bodies found in such number, not only in all contagious fevers, but in specific inflammation and other affections, syphilis, gonorrhœa, &c. He has described the *movements and mode of multiplication of mucus and pus-corpuscles*, which may be demonstrated with the aid of the highest powers now in use. Dr. Beale says that the poison "consists of very minute particles of matter in a living state, each capable of growing and multiplying rapidly when placed under favorable circumstances. The rate of growth and multiplication far exceeds that at which the normal germinal matter of the blood and tissue multiplies, and that they appropriate the pabulum of the tissues, and even grow at their expense," leading to all the many general symptoms of rinderpest.

Dr. Beale's report contains many more most interesting questions, but we have attempted to draw attention to the bare outline of the more important points which have an immediate interest to the practitioner in reference to the causation of contagious diseases.

Dr. Beale's hypothesis puts into very definite shape the ideas which have long been loosely held as to the influence of organic life in the production of disease. No doubt a large number of chemical actions are at work, and play most important parts in disease, but it is not unlikely that these in their turn are dependent upon the action of living material. It has lately been shown that fermentative changes are dependant upon the *nutritive act* of the torula cells, and in a similar sense it is admissible to entertain the idea that the phenomena of contagious diseases are intimately connected and probably depend upon the development and increase of germinal growing living matter.

It is interesting to notice that the views of Dr. Beale upon the nature of the contagious material have been remarkably confirmed by Mr. Crookes, who, from purely chemical investigation, has proved that the active contagious substance is in a living state. The results detailed in Mr. Crookes' report are extremely important, and we beg to direct attention to it.

[This Report, from the 'Medical Times and Gazette,' has been carefully revised for this Journal.]

TRANSLATION.

IAKTTAGELSER *öfver den* HVILANDE ŒDOGONIUM-SPORENS UTVECKLING. (OBSERVATIONS *on the* DEVELOPMENT *of the* RESTING-SPORES *of* ŒDOGONIUM.)

('Öfversigt af Kongl. Vetenskaps-Akademiens Förhandlingar,' Stockholm, 1863, p. 247, Tab. II.)

THROUGH Pringsheim's distinguished researches on the mode of propagation in the lower Algæ, it is now known that, besides the still longer-known propagation by means of motile gonidia or zoospores, there exists a mode of reproduction by means of spores, which are formed by the co-operation of a male and female organ. The development of these spores, which in their mode of origin correspond to the seeds of the higher plants, has been observed in many cases; but the mode whereby new plants proceed from these has not yet been followed out in several groups of Algæ. The genus Œdogonium, rich in species, belong to these latter Algæ. It has been long known that certain cells of the Œdogonium-filaments were distinguished from the remaining cells by their egg-shaped figure, and by their densely crowded contents, surrounded by a cell-membrane; but Pringsheim was the first who succeeded in giving a satisfactory explanation of their significancy. Pringsheim found, namely, that the round bodies enclosed in the inflated cells are spores, which are formed through the fertilising influence of a male organ. With the greatest accuracy Pringsheim has observed and described the mode of formation of these spores, but not how they become developed into new plants. In order, then, to become perfectly acquainted with the mode of reproduction of the Œdogonia, knowledge as to the further development of these spores is wanting; and I hope, therefore, that the following description of the germination of the spores of a species of Œdogonium will present a contribution to the natural history of these lowly but interesting plants.

Last summer I encountered, in a little collection of water in the neighbourhood of Upsala, some sterile Œdogonia, entirely covered over by Closteria. Chiefly with the view that these latter might develop themselves, I placed the mass of Algæ in a little water, and, at the expiration of some weeks, I had the pleasure to find several hundreds of the Closteria in conjugation. I wished now to follow the further development of the newly formed spores; but the rapacity of a little species of Cypris rendered this wish of no avail. During the time, the Œdogonia also had begun to fructify; but as I had already had opportunity to observe the fructification in several species of Œdogonium, I paid no attention to it. This is the cause why I cannot give any description as to the species of the present Œdogonium, the development of which I observed. The water, wherein the Algæ were kept, evaporated, so that towards the close of the month of September of last summer there remained behind but a green dry mass. This was laid aside till the middle of the month of January of the present year, when it was covered over with water. In the course of a month this green slime, which covered the bottom of the vessel, was examined, and in it, besides a quantity of minute green Algæ of the genus Scenedesmus, were found also some minute Œdogonium-plants, much resembling those which originate from the germination of the zoospores. This prompted me to try to discover the mode whereby they proceed from the spores; but it was only in the month of March that I was able to find a sufficient number of germinating spores in order to follow out consecutively the remarkable mode in which they are developed.

Previous to germination, the spore (Pl. III, fig. 1) has an egg-shaped figure; the cell-contents are densely crowded, and composed of minute brownish-green granules, closely surrounded by a distinct cell-membrane. Outside this membrane there is found, besides, a quite distinct cell-membrane. Upon germination there are formed in both membranes slit-like openings, whereupon the cell-contents emerge, surrounded by an extremely delicate hyaline covering (figs. 2 and 3). The cell-contents are composed, not of one, but usually of four green masses, each surrounded by its cell-membrane. Sometimes also, as it appears, abnormally, the masses are two or three in number (figs. 6, 7). The four cells which proceed from germination possess an oval form, and their cell-membrane is hyaline. After the contents of the spore have emerged, there remains behind the outer membrane, enclosing the inner one, as shown in figs. 8, 9. After the four cells have remained some time enclosed in the hyaline covering, this becomes resorbed subsequently, and the four cells lie still and motionless; but after the course of a short time there sets in a remarkable change—the cells burst, namely, at one end, by means of an annular slit, and the apex, separated thereby from the remainder of the cell-membrane, becomes raised up like a lid. Through the circular opening the cell-contents now emerge, which, at the part turned towards the opening, is colourless (fig. 11). This apex moves with vigorous motion backwards and forwards, and, after the brief space of an hour, the cell-contents, in the form of a zoospore, leave their place of detention, which we now find to be a doubly contoured cell-membrane (figs. 10—13). The little zoospore wheels in a lively manner about with a circling movement, whereby the colourless point becomes directed downwards towards the mirror of the microscope. Its appearance is puzzlingly like that of an ordinary zoospore, and, like it, it possesses an oval form and a lighter apex, furnished with a crown of cilia, which during the motion is always directed forwards. After the course of some time the movements become faint, and finally cease altogether. The cilia disappear, and the light end becomes elongated into a root, which sometimes becomes formed into an organ of attachment, quite like that which is produced in the germination of the ordinary zoospores (figs. 14—19). The rounded end of the germinating zoospore acquires a little point-like apex (figs. 15—18), indeed, herein much resembling the ordinary zoospores. This young unicellular growth becomes divided by a transverse septum, and a little two-celled Œdogonium has now originated.

From each spore produced by fructification there are thus formed, in general, four Œdogonium-plants.

Through Pringsheim's researches we already know the development of the resting spores of an algal species, *Bulbochæte intermedia*, which much approaches Œdogonium; but though, indeed, its development agrees with Œdogonium, there are likewise found considerable dissimilarities. According to Pringsheim,* the mature Bulbochæte-spore germinates in the following manner:—The spore, after its exit from the sporangium, assumes an oval form, whereupon its contents become divided into four masses. The cell-membrane increases in size, but simultaneously diminishes in thickness, whereupon the four masses become surrounded

* 'Jahrbücher für wissensch. Botanik,' p. 55 (1858).

each with its crown of cilia, and emerge from the extremely thin membrane. Thus, the sac which surrounds the four Bulbochæte-zoospores is the original spore-membrane. According to what I believe to have found, the covering which in Œdogonium surrounds the four cells is not the original spore-membrane. In Bulbochæte the four masses originating from the division of the cell-contents directly form the zoospores; in Œdogonium, on the other hand, they are surrounded by a distinct cell-membrane, within which the formation of the zoospores takes place. The metamorphoses in the germination of the spores in Œdogonium are thus greater than in the spores of Bulbochæte.

QUARTERLY CHRONICLE OF MICROSCOPICAL SCIENCE.

GERMANY.—**Kolliker's und Siebold's Zeitschrift.**—The microscopical papers in this number of the 'Zeitschrift' (issued in May) are as follows:

"*On the Auditory Organ of Locusta,*" by V. Hensen.—The nerve, trachea, and modified cuticula of the leg forming the auditory organ in *Locusta viridissima,* are minutely described. The termination of the nerve presents a very peculiar structure, which is figured with other parts of the organ in a beautifully executed plate.

"*A Contribution to the Knowledge of the Gall-ducts in the Liver of Mammalia,*" by G. Irminger and H. Frey.—The authors have made researches on the distribution and arrangement of these canals by means of injections in the liver of the dog, guinea-pig, cat, and pig. The views of MacGillavry and Beale are briefly discussed.

"*On the Lymph-follicles of the Conjunctiva,*" by C. Huguenin and H. Frey.

"*On the Histology of the Muscular Stomach of Birds,*" by Heinrich Curschmann.

"*On the Development of Myzostomum,*" by Elias Mecznikow. Semper, Schultze, and Schmidt have already studied the very curious genus *Myzostomum;* but the conclusions they have arrived at with regard to its position in the animal kingdom are so far unsatisfactory that one considers them as belonging to the Trematoda, and others place them among the Arthropods. Herr Mecznikow, after carefully describing the development of *M. cirriferum,* compares it with various Annelida in incomplete stages of development, and is inclined to consider it as the representative of a new group of *Chætopoda,* to be called *Chætopoda ectoparasita.*

"*On the Natural History of Caprella,*" by Dr. Anton Dohrn.—A complete account of this interesting little crustacean, illustrated by a very clear drawing of the whole animal, is contained in this paper.

Archiv fur Mikroskopische Anatomie. April, 1866.—Another number of Professor Schultze's excellent journal has appeared during the quarter, and contains some valuable papers. It is much to be hoped that the present crisis in Germany may not in any way retard or prevent the appearance of another in due course. The papers are as follows:

1. "*The Intimate Structure of the Spinning Organs of Epeira,*" by Hermann Oeffinger.—The author distinguishes and figures five sorts of glands in these spiders, as follows:—1. Glandulæ pyriformes; 2. Glandulæ cylindricæ; 3. Glandulæ ampullaceæ; 4. Glandulæ aggregatæ; 5. Glandulæ tuberosæ. Particular attention is devoted by the author to the histological characters of these glandules, and their deportment with different reagents, such as caustic potash, acetic acid, and hyperosmic acid.

2. "*Researches on the Sympathetic Cord,*" by L. G. Courvoisier.—This is an extensive essay, illustrated by two plates. The author gives the following statement of results at the end of his paper:

(1) The sympathetic cells of the Vertebrata are connected either merely at one pole ("Holopol"), as in the frog, or at more—two, for instance—as in other Vertebrata; always with two fibres, of which one ("the straight"), after loss or diminution of its fatty sheath, penetrates straight through the cell-substance, and ends in the *nucleus,* whilst the other ("the spiral") places itself in connection with the *nucleolus,* by means of a network of fibres (Fadennetz). In other cases (Hemipolen) fibres (commissural filaments) arise from the network which connect these cells with other sympathetic cells.

(2) Each commissural ramus extends from cerebro-spinal bundles, which hasten to the sympathetic nerve and to the sympathetic fibres of different ganglia which pass from above to below, diminished in number in the spinal nerves, and occupying a central position, but with increased numbers peripherally.

(3) The "straight fibres" of the sympathetic cells are cerebro-spinal, that is to say, they give origin to the cells of the spinal-cord of the spinal and brain nerve-ganglia, and enter into sympathetic cells. The "spiral fibres" are as good as the genuine sympathetic "commissural filaments" connected with them by their origin, and proceed *from* the cells of the sympathetic, either to the visceral portions of the

latter, or to strengthen the spinal-nerves, or, lastly, to pass into the brain or spinal cord.

(4) The sympathetic-cells are—although they receive "cerebro-spinal fibres"—not to be viewed as possessing a positive function in connection with the sympathetic-fibres, but either only as "nutrition centres" (Schiff), or as "centres of negative function," in opposition to the positively active cerebro-spinal cells, as checks on the function appropriated to these.

(5) The sympathetic has also, no doubt, a most intimate relation to the so-called "animal" nervous system; yet a weak individuality cannot be denied to it, which shows itself, for example, in the circumstance that from always a single "straight fibre"—here and there two, three—may be only one—"spiral fibres," can arise.

3. *"On an Instrument for Microscopical Preparation."* By V. Hensen.—This an instrument for making sections on the stage of the microscope. The author calls it the "Querschnitter," which may be translated "cross-cutter." Its principal use is in making sections of very minute objects. The author first used it in examining the auditory organs of Crustacea.

4. *"On the Germinal Spot, and the Explanation of the Parts of the Egg.* By La Valette St. George.—This a short paper, illustrated by a few good drawings of various ova. Its object is to point out that the egg at its origin by no means bears the indication of its future destiny; that it originates and developes just as every other cell, until it arrives at a certain point. This had only been clearly shown in a few cases until the paper of M. St. George.

5. *The Leptothrix-swarms, and their relation to the Vibriones.* By Ernst Hallier.—The author of this paper, which appears to be one of great value, and the result of careful research, arranges these fungoid bodies in the following developmental series:—(1) Mould series; *a,* Brush-mould (*Penicillium*); *b,* Head-mould (*Mucor*); *c,* Jointed-plants (*Oidium*); *a,* upon moderately damp firm substances, and on the upper layer of liquids; *b,* on firm, somewhat moist substances; *c,* on pap-like and fluid substances, which are thoroughly putrescent.

(2) Achorion series. Syn., *Achorion Schoenlenii.* Within fluid or very juicy substances of various chemical composition, throwing off spore-chains in irregular branches (*Oidium*); it arises from germinating brush-mould.

(3) Leptothrix series. Syn., *Leptothrix 'buccalis: Bacterium* of many authors. *a,* Thin Leptothrix-chains, arising from the swarming plasma-granules of Penicillium, of the

jointed Conidium, of Macroconidium, and, perhaps, of most or all the thread-cells upon fluid fermenting substances. Under spirituous fermentation they appear as pure chains; under acid fermentation as Leptothrix-felt; under ammonia-alkaline fermentation as swarming cellules. *b,* Thick Leptothrix-chains, arising from mucor-thecaspores upon putrescent substances.

(4) Leptothrix-yeast. Syn., *Cryptococcus.* In fermenting substances, built up from the broken chains that have fallen in, and generally from the "swarms." *a,* Penicillium-yeast. Rounded, weakly refracting, with large nucleus. *b,* Mucor-yeast. Globular, highly refracting, fine-grained. Here, too, belongs the light yeast which arises in oil from *Mucor.*

(5) Torula-yeast. Syn., *Hormiscium.* Arising through germination of Penicillium-spores in fermenting (alcoholic) liquids.

(6) Jointed-yeasts. Arising from the off-thrown conidia of the jointed-plant of *Penicillium* or *Mucor* by acid, and also ammonia-alkaline fermentation. The cells originate singly the process by which they developed from the mother-plant, and can place hydrocarbons in acid fermentation.

(7) Acrospore-yeasts. Syn., *Trichophyton tonsurans.* Developing itself by chain-like growths of the Penicillium-spores upon oil. Within the oil the jointed chains mostly separate themselves quickly. (Oil-fermentation.)

6. "*Experiments on the Solution of Berlin Blue as an Injection-colour,*" by Ernst Bruncke.—The ferrocyanide of iron forms, as is well known, in this country an excellent injection-colour. The receipt given by Dr. Lionel Beale is as useful and cheap an injection as can be desired.

7. "*On the Behaviour of the Blood-corpuscles and some Colouring Matters in Monochromatic Light,*" by W. Preyer.

8. "*Researches on the Structure and Natural History of the Bear-beasts* (*Arctiscoida*)," by Dr. Richard Greeff.—This paper, which is very lengthy and exhaustive, is devoted to the genus *Macrobiotus,* the species of which are described, while the details of their anatomy are also fully discussed and beautifully figured in two large plates. The Tardigrada have been sadly neglected by English observers; in Dr. Greeff's bibliographical survey not a single English paper is quoted. We are not able here to give an abstract of the paper, on account of its length, but would remind those who wish to enter upon the subject that the latest observations on these animals are to be found in the pages of Prof. Schultze's 'Archiv,' where there have already appeared two other memoirs on species of this group of very remarkable animals.

9. "*The Trichina in relation to the Microscope,*" by V. Hensen.

10. "*On the Generation of Red Blood-corpuscles,*" by Professor von Recklinghausen.

11. The journal concludes with a number of short essays by Professor Max Schultze, which are each of considerable interest; that on "*Reichert and the Gromia,*" and "*Researches on Noctiluca,*" in which hyperosmic acid has been made use of, appear to be well worth attention. The last is on the "*Anatomy and Physiology of the Retina.*"

Muller's Archiv. May, 1866.—There are the following microscopical papers in this journal:

"*On Redia and Sporo-cysts of Filippi,*" by G. R. Wagener.

"*On the Extension of Nerve-fibres into the Epithelium of the Horn-skin,*" by Professor H. Hoyer.

"*Remarks on Max Schultze's Article, 'Reichert and the Gromia,'*" by C. B. Reichert.

"*Remarks on Dr. H. Landois' Essay 'On the Development of the Cluster-formed Spermatozoa in the Lepidoptera,'*" by H. Meyer.

FRANCE.—**Comptes Rendus.**—"*On the Perforating Bryozoa of the Family Terebriporidæ,*" by P. Fischer.—This is a paper of considerable interest. The existence of perforating animals has been ascertained in nearly all the classes of Invertebrata, Mollusca, Annelida, Echinodermata, Spongiaria, &c. The vegetable kingdom likewise presents us with examples of Protophyta hollowing out their residence in shells and stones. Perforation, and consequently the destruction of the perforated bodies, are, therefore, the effects of a great law of nature. By the side of the creatures which accumulate masses of calcareous polyparies, and of those of which the shells strew our shores and cover the bottom of the sea, nature has placed other organisms, smaller, but not less powerful in their effects, which restore to the ocean the elements which have been drawn from it.

Among the Bryozoa the existence of terebrant cells is almost a new fact. It was known that some *Lepraliæ* and *Celleporæ* slightly alter the surface of the shells to which they attach themselves; but before the discovery of Alcide d'Orbigny no one had ever seen them lodged in the very interior of the shells. The agents by which the perforation is effected are still unknown to us. We have been unable to detect siliceous corpuscles in the excavations of the Terebriporæ, a circumstance which of itself would suffice to distinguish them from the terebrant sponges (*Cliona, Thoosa*), even if their organization were not infinitely superior. Until we acquire fuller information, therefore, we shall assume that the perforation is due to chemical action. The genus *Terebripora* was established by A. d'Orbigny for two Bryozoans collected during his voyage to South America, one on the coast of Peru, the other at the Falkland Islands. D'Orbigny indicates that this genus differs from all others in its class by its cells hollowed out in the very substance of shells, their arrangement being identical with and their mode of production similar to those of *Hippothoa*. Since the publication just referred to no author has made mention of the Terebriporæ. The investigations undertaken by M. Fischer, upon the terebrant sponges in a fossil state, led him incidentally to ascertain how widely the Terebriporæ are diffused in the secondary and tertiary beds. He has detected four or five species in the former, and as many in the latter. Their presence in the middle tertiary beds of Touraine and the Astésan led him to expect that this genus was, perhaps, not yet extinct in the European seas, when, in September, 1865, he collected in the harbour of Arcachon (Gironde) an oyster perforated by a colony of Terebriporæ. The same species occurs in the Mediterranean. From the examination of this specimen it is easy to rectify some incorrect statements made by d'Orbigny, who represented the apertures of the cells as round, whereas they are furnished with a notch of greater or less extent, a character of great importance in the classification of the Bryozoa.

Besides Terebriporæ, M. Fischer has found on the coasts of the Gironde a Bryozoan belonging to the same family and having the same habits, but differing in having its cells borne upon alternate axes. It leaves upon the shells elegant impressions resembling the ramifications of the *Sertulariæ*. He proposes to name it *Spathipora*. The living Spathiporæ are not numerous. There are only two living species known, one from the coasts of France and the Mediterranean, the other from the Pacific.

The *Terebriporæ* and *Spathiporæ* constitute a very natural group, of which the species are probably very numerous. The interest which it presents is increased by the evidence of its existence during the whole series of secondary and tertiary deposits. M. Fischer arranges the family *Terebriporidæ* in the order of Cheilostomatous Bryozoa, side by side with the *Hippothoidæ*. The latter family is composed of the true *Hippothoidæ* (*H. divaricata, Patagonica,* &c.), and the new genus *Cercaripora* Fischer established for the reception of *Œtea truncata, ligulata, argillacea,* &c.

Annales des Sciences Naturelles. March, April.—"*Researches on the Vitality of the Tissues*" is the title of an elaborate memoir by M. P. Bert, part of which appears in this number of the 'Annales.' A number of experiments—over one hundred in all—are detailed, in which the tissues of one animal were transplanted to another, two plates accompanying the paper giving microscopical sections of the united parts. The experiments were made chiefly by means of rats, the tails being removed and transplanted. The object was to observe the nature of the tissue produced, and the effect on the transplanted tissue. In many cases absorption of the bone took place, and great vascularity was induced. The conditions of relative age and health seem to have a modifying influence on the result of the transplantation. A curious experiment is suggested by the author, which, however, he has not tried—it is, to cut off the tail of a fully mature rat, and to transplant it beneath the skin of a rat much younger. When this one begins to get old the grafted tail is to be extracted, and introduced beneath the skin of an animal in full vigour of development; and so on. It is obvious that, if this process is carried on, the tail will live much longer than the animal from which it was detached, and perhaps for an indefinite time. Some interesting conclusions may be drawn from such an experiment as this.

"*Some Crustacea from the Coast of Brittany*" is the title of a paper by M. Hesse in the same journal, in which he describes species of the genera *Slobberina, Cirolane,* and a new genus, *Eucolombar*.

Journal de l'Anatomie, &c. (Robins). May and June.—This number contains a very interesting paper by Dr. Marey, the inventor of the sphygmograph, "*On the Nature of Muscular Contraction,*" which is, however, unfortunately, not a microscopical one. It also contains the continuation of M. Polaillon's paper on "*Peripheral Nervous Ganglia.*"

MM. Ranoier and Cornil contribute a paper "*On the Histological Development of Epithelial Tumours* (*Cancroid*)," which will be found very valuable by those interested in pathological microscopy.

"*Researches on the Structure of the Brain of Fishes, and on the homological signification of their different parts,*" by M. Hollard, is a good paper, illustrated by three plates. He describes a typical form of encephalon in each of the large groups of fishes, and in all these carefully points out the homologies with the parts of the human brain.

ENGLAND.—**Annals of Natural History.** June.—"*On the Anatomy and Physiology of the Vorticellidan Parasite* (*Trichodina pediculus,* Ehr.) *of Hydra,*" by Prof. H. James Clark.—This paper was read before the Boston Society of

Natural History, and contains a very minute account of the infusorian which forms its subject. *Trichodina pediculus* is found in great abundance, creeping over the body, and even to the tips of the tentacles, of our common brown and green fresh-water Hydras. Oftentimes it may be seen with the middle of its base applied directly over the centre of a group of nettling organs, the former fitting the latter like a cap, and without seeming to disturb the Hydra in the least. It appears that this animal has been much abused in European works on Infusoria, its portrait having been taken from specimens when under pressure, thus causing its true doubly conical, dice-box form to assume the appearance of a broad cylinder or a turban. In describing the œsophageal cilia of this animal, Professor Clark says that the so-called "bristle of the vestibule" of Vorticellidæ, which was first described as such by Lachman, is an optical illusion. He has satisfied himself that it is an effect produced by the right and left rows of cilia, and has confirmed his opinion by observations on *Epistylis, Carchesium, Vorticella*, and others. One great test of the genuine character of the filament would have been its disappearance when the focus was slightly altered; but Professor Clark found that it did not disappear, as would be the case in observing the outline of a transparent cylinder. After dealing very carefully with the prehensile cilia, the author passes on to those devoted to locomotion and the other prolongations of the body adapted to that function. The adherent organ is one of these, and is a complex apparatus, which altogether forms a thin circular disc, whose border reaches to the margin of the base, or, in other words, to the inner edge or line of attachment of the velum. About one third of the radius of the adherent organ, at the peripheral margin, is occupied by a striated annular membrane, which is separable from the rest of the apparatus. It lies in front of the centrifugally projecting hooks with which the organ is provided, but is closely pressed against them, and extends centripetally as far as their bases. This membrane is possessed of two sets of striæ, which radiate from its inner to its outer margin. One set of striæ occupy the anterior face, and are comparatively quite coarse, and in number about ninety-six, *i. e.* about four times the number of the hooks of this organ. They lie wide apart, and are arranged so uniformly that two traverse the interval between every two hooks, and two overlap every hook, where they run to the proximal margin of the membrane. The other, or posterior set of striæ, is much more readily detected than the anterior one, and the striæ are about three times as numerous. The membrane is very flexible, and is frequently made to undulate, apparently by the successive impacts of the vibrating cilia. The apparently most important members of the adherent organs are the *hooks*. They vary in number from twenty-two to twenty-four, and curve in a direction which is diametrically opposite to the upward coil of the vibratory organ; *i. e.* they are *læotropic*. They are separate pieces, of an *L*-formed shape, the upright part of the *L* being the hook proper, and the horizontal limb the base of it. These hooks are arranged in a circle, with their horizontal limbs all pointing one way, and nearly or quite touch each other, according to circumstances. Immediately within the row of hooks a series of nail-shaped pieces extends in a circle, and they are arranged in such order that each one lies opposite the horizontal part of a hook. The tip of the nail-head projects between the point of the succeeding nail and the base of a hook, the two latter constituting a sort of socket in which the former appears to slide. This would seem conclusively to show that this complicated ring may be enlarged or diminished at the will of the animal. Faint radiating ridges, occupying the central two thirds of the adherent apparatus, are attached one by one to the point of the nail-shaped bodies just mentioned, and at right angles to them. In dying specimens the adherent organ readily separates from the body *en masse;* but shortly after the striated membrane loosens from the circle of hooks, and they become disjointed. It is worth noting that, after a cursory examination of this radiate apparatus, Professor Agassiz was rash enough at once to pronounce *Trichodina* as the medusoid of *Hydra*, while at the same time he asserts that *Vorticellidæ* are simple forms of *Bryozoa*. Assuredly, Professor Clark remarks, if the one is a medusoid the others are, and if these are Bryozoa so is the asserted medusoid. Hence we should have Acalephan Bryozoa or Molluscan Acalephæ. The rest of the paper describes the digestive, circulatory, and reproductive organs in an equally careful manner. The contractile vesicle is a simple cavity, which performs its systole once in fifteen seconds. The paper is illustrated by two clearly drawn plates, and is a valuable contribution to microzoology.

Quarterly Journal of Science.—A curious and interesting paper "*On Cells*," by Prof. Fick, of Zurich, appears in the last number of this journal, from which we quote the following passage:

"If it be once admitted that animation extends downwards into the lowest forms of the animal kingdom, then it is also admitted that *there exist single cells, which are to be reckoned* *individually as animated beings;* for there are numberless animals belonging to the order infusoria which consist of a single cell. Such an animal, for instance, is an Amœba, a minute, microscopic, protoplasmic mass, with nucleus and nucleolus. If its actions are observed under the microscope, one can see how it alters the form of its body at will; how it sends forward prolongations here and there, draws out the mass of its body, and so changes its place. On outward irritation it generally rolls itself up into a bullet-shaped lump, and rapidly draws in again all the prolongations lately stretched forward. Often one may observe it engulf smaller bodies in its substance, where they are changed—one may say, digested—and half disappear, the undigested leavings being again ejected. The little animal grows, and goes on propagating itself by division.

"A cell which belongs to the tissues of one of the higher animals behaves exactly in the same manner as a single-celled infusorium. For example, in the blood we have cells; the so-called white blood-corpuscles, which are exactly like certain infusoria. Thus, they stretch out prolongations of their substance subject to their will, and upon irritation and the like they show the well-known reactions. The cells in connective tissue deport themselves similarly. They crawl regularly about in certain chasms in the substance of the tissue formed beforehand, which they elaborate for themselves, which, in fact, they have constructed as their dwelling. What is particularly worthy of attention is that these cells, when they have left the tissue, can move themselves for some time in a fluid, and show all the phenomena described. These facts are truly among the most beautiful acquisitions to our knowledge lately derived from microscopic research. They had for a long time escaped the attention of microscopic observers, because animal tissues were not examined under the same condition in which they exist in the living organism. It has already been mentioned that cells in the tissues of highly organized animals are exactly the same in their growth and reproduction as single-celled organisms. And, in the last place, to complete the identity, all the cells of a whole animal are actually the brood of one single cell—namely, the ovum. We have here before us exactly the phenomena which we regard as the characteristics of an animated being—movement at will, and reaction on outward irritation. Thus, then, we can by a well-connected chain of strict analogies arrive at the proposition which was placed before us. Each cell, whether it be an independent animal or part of the tissues of a higher organization, is in itself, *subjectively*, an animated being. The want of self-dependence in the cell, which forms a part of the tissues of a higher animal, is really not greater than in the single-celled infusorium, which lives freely by itself. In fact, each organism has its own conditions of life; and as the tissue-cells can only live, for any length of time, in a certain fluid, or in their appointed self-wrought habitation, where they dwell as a compound organism, so can certain single-celled infusoria live persistently only in certain fluids; they also die if placed under conditions to which their organization is not adapted. I am not, moreover, at all certain, as before said, of the impossibility of a cell, if once removed from the blood or connective tissue of a higher animal, and placed in another soil (as it were) under favorable auspices, proceeding with its life as an independent animal, and becoming the mother of a brood of infusoria.

"From the standing-point which we have now gained, we cannot call an organism which consists of more than one cell an individual. Such an object is much more like an association of individuals, which live together in a habitation wrought by them. The cells have themselves secreted the materials for building from their bodies. Association makes a division of labour possible. It is no longer necessary for each cell to execute for itself every organic function—digestion, assimilation, &c., in their different stages. One group is able much more satisfactorily to execute this, and another that office for the whole household; and thus the particular functions are brought to greater perfection, and the performances of the entire organism become more varied and numerous.

"The best type of such an association of organic individuals is a plant. Here we see different groups of cells execute different offices which benefit the whole plant. One set extracts material from the ground, another elaborates it in various ways; others again draw material from the air; others are especially fruitful in producing new generations. But we do not attain to the higher efforts of physical activity in the plant. The reason of this is easily seen.

"In plants each single cell surrounds itself directly with a membrane of the so-called cellulose, the substance which we have before us in wood, in cotton, and in paper. The cells are by means of this individually shut up; they can, it is true, influence one another to a certain degree, in that they can transmit material to one another; but they cannot influence one another to an unlimited extent; they cannot share their conditions, their sensations, we may even say their experiences, with one another. Each therefore is confined to the bare circle of its own sensations (which we are as little able to dispute in plant-cells as in animal-cells), and therefore it can reach to no higher grade of physical life.

"The cells of a plant are, in a word, like a number of men shut up from childhood together in a cellular prison, who perhaps might have exercised much important influence on one another, but between whom all spiritual intercouse has been prevented. These men would never display the deeper characteristics of spiritual development.

"In the higher animals there are numerous groups of cells which are disposed in a manner analogous to that observed in the plant cells; that is to say, they lie isolated, yet near each other, though not enclosed in the same hard dwellings as in plants. Such aggregates of cells, for example, are the blood and the epithelium. The epithelium is the name given to the layers of cells which lie arranged like strata wherever an organic structure is bounded towards external space, as in the outer skin (epidermis), and the slime-skin, or mucous membrane, which lines the surface of internal cavities open to external space. Many other tissues also form the same kind of cell-masses, upon the principle of the plant's organization. Their action has been long designated as 'vegetative,' correctly referring to the analogies which they present to plant-life.

"In the higher animals a new system of cells is added to this vegetative group, which are disposed on a totally different plan. It defines what is truly *animal,* and its actions are rightly designated 'animal.'

"In fact, the difference between plants and animals does not really lie in their elementary components. The distinction can only be clearly shown where one has to deal with complex organisms formed of many cells. The true characteristics of the two kingdoms are to be found in the manner in which the colony is built up by its individuals, and thus especially in that system of cells just mentioned which gives its peculiarity to the animal kingdom. This system is a series of cells widely spread through the whole body, in which the protoplasmic matter is maintained in unbroken continuity throughout, by fine, long threads. It is the 'nervous system.'"

NOTES AND CORRESPONDENCE.

On Microphotography with High Powers.—In the 'Quart. Journal of Microscopical Science' for July, 1865, Vol. XIII, p. 249, I notice an interesting letter on a new method of illumination, by Count Francesco Castracane, who proposes the use of monochromatic light, by "the employment of one of the component rays of the solar spectrum, which was made to fall on the mirror of the microscope." It appears, also, from this paper and the accompanying editorial remarks, that Count Castracane has succeeded in obtaining a good photograph of *Pleurosigma angulatum*, in which the minute markings on the frustule appear as hexagons.

I take pleasure in confirming the statement thus made as to monochromatic light, and especially would mention the advantages of violet light for microphotographic purposes.

For some months before I read the paper above referred to photographs had been successfully made by Dr. Edward Curtis, Brevet-Captain U.S.A., in the Army Medical Museum, with all powers up to 1000 diameters, the illumination being the direct rays of the sun reflected on the microscope mirror by a heliostat, and the pencil thus obtained being thrown through a cell containing a solution of the ammonio-sulphate of copper before falling on the achromatic condenser.

To obtain the full effect of the violet light, however, the objective should be photographically corrected, that is, in determining its curves the index of refraction of the violet ray should be considered, and not that of white light. With such a lens the actinic and visual foci coincide if violet light is employed. Several such lenses, of excellent quality, have been constructed for the museum by W. Wales, of Fort Lee, New Jersey. A brief note on this subject was published in my report to the Surgeon-General, October 20th, 1865, "On the Extent and Nature of the Materials available for the Preparation of a Medical History of the Rebellion' (see p. 148, circular No. 6, Surgeon-General's Office.

At the date of that publication both Dr. Curtis and myself believed the markings on *Pleurosigma angulatum* to be hexagonal, the photographs on which this opinion was based being magnified, originally about 1000 diameters, and afterwards enlarged to 7300 in a copying camera. Subsequent observations with higher powers, however, have satisfied us that this opinion is erroneous, and that, as, in fact, Mr. Wenham had previously suggested, the real conformation of the markings is circular.

The photographs on which this opinion was based were some of them made with an objective of one fiftieth of an inch focal length, constructed by Powell and Lealand, some of them with a Wales' objective of an eighth of an inch focal length, corrected for photography as above indicated, and the necessary amplification being given by the introduction into the draw-tube of an achromatic concave also corrected for photography. No eye-pieces were employed. With either of these arrangements Dr. Curtis obtained direct photographs of excellent definition and powers, varying with the distance up to 2500 diameters, with about three feet distance, beyond which, in either case, the pictures began to diminish in clearness. To obtain any given power, it was found the one-fiftieth required a few inches' greater distance than the one-eighth and amplifier. The use of an eye-piece, or of a concave amplifier similar to that used with the one-eighth, but of much lower power, was carefully tried with the one-fiftieth, but it was found that the results were not well defined, so that 2500 diameters must be regarded as the maximum power to be obtained photographically with the one-fiftieth. With the one-eighth and amplifier the same power was attained with perfect ease. The negatives taken in this way were readily enlarged in the copying camera to 19000 diameters. I enclose albumen prints of the pictures with both powers, and by both glasses, for comparison. The enlarged prints are almost fac-similes of those of about 2500 diameters; that by the one-fiftieth is perhaps a trifle sharper, but it was accidentally taken with 200 diameters less than were allowed the one-eighth. The flatness of field is, of course, greatest in the one-eighth picture.

It might be suggested that the eighth being photographically corrected, had the advantage over the fiftieth in this comparison; but the photographic correction for an eighth is already small, and that for a fiftieth may be regarded as too trifling to modify the results very greatly.

In both the small pictures and the large you will notice the markings are perfectly circular spaces, whic[illegible] small picture (with 2500 diameters) appear hexagonal, but reveal their true structure under a lens; in the large are quite distinctly circular, but will assume an hexagonal appearance if reduced by a concave lens of sufficient power, or even by mere distance.

If these pictures appear good enough to give interest to the above statements, I beg you to give a place to this communication in the pages of your valuable Journal.—J. J. Woodward, M.D., Assistant-Surgeon and Brevet-Major U.S.A., in charge of the Record and Pension Division, Surgeon-General's Office, and of the Medical Section, Army Medical Museum.

Light Reflected from Transparent Surfaces.—At present this subject, being one of interest in relation to recent binocular arrangements, I beg to record some notes. Selecting a few examples of the amount of light reflected from the surface of crown-glass, having a refractive index of 1·525, they range as follows:

Angle of incidence.	Quantity of light reflected from 1000 of incident rays.
30°	44·78
45°	53·66
60°	93·31
80°	362·14

These examples are taken within the limits of useful application, and show the small quantity of light really obtainable from crown glass such as is used for prisms. It consequently became a consideration to ascertain what increase would result from the use of dense flint glass of a high refractive power. Certain formulæ have been given for this which claimed a very promising result, but which is scarcely confirmed by experiment. Mr. Huggins kindly undertook to try this, being possessed of very perfect photometric apparatus, and as I had suggested that the dense glass prisms of a spectroscope might have their numerous surfaces coated with a thin film of albumen, with the view of lessening the quantity of reflected, and consequently increasing the amount of *transmitted*, light (which theoretically it should do, as the refractive index of albumen is nearly as low as that of water).

The following is his letter to me, dated April 16th:

"Dear Sir,—On Friday evening last I tried the reflection from different transparent surfaces, and found the diffe too small to be measured with the photometer. I then placed two different surfaces together in a straight line, so that half a small beam of light (from a candle enclosed in a magic lantern, from which the lenses had been removed) was reflected from one surface, and the other half reflected at the same angle from the next surface. The light reflected was received on a sheet of paper some feet distant. In this way, the light being feeble and the room dark, the difference of illumination could be easily detected by the eye. When one surface was dense flint, and the other optical crown glass, the difference, at an angle of 45°, was *only just appreciable*. The quartz surface reflected more light than either. I then coated one surface of a dense flint prism with diluted albumen, and this was compared with the surface of a second prism made of the same glass. There was less light reflected from the albumen, but the difference was surprisingly small. These experiments led me to the conclusion that the working of the surface is more important than the quality of the glass; also that coating with albumen would not make sufficient difference to compensate for any inconveniences that might be caused by air-bubbles or irregularities of the film.—W. HUGGINS."—F. H. WENHAM.

How to make Diatoms Stick.—In your last Journal (April) Mr. Ward asks how to make diatoms stick on a slide after being arranged. I have done a little in setting diatoms, and never had any trouble with their moving when covering. My plan is to centre the slide with a spot of ink on the reverse side before putting it on the stage, then with a dipping-tube to take a drop of the water the diatoms are in, put it on the slide, but not on the centre; now with a bristle and the aid of an object-glass pick out the diatoms wanted, and push them to their position with a little water adhering to them. When the number are arranged, dry the slide over a gas flame, and mount in the usual way with thin balsam. I find, when the diatoms are perfectly dry, that it takes some force to move them, and some of them will even break before they can be moved.—R. LEIGH, Aberdeen.

Price of Vulcanite Cells, &c.—You will oblige by correcting an error in your report of my remarks on vulcanite cells published in the last number of the Journal, p. 112. The price at which I stated these cells are sold was *6d.*, not *4d.*, per dozen. Mr. Bailey informs me he has been put to some inconvenience in consequence of the misprint.

I may also note that, as the seconder of the resolution proposed by Mr. Tyler (p. 64), you have called me H*i*ll, instead of Hall. Again, at p. 65, in the vote of thanks, the word "Treasurer" should be inserted between "President" and "Secretaries."—W. H. HALL, Hackney.

PROCEEDINGS OF SOCIETIES.

MICROSCOPICAL SOCIETY.

March 14th, 1866.

JAMES GLASHIER, Esq., F.R.S., in the Chair.

THE minutes of the previous meeting having been read and confirmed,

A MEMBER inquired, in reference to the proposed incorporation of the Society, if it could take the ordinary style of the "'Royal' Microscopical Society."

The PRESIDENT explained that, to entitle the Society to use the style "Royal," it was necessary that some royal personage should be connected with it. The primary object would be to obtain the Charter in the form in which they could then take it, and, if necessary, it could be subsequently renewed under the altered name.

A paper "On a Brass Slide Clip," by Dr. Maddox, was read. ('Trans.,' p. 65.)

A vote of thanks to Dr. Maddox was passed.

Two papers by Mr. Tuffen West were then read. ('Trans.,' pp. 67, 69.)

The thanks of the Society were tendered to Mr. West.

A paper by Dr. Greville was also read. ('Trans.,' p. 77.)

The usual vote of thanks was awarded.

A paper by Captain Mitchell, Superintendent of the Madras Government Museum, "On the True Reading of Measurements with the Cobweb Micrometer," was read, and the thanks of the Society awarded for the same. ('Trans.,' p. 71.)

A paper by H. Charlton Bastian, Esq., M.A., F.R.S., communicated by Mr. W. H. Ince, F.L.S., was read. ('Trans.,' p. 86.)

After some remarks by Mr. Brooks and the President, and the thanks of the Society having been given to Mr. Bastian and Mr. Ince. A paper "On a New and Adjustable Diaphragm," by Sydney D. Kincaid, Esq., was read. ('Trans.,' p. 75.)

After a few remarks from M. Wenham, the thanks of the Society were voted to Mr. Kincaid.

Dr. HALIFAX produced some specimens of Insects, chiefly Bees, Wasps, &c., prepared by him, and explained his method of preparing them. The objects were operated upon by the ordinary cutting instrument, with a cylinder in the middle of the brass plate, and the object is raised by means of a screw rod working a small circular plate that rises up in the cylinder, or the well, as he should call it. The only alteration he made was to enlarge the instrument, so as to adapt it to the size of the object, it being usually furnished with but a small aperture which is not sufficient to receive a large bee or a beetle, or even a wasp. This he endeavoured to accomplish by means of an additional plate, placed over the ordinary brass plate, having a larger aperture, being an adaptation of the well of the smaller instrument, so that the same screw may operate upon the plug, and raise the object, the same as in the smaller instrument. He might add, that he found a glass surface answer better with regard to the razor or cutting instrument than the ordinary plate. The razor works very easily over the surface, and is less liable to injury from scratches. The object must, of course, be fixed, in order to be available for the cutting of the razor; and this he effected by placing the object in a paper cell, and imbedding it in wax. (Dr. Halifax produced a specimen prepared in this way.) Then the plug or block, which is to be received by the well of the cutting instrument, will consist of a little cylinder, made up partly by a small cylinder of wood, and partly by a small cylinder of wax, and wax contents. In some cases the objects become almost useless, from the difficulty of removing the wax afterwards; and, to avoid that, he previously immersed the object in stiff gum, and allowed it a very short time to harden before inserting it in the wax capsule. Dr. Halifax concluded by showing several specimens, and explained fully the details of the plan adopted by him.

The President announced that the Soirée of the Society would be held on the 4th of April; also that the meeting to be held on the 9th of May would be made special, to take into consideration the changes in the constitution of the Society suggested by the Council, and, if approved, to adopt them. He also read a communication received by the Committee from the Committee of the Hackney Working Men's Institute. (See p. 194.)

Annual Soirée.

April 4th, 1866.

The Annual Soirée of the Microscopical Society was held in the Society's Rooms, King's College, London, on April 4th, and was attended by nearly a thousand members and visitors. The walls of the rooms were hung with beautiful drawings and diagrams, illustrating various microscopic objects and minute tissues of the animal and vegetable kingdom. On the tables were arranged two hundred microscopes, a large portion of which were first-class instruments. The whole of the arrangements and preparations for the Soirée were under the superintendence of Mr. Blenkins, one of the Honorary Secretaries, and the company were received, on entering, by the President, James Glaisher, Esq., F.R.S.—Mr. Williams had charge of the ancient microscopes, including the large Martin microscope, the property of the Society. This collection excited much interest, as showing the gradual improvement and development of the instrument.—Mr. Wenham exhibited an improved form of binocular microscope for the highest powers, starting from the recent idea brought out by Messrs. Powell and Lealand of obtaining the whole aperture of the object-glass in each eye by means of the direct transmission and partial reflection from an inclined plate of glass placed behind the object-glass. It seems most desirable to increase, if possible, the quantity of light in the reflected image, as when the disc of plate glass is inclined at an angle of 45° the quantity of light is less than $\frac{1}{10}$th part of the incident rays. Mr. Wenham has succeeded in effecting this by reducing the number of transmitting surfaces and obtaining the light in the inclined tube by means of two reflectors. A small prism is used, in form and size resembling the common binocular prism, but with the two reflecting surfaces more inclined, so as to be beyond the angle of total reflection. In contact with the first reflecting surface is another small triangular prism, whose upper plane is parallel with the base of the main prism; the rays from the object-glass will then pass direct through without refraction, and the same rays are reflected from the two contact surfaces in the inclined body in the usual way. The arrangement nearly equalises the amount of light in each eye.—Mr. Browning exhibited some of his now celebrated micro-spectroscopes, such as has been so successfully applied by Dr. Bird Herapath to the detection of blood-stains in the Ash murder case. Mr. Browning also exhibited some very beautiful, curious, and interesting spectra, among which we noticed Cochineal, Brazilwood, and, most curious of all, Sumach.—Mr. Conrad W. Cooke exhibited an instrument designed by him, and to which he has given the name of "Micrographic Camera;" one of the purposes for which it is intended, being to facilitate the figuring of microscopic objects to any desired scale. By this instrument an image (with perfect definition) can be thrown on a sheet of paper placed in a horizontal or slanting position, so that an uneducated eye can appreciate the form, and any one may trace the outlines and detail, with a fair amount of accuracy, on the paper. It is useful also for purposes of demonstration, for two or more persons may at the same time conveniently examine the image formed on the paper: this, for the explanation of minute organic structure to students and others, may be found of value. This instrument may be worked as well in an illuminated room as in a dark one, because the head of the observer is isolated from external light by means of a curtain which falls over the back of his chair. Measurement of the objects shown in this camera may very easily be made, for it is furnished with boxwood scales corresponding to the magnifying powers of the different objectives employed. Thus, the image may be treated as a drawing, and measured and delineated with rules and compasses in the usual way. All the necessary adjustments can be effected from the inside, in order to avoid the inconvenience to the observer of continually altering his position. The use of this microscope is not entirely confined to the examination of transparent objects, for an image of many of the *opaque* bodies may be shown with it on the paper. The effects of dark field illumination (with the paraboloid and Lieberkuhn) and those of the polariscope may be shown on the paper without loss of definition, and all these accessories, as well as the objectives used, are the same as those of a microscope of the ordinary construction. The whole apparatus is made to fold up so as to occupy as little space as possible for the sake of portability. Mr. Cooke also exhibited a simple form of heliostat, which is useful when the camera is worked for a long time with sun-light. Mr. Ross, relying on his well-earned fame rather than on questionable novelties, exhibited, in a collection of his highly-finished first-class instruments, a variety of specimens of marine Polyzoa, &c., remarkable for their beauty and the perfection with which they were shown.—Messrs. Powell and Lealand showed their new binocular with some first-class instruments. Under one of their instruments was exhibited a beautiful illustration of the marvellous power of the eye of a beetle. A likeness of the Princess of Wales was reflected through the 100 facets of that compound structure, and in each part was distinctly seen a perfect image of the Princess. Mr. Lealand also showed the objects for which he is so celebrated, the circulation in the Vallisneria and the *Volvox globator*.—Messrs. Smith and Beck exhibited a variety of beautiful objects under many of their best instruments.—Mr. James How had some beautiful examples of Zoophytes with expanded tentacles, Halodactylus, Sertularia, &c.; the larvæ of the shore crab, circulation of the blood in the frog, specimens of *Trichina spiralis* in human muscle, &c. Mr. How also exhibited, in one of the rooms upstairs, by means of the oxyhydrogen light, a selection of photomicrographs by Dr. Maddox, consisting of vegetable structures, diatoms, parasites, parts of insects (some of these exibited for the first time), such as preparations of the head and wings of the male and female gnat, and larvæ and pupa state of the same, and a fine photograph of the tongue of the house-cricket.—Mr. Baker showed binocular microscopes, under which were many striking illustrations of pond and marine life—such as Tabularia and Campanularia, minute crabs, and other crustaceans, fresh from their native element, a novel feature in objects usually shown at these meetings.—Mr. Charles Tyler exhibited silicious sponges from Barbadoes, opaque and in section; new Grantias from Australia; keratose sponges, with a new variety from Australia; a unique sponge with inhalent orifices. Dr. Miller showed *Conochilus Volvox* in his usual beautiful manner, and recent

Desmidiæ.—Mr. Henry Lee exhibited living young salmon, living larvæ of gnats, and preparations of Asteridæ. There were numerous other exhibitors with most interesting objects, which were highly appreciated and most attentively examined by the large numbers assembled on the occasion.

May 9th, 1866.

James Glaisher, Esq., F.R.S., President, in the Chair.

Two papers by James Smith, Esq., F.L.S., "On a Leaf-holder for the Microscope," and "On a revolving Slide-holder with Selenite Stage," were read. ('Trans.,' p. 100.)

The thanks of the Society were tendered to Mr. Smith.

A paper, by F. H. Wenham, Esq., "On a Binocular Microscope with High Powers," was read. ('Trans.,' 103.)

Mr. Beck thought a distinction should now be drawn between the binocular microscope and the microscope with stereoscopic vision. Hitherto the binocular microscope had been looked on as giving stereoscopic vision; but in the present case there was rather a tendency to give the objects a flatter appearance. He was of opinion that Mr. Wenham's invention would render little aid in matters of research, and remarked that Mr. Wenham had not in his paper given any instance in which his own arrangement or Messrs. Powell and Leyland's prisms would be of any real advantage.

Mr. Browning supported Mr. Beck's views with regard to stereoscopic vision. He had been unable to get stereoscopic effect from any arrangement of the kind under discussion, and when he attempted to do so a part of the field of view was cut off. It was too far from the object-glass necessarily used with high powers. There was, no doubt, a certain comfort in being able to use both eyes, and in this lay the real merit of the invention. The same advantage attended the use of the binocular telescope, as it enabled the observer to continue his observations with less fatigue; but he had never been able by it to produce the slightest stereoscopic relief.

A Member thought it would be difficult to overrate the value of being able to use both eyes. He had attempted to improve the binocular telescope with a view to bringing it to a moderate price; but though he had not succeeded in that object, he had produced some good binocular telescopes which answered very well, and but for their being less portable he thought no one who could obtain a binocular telescope would use a monocular one.

Mr. Slack said that his two eyes differed in focus to such an extent that he did not care for the ordinary binocular arrangement, but thought that persons whose eyes were ordinarily nearly alike in focus would be saved fatigue in making quick comparisons, as by using both eyes alternately one eye could be kept comparatively fresh, and this alternation would be favorable to the prolonged examination of exceedingly delicate objects. He thought, too, that Mr. Wenham's invention would be exceedingly valuable for objects which required the stereoscopic effect of combining two dissimilar images. He presumed it would not be doubted that this result would be obtained. No one could look at the moon through an ordinary stereoscope and say it appeared flat; and he (Mr. Slack) had never met with any person who could see even an approximation to flatness, and though in his own case he could not say that the invention produced the stereoscopic effect of the combination of two dissimilar objects, it certainly did not give the idea of flatness. Mr. Slack concluded by asking Mr. Wenham whether in his arrangement each eye got exactly the same proportion of marginal and peripheral ray, as a difference in this respect might produce a difference in result.

Mr. Wenham said that with the eight and twelve and higher powers the images would be identical. On drawing out the prism it would simply cut off a portion of the field of view, and this would be done simultaneously with both eye-pieces.

Mr. Gray thought Mr. Slack had combined two things which were essentially different—the stereoscopic effect produced by single vision, such as looking through a telescope, and the effect of viewing the same object binocularly. There were two ways of arriving at a conclusion whether an object was flat or not. In the case of the moon they would see the shadows of that body.

Mr. Wenham.—I spoke of the full moon.

Mr. Gray continued—If any one doubted that there was a difference between real stereoscopical vision and inferential stereoscopical vision, let him examine stereoscopic slides of the moon where a corresponding image was taken of two extremities. He could not say that the moon would appear flat through a telescope; it would appear as if reduced into a small globe; but in the stereoscopic slides they saw more than a hemisphere, say three quarters of the diameter, and bearing this difference in mind would simplify the distinction between real stereoscopical and inferentially stereoscopical vision. Mr. Slack had mentioned that one of his eyes differed from the other in focus, and he therefore probably did not fully appreciate the effect that most persons received from a stereoscopic picture, and was therefore the less able to distinguish between the inferentially stereoscopic and real stereoscopic vision.

Mr. Beck said that Mr. Slack's remarks confirmed his opinion that the moon could not be seen as flat through an ordinary telescope, but he thought it would be seen flat through a binocular telescope. The effect of the binocular telescope, with its two telescopes placed any farther apart than the ordinary distance of the eyes, would be rather to diminish stereoscopic vision. For instance, a tolerably near object, such as a flower-pot standing outside a window, would, with an ordinary-vision telescope, appear to be outside the window; but with a binocular telescope it would appear in the same plane with the window. The telescope drew the object nearer the eyes, but did not increase the distance of the eyes apart. So an artist, directing the attention of a spectator to a picture, would ask him to look at it with one eye, because looking at it with both at once would show that it was a flat surface; and a similar effect would follow from the use of the binocular telescope.

Mr. WENHAM could not agree with Mr. Beck in not being able to procure stereoscopic vision from the binocular telescope. He had used it in his travels on the Nile, in a country where it was difficult to measure distances, and there he had certainly got the effect of distance. He (Mr. Wenham) had a telescope, made many years ago, in which, viewing the objects with both eyes, they did appear to be stereoscopic. It might be imaginary—indeed, it ought to be—but the object certainly did appear to stand out.

The PRESIDENT, in concluding the discussion, proposed a vote of thanks to Mr. Wenham for his paper, which was duly carried. He could, from his own experience, speak of the fatigue caused by the continuous use of one eye only—not, however, to the eye at work, but to the closed one. Anything that could relieve that fatigue, and enable the observer to use the high powers of the microscope with more comfort, would be a great benefit.

A paper by Mr. Beck was then read.

The meeting was then made special.

The SECRETARY, in moving a resolution approving of certain alterations in the laws of the Society, stated that certain modifications would be necessary in anticipation of the Royal Charter of Incorporation, endeavours to obtain which were being made on behalf of the Society. This would also afford an opportunity for making a better arrangement of the clauses. In 1840 a law was passed, providing that past Presidents should be permanent members of the Council; but at the suggestion of the present President it was proposed that, while that rule should be acted on up to the year 1866, henceforward there should be four Vice-Presidents. He therefore moved—"That in the clause relating to the constitution and government of the Society the words 'four Vice-Presidents' be inserted immediately after the word 'President.'"

Mr. CHARLES TYLER seconded the motion.

The PRESIDENT, in putting the motion to the meeting, explained that retiring Presidents would be eligible to serve as Vice-Presidents.

The motion was unanimously carried.

It was moved by the SECRETARY, seconded by Mr. HENRY LEE, F.L.S., and carried unanimously—"That the laws, as revised by the Council, be the laws of the Society from the 9th May, 1866."

The PRESIDENT announced that the draft of the Charter had been prepared, and that a Committee, consisting of himself, the

Treasurer, and Secretaries, had been appointed to act in the matter with Mr. Burr, and that a sum of £135 had been subscribed towards the expenses.

SUBSCRIBERS TO THE CHARTER FUND OF THE MICROSCOPICAL SOCIETY.

	£	s.	d.
Allen, C. J. Hyde, F.L.S., Treasurer	50	0	0
Berney, J.	1	1	0
Bezant, W. F.	1	1	0
Black, H.	1	1	0
Blenkins, G. E.	1	1	0
Bowerbank, J. S., LL.D., F.R.S.	5	5	0
Bradley, C. L., F.L.S.	1	1	0
Brooke, Chas., F.R.S	2	2	0
Brown, Rev. T. H.	2	2	0
Bunting, J.	1	1	0
Burton, J. R.	1	1	0
Busk, George, F.R.S.	1	1	0
Bywater, W. M.	1	1	0
Cundell, G. S.	1	1	0
Davison, T.	1	1	0
Deane, Henry, F.L.S.	1	1	0
Delferries, W.	1	1	0
Ellis, Septimus	0	10	6
Fleetwood, F. K.	1	1	0
Fox, Chas. Jas.	1	1	0
George, Edward	1	1	0
Gilbertson, Chas.	1	1	0
Glaisher, James, F.R.S., President	5	5	0
Gray, Peter, F.R.A.S	1	1	0
Guyon, G.	1	1	0
Hall, W. H.	1	1	0
Hilton, Jas.	2	2	0
Hogg, Jabez, F.L.S.	1	1	0
Ince, W. H., F.L.S.	5	5	0
Jones, Peter, F.L.S.	1	1	0
Ladd, W.	1	1	0
Lankester, E., M.D., F.R.S.	1	1	0
Lankester, E. Ray	1	1	0
Lealand, P. H.	1	1	0
Lee, Henry, F.L.S.	2	2	0
Lobb, E. G.	2	2	0
Mason, S., F.R.A.S.	1	1	0
Mestayer, Rich.	2	2	0
Millar, John, F.G.S.	2	2	0
Moore, Joseph	2	2	0
Noble, J. G., F.R.H.S.	1	1	0
Perigal, H., F.R.A.S.	1	1	0
Reade, Rev. J. B., F.R.S.	1	1	0
Rikatcheff, M., Lieut. R.I.N.	1	0	0
Roper, F. C. S., F.L.S.	5	5	0
Ross, Thos.	2	2	0
Shadbolt, G.	1	1	0
Shuter, J. L., F.R.A.S.	1	1	0
Smith, Jas., F.L.S.	1	1	0
Spicer, Rev. W. W.	1	1	0
Thompson, J.	1	1	0
Tomkins, J. N., F.L.S.	2	2	0
Tulk, J. A., F.G.S.	2	2	0
Tupholme, J. T.	1	1	0
Tyer, E., F.R.H.S.	1	1	0
Tyler, C., F.G.S. &c.	5	5	0
Vinen, E. Hart, M.D., F.L.S.	1	1	0
Ward, N. B., F.R.S.	1	1	0
Waterhouse, J., F.R.S. &c.	1	1	0
Wenham, F. H.	1	1	0
Westley, W.	2	2	0
Wiltshire, Rev. T., F.L.S.	1	1	0
Woodward, Chas., F.R.S.	5	5	0

Oxford Microscopical Society.

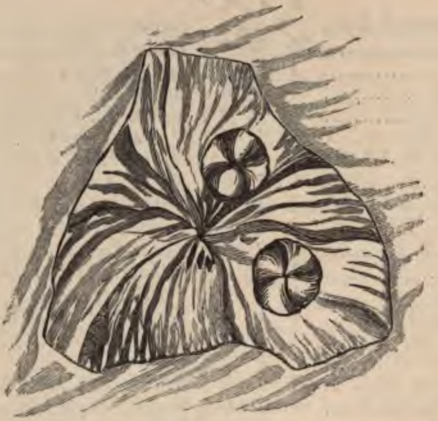
Further Remarks *on* Crystallization.

By R. Thomas.

The following diagrams illustrate a series of singular crystalline forms, which I have been enabled to obtain from solutions of sulphate of copper, by carefully crystallizing that salt *at various* *temperatures.* I have ventured to apply the term "spiral crystallization" to this peculiar and very beautiful series of phenomena.

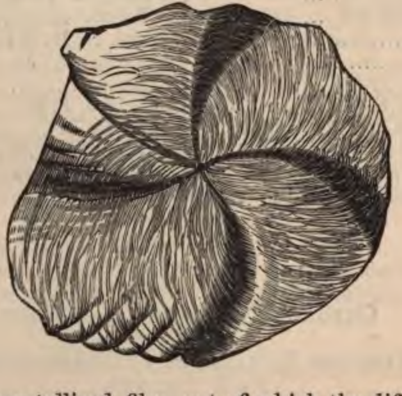
The first and most difficult stage of the process consists in evaporating a solution of sulphate of copper in such a way that the evaporation be not conducted too slowly, and that the heat em-

Fig. 1.



ployed be not excessive. By steering warily between these two extremes, we avoid on the one hand crystallization of the solution, on the other the formation of small granular masses, which cover the slide and spoil it for future operations; and we are enabled to

Fig. 2.



obtain an uncrystallized film, out of which the different crystalline forms under consideration may presently develop themselves. If, now, such a film be subjected (after the manner indicated in my paper contained in the April number of this Journal) to a temperature of about 60° Fahr., numerous foliated crystals radiating from centres will soon be seen to form, and, if the slide be examined minutely, other small round forms will be noticed, which

Fig. 3.

have no connection with the foliated crystals, but which constitute the first stage of the spiral. (Fig. 1.)

At 65° the foliated structures are lost, and the round crystals only are seen in great numbers, clearly showing a further advance

Fig. 4.

in the direction of the spiral, and presenting a well-marked but curved black cross. (Fig. 2.)

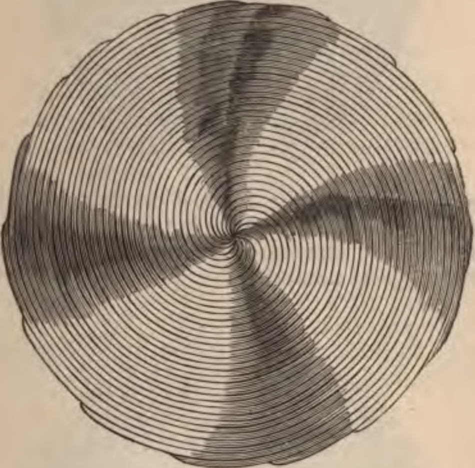
At 70° the spiral is still more marked. (Fig. 3.)

At 80° to 90° the lines are smaller and more numerous, while the spiral is evidently more pronounced. (Fig. 4.)

At 90° to 100°, if the slide be kept free from dust, numbers of the most perfect spiral crystals, some right- some left-handed, will be seen to cover the slide. (Fig. 5.)

I have no doubt that some of these crystals are, in reality, cones standing out in relief from the slide. Of this I have satisfied myself by allowing them to form in a partial vacuum in the receiver of an air-pump, and then suddenly letting in the air upon them, when I have seen the apex of the cone broken or forced in by the atmospheric pressure. I may also add that, under all circumstances, the crystals thus formed in a vacuum are more perfect than when exposed to the air, owing to the exclusion of foreign matters, such

Fig. 5.



as small particles of dust, which are apt to interfere with the formation of the curves.

Very beautiful effects may likewise be produced by allowing the film to crystallize gradually in Canada balsam. The balsam should be gently warmed, but not sufficiently heated to drive off the few atoms of water contained in it. The salt gradually absorbs this water, and crystallization is slowly effected.

Dublin Microscopical Club.

November 16th, 1865.

Dr. E. Perceval Wright exhibited some spirally twisted cases of a phryganidous insect, collected by Professor Harvey some *years* ago in Australia. They had been taken, with a large number of minute Helices and Bithiniæ, from under stones on the borders of a pond, and had been overlooked as small shells allied to Valvata. A microscopical examination, however, not only at once showed that they belonged to the genus Helicopsyche, of Bremi, but likewise made apparent the dried-up thorax and limbs of the insect. At present, Dr. Wright knew of but two species of this genus, *H. Shuttleworthii*, Bremi, from Corsica and Como, and *H. minima*, Bremi, from Porto Rico, which they resembled; and, looking at the differences in the localities of these two species and of the one he now exhibited, he believed it would be found that these helicine cases belonged to a different phryganidous insect, to which he would venture to give the provisional name of *H. Sieboldii*, after the distinguished Professor of Zoology at Munich. Dr. Wright had not, however, been enabled to consult Dr. Hagen's paper in the Stettin's Entomological Society's Proceedings.

Mr. Archer exhibited specimens, obtained from Yorkshire (near Market-Weighton), through the kindness of Professor Gagliardi, at present resident there, of *Closterium aciculare*, West. This elegant form seems to be rare; he (Mr. Archer) had only once met with it in Ireland, in a collection made by Mr. Porte in the King's County. These specimens, however, were not so very long, in proportion to their extreme slenderness, as the original specimens described by Mr. Tuffen West; hence Mr. Archer sent some on that occasion to that gentleman, who kindly informed him that the Irish specimens were truly his *C. aciculare*. The specimens now exhibited seemed to Mr. Archer quite to agree with those he had previously seen.

In the same Yorkshire gathering Mr. Archer drew attention likewise to some specimens of *Gonatozygon Ralfsii*, De Bary (= *Docidium asperum*, Ralfs), in which the characteristic superficial roughnesses were the least evident he had ever seen. Indeed, at first glance one would have thought them absent; but a closer examination revealed their existence, and the comparatively smooth appearance of the surface seemed to be due to the pellucid character of the minute granules, but they were probably also less elevated than usual. There could not, however, be a doubt as to the identity of the plant.

Mr. Porte exhibited a gold-fish having a large patch of Saprolegnia growing upon its side, and which stood out, perhaps, three-quarters of an inch. This proved to be in the state of developing the zoospores, some of which were discharged, others just discharging, and some with the secondary or tertiary sporangia formed one within the other, thus identifying the genus. This growth had manifested itself upon the side of the fish where it had met with an accidental injury, thus indicating that its presence was a consequence, not the cause, of disease.

Mr. Archer showed specimens of *Cosmarium quadratum*, in allusion to the Cosmarium shown by Dr. J. Barker at last meeting of the Club, in order to draw attention to the great differences between them, both in size and figure.

Dr. John Barker exhibited blood of the Napu Deer (*Tragulus Javanicus*), composed mostly of red corpuscles which are amongst the smallest in mammalia, measuring, according to Gulliver, $\frac{1}{12325}''$ in diameter. As far as Dr. Barker could see, they are not perfectly round.

December 21*st*, 1865.

Dr. John Barker showed specimens of an Acineta, which had become produced in considerable quantity in a gathering made so long ago as the occasion of the Lugnaquilla excursion. It was very interesting to watch the disappearance and gradual return of the well-marked circular contractile vacuole. He had noticed a curious kind of swarming movement of the granular contents, not like the jerking or dancing movement of the granules (as, for instance, in the Desmidiaceæ, &c.), but a slower and more decided change of place of the particles in a curious writhing manner.

Mr. Archer drew attention to the seemingly not uncommon but remarkable organism *Anthophysa Mülleri*, lately taken by Dr. J. Barker near Finglas. Mr. Archer read a lengthened extract from Professor Cohn's remarks on this curious production in his 'Untersuchungen über die Entwickelungsgeschichte der mikroskopischen Algen und Pilze,' pp. 109 *et seq.* The specimens now exhibited, probably being too long kept, did not show any of the Uvella-like bodies at the summits of the so-called "Stereonema" filaments, which Dr. Barker and he had seen in company. However, at the apices of some of the younger, pale greenish, or colourless filaments of the same, and not a distinct organism, a single globose body was here and there seated, with pale granular contents, seemingly the forerunner, by subsequent division, of a future Uvella-like family. On the present occasion a specimen turned up in which the body at the apex of one of the filaments, here of an elliptic shape, had its contents divided into a number of portions, still confined within their common boundary. It became a question as to this being a more advanced state, tending towards the Uvella-like family. In any case this may, perhaps, be of some interest, as Cohn had not seen these bodies otherwise than as fully developed Uvella-like clusters. Mr. Archer was disposed to think that the filaments themselves grew and branched, and that the indications seemed to point to the conclusion that the Uvella-like bodies were a subsequent development at the summit of certain seemingly soft, and younger, and nearly colourless branches, not that the Uvella-like bodies developed the stipes *analogous to* that of Gomphonema, &c., amongst diatoms. Thus, the *quondam* Stereonema filaments and their accompanying Uvella-like terminal clusters together form *Anthophysa Mülleri*, that is, both these portions of this curious growth are part and parcel of the same organism, though it is not easy to perceive, regarding the Uvella-like group as germs, how these would again develop a new "Stereonema" thread, giving the stipes that name as a convenient one, though, of course, as Cohn most justly states, "Stereonema," as either an algal or fungal genus, quite falls to the ground; but, on the other hand, it might, perhaps, be too hasty an assumption that all Uvellæ were but detached groups or clusters of Anthophysa.

In connection with the foregoing, and as in a measure supplementary thereto, Mr. Archer took occasion to exhibit a production seemingly not uncommon in certain localities, and which he has several times brought down to the meetings, but had never presented, as on those occasions so many other objects had pressed themselves on attention. Of this production he had not been able to find any record, though doubtless such may exist; he thought the present a good opportunity to show it to the Club on account of a possible affinity—at least, a certain amount of resemblance—to Anthophysa. This formed a much-compressed, plane, broad, more or less and indefinitely branched production, the branches plane, broad, more or less curved, divergent, gradually widening from below upwards; the ends abruptly rounded off; their surface furnished with interrupted coarse ridges, giving the whole the appearance of being formed of elongate cells; the whole structure free; colour yellowish, reddish, or brown. This production Mr. Archer had met with several times, but without being able to make anything more of it, until on one occasion, in company with Dr. Barker, who, indeed, drew attention to it, a view of a further characteristic was obtained. At the broad and tolerably sharply rounded-off extremities of the compressed branches was seen, in several instances, a subconical projection of colourless granular substance, from which was distinctly seen to emanate usually two long flagelliform cilia, which waved about in the water with much vigour. That this remarkable addition to the usual organization of this production was really part and parcel of it, and not an accidentally located foreign organism, was evidenced by the regularity with which it was seen in just the same way and in just the same situation, as well as by a kind of movement, comparable to a kind of circulation, of the contained granules of the terminal conical protuberance mentioned as bearing the cilia, somewhat downwards below the broad and expanded extremities of the branch bearing the same, as if the terminal body were not, indeed, seated on the extreme margin, but may have originated within it. But of this terminal body no definite structure could be made out; its outline externally was not very sharp; and in this state the observation rests. Perhaps further experience may throw a light upon the true nature of this curious organism. Perhaps *ad interim* a certain amount of analogy with Anthophysa may be worth keeping in mind. In the one the (*quondam*) Stereonema threads are elongate, round, and tapering; in the other the stems (so to call them) are short, compressed, broad, and expanded towards the summits; both, however, are of a brown or yellowish colour, and both bear at their summits monad-like bodies bearing flagella, in the one, however, eventually combined into groups or families—Uvella-like—in the other seemingly solitary and with one or two more drawn out flagella. Pending knowledge, however, of these two productions, more especially of the latter, no more can be said than that there exists this certain amount of analogy, an analogy which may, indeed, by no means indicate a true affinity.

Dr. J. Barker likewise exhibited the organism *Anthophysa Mülleri* under his microscope. The gathering had been made in an overflow of the river Tolka, the submerged plants presenting a reddish-brown colour from the quantity of this growth. In Dr. Barker's opinion there are two different organisms nearly allied—one the ordinary reddish-brown, nearly opaque, branching stems, which bear on their summits groups of Uvella-form buds; each of these buds has one or two flagelliform cilia; each group is very slightly attached by a considerably long, soft, gelatinous, and granulated termination of the stem. These groups become free, and are found very abundantly rolling about. These have been described by Cohn. Dr. Barker had observed also another kind, more rarely met with. It has a transparent, straight, or slightly curved stem; this stem is frequently seen in gatherings of the ordinary Anthophysa. He had noticed, also, a very active single bud, like one of the Anthophysa groups, but about three times larger; this organism seemed to possess more than one or two cilia, and to be very active; on more than one occasion he had seen this organism attached singly to the clear stem, just like the Anthophysa groups, and struggle, as it were, to get free; it was likewise attached to its stem by an interval of granular mucus, as in Anthophysa. Dr. Barker expressed his view that, as a general rule, many organisms found moving about in gatherings are the free buds of attached plants, just as certain diatoms are first attached by stems and afterwards become free.

Dr. Moore showed spiral vessels from the leaf of *Nepenthes Rafflesiana*, forming very pretty objects under the polariscope.

Dr. J. Barker showed *Staurastrum scabrum*, new to Ireland; also *S. Griffithsianum* (at least, the form which Mr. Archer was so disposed to name, and not *S. spongiosum*, as mentioned by him at a previous meeting).

January 18*th*, 1866.

Dr. Moore exhibited the prothallia of some Ferns, showing the antheridia and spermatozoids.

The Rev. E. O'Meara, A.M., showed a new Gephyria, which he proposed to name, after Professor Harvey, *G. Harveyi*, and which he characterised as follows:—Frustules much smaller than those of *G. incurvata* and *G. media*. In front view the costate margins are rounded, and elevated above the surface of the connecting zone, which is narrow, not costate; the side view is elliptical, the terminal spaces on ventral surface small, the median line indistinct; the median line absent on dorsal surface, the costæ running across the valve. Found on *Haloplegma Preissii*, from Port Fairy, Victoria.

Mr. Archer exhibited several forms of fresh-water Rhizopods, all which occurred in the same pool, indeed on one slide. These, so far as Mr. Archer could identify them, and taken in the order of the comparative frequency of their occurrence in the gathering, were *Difflugia pyriformis*, *D. corona*, *D. spiralis*, *Arcella vulgaris*, *A. aculeata*, *Euglypha alveolata*, *Gromia fluviatilis*, *Actinophrys sol*, *A. Eichornii*, and a Plagyophrys (?). As so varied an assemblage of these forms in a fresh and vigorous condition, though individually, as regards some of them, not rare, does not seem very frequently to present itself, Mr. Archer thought the present would not be without interest. It is to be regretted, indeed, that Rhizopodous creatures do not bear a transit from one house to another, spread out upon a slide, without more or less shrinking in, withdrawing their pseudopods, and ceasing to present their characteristic conditions; and this was more especially the case with the beautiful Gromia. A fresh dip from the supply of the material brought down fortunately, however, amply presented a group in good condition of the Difflugiæ and Arcellæ. Mr. Archer said it would, indeed, not well become him too hastily to put forward an opinion of his own opposed to those who had bestowed large attention upon these interesting organisms, such as Dr. Wallich or Dr. Carpenter, yet he would venture to suggest that, so far as the fresh-water forms of this group are concerned, they seem in themselves sufficiently constant to make it probable that the former writer at least was somewhat premature in the views set forth by him in the 'Annals of Natural History,' 3rd ser., vol. xiii, pp. 215 et seqq. The Difflugiæ and Arcellæ seem to turn up again and again, and apparently so far duplicates of one another that one can at least say that such a given recurring form is at least the same thing one has seen before; though it may be possible, indeed, that some assumed as distinct may be younger states of other forms, and thus that Dr. Wallich may be right in part and wrong in his too comprehensive ultimate conclusions. Between the different forms now exhibited there did not seem any puzzling nondescripts. It may be said the next adjacent pond might produce them: a gathering from another pond on the same heath was on the table, and though by no means so rich in Rhizopods, there unmistakeably were those frequent forms, *Difflugia pyriformis*, and *Arcella vulgaris*, and *A. aculeata*. But, again, it might be said a gathering from a few hundred miles away might produce them. There was on the table a gathering from Yorkshire (due to Mr. Archer's obliging correspondent, Professor Gagliardi), and in it was *Arcella vulgaris*, and *A. aculeata*, and *Euglypha alveolata*.

But the gathering now brought forward seemed to present a certain amount of interest in another point of view, and that was the number of these organisms which presented themselves "conjugated"—or, if this term, as it has been elsewhere applied, be considered a begging of the question, and as presupposing a process analogous to the phenomenon which takes place in the Conjugatæ amongst Algæ—these Rhizopods were at least coupled in pairs, and the tests in contact by their frontal openings. Now, be Carter right or wrong in the views he has published on this phenomenon, and difficult, on account of the opacity of the tests, as it is to discern what goes on during the continuance of this coupling, it cannot be a meaningless process, and, as it has been seen by so many observers, it cannot be a merely occasional, or simply casual, or accidental one. It must, indeed, point to a process important in the life-history of these creatures, and it seems most reasonable to conclude that that process is connected with reproduction, even not to speak of Carter's observations. Now, a point which deserved attention as regards the specimens at present exhibited, and which quite accorded with all observations made on the subject, was that, although the individuals were numerous, *always like form was "conjugated" or in contact with like form;* and this was true as regarded Difflugiæ, Arcellæ, or Euglyphæ respectively. Whilst, then, with his own comparatively very slender acquaintance with these organisms, Mr. Archer hoped it might not be thought undue temerity in calling in question Dr. Wallich's views as to the convertibility of these organisms, he could not but for the present dissent therefrom, and this for the two reasons set forth—first, that the same forms seem continually to present themselves; and, secondly, be the precise physiological significance of the phenomenon what it may, that like form always chooses out like form when about to "conjugate."

As regards the identification of the forms on the slide, whatever difficulty there might be in reconciling them with species as described, the same forms seemed, at least when met with, always to be like one another; yet it seemed that *D. pyriformis* could hardly be mistaken. Doubtless it sometimes appeared more globose and inflated, sometimes more elongate, sometimes with a more or less elongate neck; but still *pyriform* seems to be its characteristic. Again, as to the form, Mr. Archer would refer somewhat doubtfully to *D. corona;* it may appear paradoxical to say that no two specimens were absolutely alike, and yet, so far as the individuals from this heath, they could all at a glance be pronounced to be one and the same thing. If, indeed, this be *D. corona*, Dr. Wallich's figure is too regular and symmetrical, too diagrammatic, the adherent foreign particles too accurately adapted, and too much of one size, and the horns (so to call them) too short. But in the existent state of knowledge it would be premature to give this form a name. That these animals seem to have a power of selection of the materials wherewith to *build* their habitations is evident. *D. pyriformis* seems to use very small, tolerably regular-sized, particles; the horned form huge crags and boulders (microscopically speaking) in comparison, as well as large Pinnularia frustules, &c., and these laid on in any and every way, and projecting irregularly in every direction. Whilst the surface of the first seems somewhat evenly paved, the latter carries about a complete little *rockery*, and this, added to the different form of each, gave them a character that stamped them at once.

Again, as bearing on external distinctions, Mr. Archer's attention was first attracted to the solitary Gromia on the slide, not by its pseudopods, for they were not then visible, but, even under a low power, by its *contour*, for its opaque test had much the same colour as the Difflugiæ. Here was an egg-shaped form, its surface less rough than that of the Difflugiæ around; this was enough to attract observation. Upon the slide being laid aside for a little, however, and this egg-shaped form again examined, there were the beautiful pseudopods of this curious creature expanded to the full, to three, four, or even five times the length of the test, ramifying in every direction, and inosculated here and there, and occasionally expanded. The majority of the pseudopods projected in front, but, as in Carpenter's well-known figure, not a few radiating laterally and posteriorly, and a beautiful "circulation" going on like that of the protoplasm of the cells of the hairs of the stamens of Tradescantia. Now, here external form and external character were enough to indicate that this was, at all events, not the same thing as the Difflugiæ around; actually how *very* different has been seen. It could not be contended that Euglypha is not a different thing from Difflugia, *per se*, nor can any genetic affinity be founded on possibilities. Another curious Rhizopod in the present gathering was the Plagiophrys. Mr. Archer's only acquaintance with the genus was that afforded in Dr. Carpenter's work, for he had not Claparède's work. But at all events here was a type quite distinct, be it referred correctly or not to that genus. It did not appear to agree quite with the figure given by Carpenter; the body was elliptic, minute, and the pseudopods emanating from one spot in a kind of tuft, not distributed, and so it approached more to a Lagynis, as it were, without a test. Of the Actinophrys it is, of course, unnecessary to speak.

Now, if Dr. Wallich be right in assuming that, the animals being alike in Difflugiæ, the different forms are but the result of, and in obedience to, local conditions—how could these several distinct and varied forms, not to speak of different types of Rhizopods, be the products of identically the same circumstances and exactly the same local conditions—that is, how could one and the same cause produce several distinct results? It is argued that the tests only are different—that the animals are alike—but not more alike than the cell-contents, the analogous portion, in the different forms of Diatomaceæ (for instance), are to one another.

Again, as regards the so-called conjugation, how is it that, "the animals being the same," not only does Difflugia unite with Difflugia, and Arcella with Arcella, and Euglypha with Euglypha, but these seemingly only *specifically* with each other? It is true that Dr. Wallich alludes to an instance of this phenomenon taking place between Difflugia and another smaller one regarded as a distinct species. Now, in this present gathering, besides the very many instances of forms alike in size as well as outer characters conjugating with each other, several examples presented themselves quite like that so well figured by Wallich ('Ann. Nat. Hist.,' 3 ser., vol. xiii, pl. xvi, fig. 39); and it would seemingly never otherwise suggest itself than to look upon the smaller individual as simply but a smaller and younger individual of one and the same species. It has been said, indeed, that this process is not a conjugation or union in any sense of the word at all, but merely a budding-off—that is, that a portion of the original animal becomes simply extended through the frontal aperture, then clothing itself with a test, and afterwards separating from the first, as a distinct individual. But how is it that no intermediate stages present themselves? All the specimens in contact are of full size and figure in ninety-nine cases of a hundred, and never an unclothed or partially clothed one seems to be found united with a fully clothed one. It might, perhaps, be *à priori* thought that so lowly organized a creature could have no power of electing amongst its neighbours only another individual of its own species with which to unite. That such an idea would be too hasty, indeed, is seen when we find them able to a great extent to select the materials of their habitations. But when about to conjugate we cannot deny to them that they may be impelled by some kind of inherent attraction, species for species, when we see vegetables—Mesocarpeæ, Zygnemeæ, and Desmidieæ, finding out and conjugating with those only of their own identical species, admitting the processes in each to be analogous.—In one instance two of the Arcellæ, upon being separated, seemed to have extended between them what appeared to be a tubular plicated membrane, proceeding from the mouth of each test. The great opacity of the tests prevents an insight being gained into the internal conditions.

On the whole, therefore, while Mr. Archer would deprecate being supposed as dogmatically setting up his own views against those of a Wallich or a Carpenter, yet he thought he might venture so far as to say that their arguments, as regards the fresh-water Rhizopods only, had not yet convinced him of the total want of stability in these forms, and he thought that the considerations he here ventured to bring forward could not be regarded as devoid of significance or importance.

Mr. Yeates showed Smith and Beck's new illumination for opaque objects, in which the object-glass is made its own illuminator by reflecting the light from a lateral opening down through the object-glass.

Mr. Porte exhibited a series of slides of vegetable sections showing a variety of spiral vessels.

Dr. Moore showed a Scytonema, the same as the one sent by him to Dr. Hassall, and named by the latter *S. hibernicum*. Dr. Moore had taken this on the occasion of the Lugnaquilla excursion.

February 15th, 1866.

Dr. E. Perceval Wright brought forward a number of diatoms from Mauritius, collected by Captain Crozier, R.E. These Mr. O'Meara undertook to examine and report upon.

Mr. Archer exhibited side by side on the same slide two rare species of Staurastrum. These were *Staurastrum oligacanthum* (Bréb. in litt.) and *Staurastrum* (*Phycastrum*, *Pachyactinium*) *cristatum* (Näg.)=*Staurastrum nitidum* (Arch.). He brought them forward, however, chiefly for the purpose of drawing attention to their marked distinctions, and yet to the possibility of their being mistaken the one for the other. The first species he had seen only a very few times (see Minutes of Club of June 15th, 1865), the second only from the pool in which these specimens were found; but in this he had taken it for three or four successive years. It is not easy to bring the distinctive characters of these two forms before other observers without the specimens, but yet Mr. Archer thought no two could be more distinct. In fact, with an inch object-glass one could distinguish them, once their characteristics have been seized upon. In front view *St. cristatum* has its ends convex, the lateral extremities sub-mammillate, and the end view has the sides convex. In *St. oligacanthum* in front view the ends are flat, the lateral extremities subacute; in end view the sides concave at the middle, the angles inflated, then acute.

The Rev. E. O'Meara, A.M., showed a new Striatella found by him on a frond of *Haloplegma Preissii* from Australia. As only two other species of this genus are already known, this accession would possess an additional interest. The characters of the genus are stipitate, septate, the septa alternate, and not extending across the valve. By such peculiarities, the form under consideration would be at once recognised as a Striatella, of which genus Mr. O'Meara felt himself quite warranted in regarding it as a new species. In *Striatella unipunctata* the stipes are remarkably long; the septa rectilinear, with bead-like expansions at the distance of about ⅓rd the length of the frustule from the margin. In the form under consideration the stipes are not remarkably long; the septa are curvilinear, and curved in opposite directions in the two attached frustules; the bead-like expansions are marginal. In the front view in the centre of the upper margin there is a remarkable depression; corresponding with this on the side view there is a region with curvilinear boundaries. Besides this peculiarity, there is in the side view a remarkable difference between the present form and *S. unipunctata*, the latter being elliptico-lanceolate, the former linear-oblong. Mr. O'Meara proposed for this form the name *Striatella curviseptata*.

Mr. Vickers exhibited a fine diatom, *Eupodiscus Rodgeri*, forwarded by Mr. Stokes.

Dr. John Barker exhibited a new plan, constructed from his design, for placing a number of slides under the microscope and bringing them one by one in succession quickly under view. This consists of a large disc of wood, with a number of round openings near the circumference, of about an inch in diameter, over each of which a slide is placed and retained in its position, with the object over the aperture, by an elastic ribbon passed through some small holes in the disc. The disc itself is fastened to the stage by a piece of projecting brass-work made to fit and hold in the central opening of the stage, and projecting out beyond the stage in front, and bearing the pivot or axis adapted to the centre of the disc, and on which it revolves. This apparatus could therefore be made to follow the stage movements, and would be suitable, of course, for opaque or transparent objects. It would be very advantageous for a class, for the purpose, during a demonstration, of bringing a series of slides quickly under view.

Mr. Archer exhibited fine examples of *Amœba villosa* (Wallich), but he now drew attention to this seemingly not uncommon form, in order to show a remarkable addition to the usual characteristics of this organism. This was the presence of a large and numerous tuft of very long prolongations, commonly issuing from just beside the villous patch. These prolongations, which formed a compact bundle, were slender, linear, often as long as the ordinary length of the animal, about the middle often with a slight groove-like constriction or narrowing, their ends terminating abruptly. Seemingly nine out of ten of the specimens in this gathering possessed these appendages, giving them a very remarkable and curious appearance. Under a low power and at a hasty glance these Amœbæ appeared as if each carrying posteriorly a whole bundle of straight bacillar objects, seemingly immersed in their substance; under so low an amplification and hastily viewed, it might be thought almost like a bundle of Nitzschiæ or rigid oscillatoriaceous filaments stuck into the posterior end of the Amœba (pincushion-like) by some external foreign force, and as if as many as possible had been made to go into one spot. But upon examining these curious fasciculi under a higher power more closely, he thought it could readily be seen that they were not composed of foreign bodies either issuing from or penetrating into the Amœba, but were really linear prolongations of the sarcode itself. It was only under a higher power, say a quarter-inch, that the slight central constriction of these linear appendages could be seen. At this point one seemed prone to bend, and the animal seemed to have the power again to erect it somewhat quickly. Sometimes these prolongations were somewhat more scattered, but were always very close, mostly, indeed, as has been said, issuing in a tuft. This tuft, as has been also said, in by far the greatest number of cases occurred close beside the villous patch, but sometimes a few of these linear appendages seemed to take origin from the villous patch. Dr. Wallich, in his papers on this form ('Ann. Nat. Hist.,' 3rd ser., vol. xi, plate viii, fig. 2), draws attention to the villous patch displaying a number of short, narrow extensions, seemingly emarginate at the ends; these seem to be enlarged and prolonged villi, as it were, and do not appear the same thing as the very long appendages here drawn attention to, as the latter are very greatly longer, more rigid, and mostly coexist alongside the villous region, the latter exhibiting its ordinary appearance and condition. This observation, *quantum valeat*, seems possibly to point to a still greater differentiation of parts than has yet been observed in this remarkable form; and be the significance of these unusual appendages what it may, Mr. Archer thought the observation would not, perhaps, be without a certain amount of interest.

Mr. Archer presented, on the part of the author, Mr. C. P. Roper, his 'Catalogue of Works on the Microscope,' for which gift the thanks of the Club were voted.

Captain Crozier, R.E., at present residing at Gosport, was elected a corresponding member of the Club.

March 15th, 1866.

The Rev. E. O'Meara, A.M., exhibited *Terpsinoe musica* and *Pleurodesmium Brébisonii*, both from slides supplied by Captain Crozier, corresponding member of the Club.

Mr. Archer showed two cells of Zygnema presenting examples of the organism named *Monas parasitica*, by Cienkowski, and exhibited the figure given by that observer in Pringsheim's 'Jahrbücher für wissensch. Botanik,' Band i, t. xxiv, figs. i, ii, iii, iv, *m*, with which the present specimens seemed quite to agree. It seems, however, that the organisms referred to may, indeed, more likely be some stage of a plant allied to Chytridium near Saprolegnieæ, let opinions differ as they may as to the algal or fungal nature of that singular group.

Mr. Archer exhibited specimens of *Spirotænia parvula* (ejus) (described by him, 'Proc. Nat. Hist. Soc. Dub.,' vol. iii, p, 84, pl. ii. figs. 32—43, and 'Quart. Journ. Mic. Soc.,' n. s., Vol. II, p. 253, pl. xii, figs. 32—43), presenting the peculiarity of being suspended together into indefinitely long chains by a cylindrical mucous investment, comparable to that of *Hormospora mutabilis* (Bréb.), fresh specimens of which latter he was also fortunately able to lay on the table. He had never seen this Spirotænia, nor, indeed, any of the other species of that genus presenting this condition. When he first took this very well-marked and very minute species there were never more than two cells, as is usual in the genus, held together by a mucous coating, which two cells usually become disassociated before the next ensuing self-division of either cell takes place. Though thus held together, the so-connected chain could not, strictly speaking, be called a filament, as the cells themselves did not remain united, but were, indeed, often separated by a perceptible interval, thus unlike such forms as Hyalotheca, Sphærozosma, &c. With some, indeed, a question might arise as to the advisability of holding filamentous genera in Desmidieæ as distinct *per se* from free genera. Thus, as regards Diatomaceæ, Heiberg has already propounded the view that distinctions founded on the external conditions, or on the mode in which the cells are held more or less definitely together, in filaments or otherwise, should not be regarded as of generic value. And, as regards Desmidiæ, in this point of view, Dr. Wallich finds a filamentous Docidium and a filamentous Micrasterias in Bengal; but, on the other hand, while Desmidium might, perhaps, be regarded as representing a filamentous Staurastrum, Sphærozosma a filamentous Cosmarium, Hyalotheca also a filamentous Cosmarium or Euastrum, yet certain of these seem formed to exist as filamentous types (such as Sphærozosma, Aptogonum, and some Bengal forms), by reason of the connecting processes between the links forming fulcra of attachment. But, of course, in the Spirotænia now shown there were no uniting processes; as already said, the only bond of union being the tubular mucous investment. As the cells themselves showed no distinction whatever from the form already described, there could be no doubt but that this was *S. parvula*, and a beautifully distinct and constant form. Like most, it must be examined fresh to see its characters, with the parietal band of endochrome of one or two turns.

Mr. Crowe showed *Cosmarium curtum* (Ralfs) = *Penium curtum* (Bréb.) taken from a shallow rut in the avenue before his own door at Bray. The first occasion he had taken it was on a visit to North Wales. He had watched it for some time in its present locality, but had not found it conjugating.

Mr. Archer remarked that probably this well-marked form might turn out to be more common than we had supposed, as this situation agreed so much in character with that in which he had himself found it close to the "Dargle" gate, and which is unlike that in which Desmidieæ are usually found. Unfortunately for a protracted observation of this species as to its conjugating state, it seems to have occurred only in pools which are so shallow and so little fed with water as to be sure to become dried up with the first continuance of dry weather.

Mr. Draper showed recent specimens of Trichina from pork.

Mr. W. H. Baily exhibited a number of slides of fossil Foraminifera, collected by Mr. Joseph O'Kelly, of the Geological Survey of Ireland, at the Tajares Tile Pits, near Malaga. The following species have been determined by Professor T. Rupert Jones:

1. *Nodosaria Raphanistrum*, Linnæus.
2. „ *longiscata*, D'Orbigny.
3. *Nodosarina Raphanus*, Linn.
4. *Cristellaria arcuata*, D'Orb.
5. „ *Ariminensis*, D'Orb.
6. „ *calcar*, Linn.
7. „ *cassis*, Fichtell & Moll.
8. „ *cultrata*, Montfort.
9. „ *echinata*, D'Orb.
10. „ *Italica*, Defrance.
11. „ *ornata*, D'Orb.
12. „ *rotulata*, Lamarck.
13. *Frondicularia complanata*, Defr.
14. *Dentalina acicula*, Lam.
15. „ *communis*, D'Orb., comprising sub-varieties *D. pauperata*, *D. elegans*, *D. inornata*.
16. „ *soluta*, Reuss.

Miliolæ. { 17. *Biloculina ringens*, Lamarck.
18. *Quinquiloculina semilunum*, Lam. }

19. *Orbulina universa*, D'Orb. / *Globigerina bulloides*, D'Orb. } Known to be one and the same species. Orb. produces Globig., Prof. Jones.

20. *Planorbulina Hardingerii*, D'Orb.
21. *Polymorphina lactea*, var. *problema*, W. & J.
22. *Polystomella crispa*, Linn., var. *macella*, F. & M.
23. *Pulvinulina Schreibersii*, D'Orb.

Professor Rupert Jones remarks that "the Malaga forms of Foraminifera are almost the exact counterpart of those from the clays of the Vienna Tertiary basin. In the Mediterranean, from the shore to a depth of 100 fathoms, we have a similar group of Rhizopods, though the *Nodosariæ* and *Cristellariæ* do not approach the size of those of Malaga." ('Journal of the Geol. Soc. of London,' vol. xv, 1859, p. 600.)

Mr. Archer showed a fresh Characium, very slender, ensiform, both extremities very acute, which seemed to come nearest to *Characium tenue* (Hermann), in Rabenhorst's 'Beiträge zur näheren Kenntniss und Verbreitung der Algen,' Heft i. 1863, in a paper by Dr. Hermann, entitled "Ueber d aufgefundenen Arten des genus Characium," p

Mr. Archer showed some fine living examples of *Volvox globator*, and stated he had taken some of this beautiful organismin summer vigour and condition *every* month in 1865 since April last, and in January and March, 1866. He had not visited the pond in February, 1866, but he entertained no doubt, from getting a copious gathering in December and January, and another in March, but that he should have met it had he looked for it. He thought it seemed almost as if the history of Volvox was, so to say, inverted last year. In May, 1865, he took it in the "autumnal" state, that is, as the *quondam* "*Volvox aureus*," and then, also, specimens showing the remarkable polymorphous condition of the gonidia; and in winter he took it as vigorous and as normal, but not so abundantly, indeed, as it usually presents itself in spring or summer. As it seems to be generally held that the active motile "summer" characteristic condition of this plant does not present itself in the *winter* months, Mr. Archer thought that this notice of a fact, seemingly new in itself, might, perhaps, possess some interest.

Hackney Microscopical Soirée.

A Microscopic Scientific and Artistic Conversazione was held at Pembroke Hall, Lamb Lane, Mare Street, Hackney, (Dr. Christie having lent the hall for that purpose) in aid of the funds of the Hackney Working Men's Institute.

An appeal was made by the committee of the said institute, through Mr. W. L. Freestone and Dr. Millar, to the Council of the Microscopical Society, for their assistance and co-operation, which appeal was announced by the President to the meeting held in March last, which was most cordially responded to, and a high-class entertainment was the result, which was patronised by a considerable attendance of the first families of Hackney and Clapton, and ably supported by many distinguished members of the microscopic and other scientific societies of London; and on the first evening James Glaisher, Esq., F.R.S., was present. All the principal microscope makers were represented, viz., Messrs. Ross, Smith & Beck, Baker, Crouch, Steward, Browning, Salmon, Bailey, &c. There were shown altogether about sixty microscopes, and many works of art and articles of vertù were exhibited, several cabinet stereoscopes, a fine selection of glass slides, and also a variety of beautiful objects, living and prepared, amongst which may be mentioned—

Dr. Millar exhibited the eggs of an insect of elaborate form.

Charles Tyler, Esq., F.L.S., many interesting specimens of sponge-spiculæ, &c.

Henry Lee, Esq., F.L.S., marine zoophytes, Echinidæ, and a fine specimen of the Tsetse.

Dr. Christie, a slide of *Trichina spiralis* in human muscle, prepared by W. L. Freestone.

James Smith, Esq., F.L.S., diseased wheat, showing the presence of *Anguillula Tritici.*

W. H. Hall, Esq., a jar of the Cheirocephalus, or fairy shrimp, and many fine objects.

Mr. Crouch showed a fine preparation of Polycystina, opaque, by W. L. Freestone.

H. N. White, Esq., of Dalston, procured various electrical and galvanic batteries of Mr. Wood, Cheapside, and afforded a series of experiments.

Mr. Browning showed several spectroscopes for manifesting the presence of blood in fluid.

Dr. Millar also showed the magnesian light, tables showing waves of sound, and a fine polariscope.

John Murray, Esq., added to the interest of the evening by a piping bullfinch, and some fine bronzes to decorate the hall.

S. Helm, Esq., and four other gentlemen, all members of the Old Change Microscopic Club, showed many good objects, amongst which a micro-photographic portrait of W. L. Freestone, by Henry Davis, Esq., Cornhill; also *Volvox globator*, skin of human thumb, and the eel-like insects in vinegar.

Mr. How, of Foster Lane, lent six frames of beautiful micro-photographic objects by Dr. Maddox.

Mr. Bridgeman, of Hackney, lent some highly creditable oil paintings, copied by himself from several of the first masters.

Some good models, by a working man, were shown.

Many excellent diagrams by Drs. Carpenter and Lionel Beale were kindly lent for the occasion.

Specimens of the *Eozoon Canadense* were lent by Dr. Carpenter during each evening. The Gentlemen Amateur Band of Hackney, and some professional singers, served to cause agreeable diversion.

The funds of the institute, to benefit which this entertainment was originated, is but slightly augmented, but no doubt is entertained that considerable attention will be drawn to the institute, and that the addition of many patrons and subscribers to its funds will be the result.

The Birmingham Natural History and Microscopical Society.

MIDLAND INSTITUTE.

President—Mr. Hughes.
Vice-Presidents—Mr. Thos. Fiddian and Mr. L. Percival.

April, 1865, *to June*, 1866.

At the Microscopical Meetings of this Society held during the past and present year the following papers have been read:

1865, *April* 11th.—Dr. T. Bartleet read an instructive and interesting paper "On the Minute Anatomy of Bone." The paper entered fully into the uses, chemical constituents, physical properties, structure, and development and growth of bone, and was illustrated by numerous well-executed diagrams, and by microscopical preparations.

May 9th.—Mr. Parkes read a paper "On the Respiratory System of Insects, and its direct relation to their Nervous, Nutritive, and Muscular Functions." The structure of the air-channels was explained, and especial attention bestowed on the spiracles or breathing pores. The distribution of the air-tubes was elaborately shown. The paper was illustrated by a great number of microscopical preparations, many of them of extreme interest, by the incomparable Bourgogne.

June 13th.—Dr. Norris read a paper "On the Physiology and Minute Anatomy of Nervous Tissue." The paper was illustrated by diagrams and microscopical preparations.

Sept. 5th.—Dr. C. J. Bracey read a very elaborate and interesting paper "On the Comparative Anatomy of the Organ of Hearing." The paper was profusely illustrated by diagrams and specimens.

Oct. 10th.—Mr. F. Davis read a paper "On the Earth-worm." The paper dealt chiefly with the alimentary and circuculating systems, the reproductive system being reserved for a second paper. The paper was illustrated by diagrams.

Dec. 12th.—Mr. Thomas Fiddian read a paper "On Starch, Raphides, Chlorophylle, and Silica." In introducing the subject Mr. Fiddian observed that his object in choosing it was not because he thought he could say much that was new, but in the hope of inducing those members who are botanists, but not microscopists, to study microscopy, a most useful handmaid to botany, as it often happens that without her aid botany is powerless in her endeavours to make herself intelligible to the student. The paper was illustrated by a lithographed diagram, a copy of which was kindly presented to each member present.

1866, *Jan. 16th.*—Mr. H. Webb read a highly practical and interesting paper "On Blights." It was most profusely illustrated by diagrams, specimens, and microscopical preparations, and was followed by a most animated discussion on the potato blight, in which Messrs. Fiddian, Scott, Pumphrey, and Dr. W. Hinds, took part.

Feb. 13th.—Mr. F. Fowke read a short but able and interesting paper on the "Microscope in connection with the Natural Sciences." It was most profusely illustrated with diagrams and microscopical objects and preparations.

March 13th.—Dr. James Hinds read an able paper, illustrated by diagrams and many beautiful injected microscopic sections, "On the Comparative Anatomy of the Kidney." Some discussion followed.

May 8th.—Mr. F. Davis read a paper "On the Common Earth-worm." It was the second of a series on the same subject, was devoted to the description of the reproductive organs of the animal, and was illustrated by several finely-executed diagrams.

June 5th.—Mr. Thomas Fiddian read a paper "On the Application of Micro-photography to the illustration of Papers on Microscopy." He exhibited, on large discs, by means of the oxyhydrogen lantern, the following series of beautiful micro-photographs, from negatives, by Dr. Maddox:—Human blood, blood of newt, tracheal system of the silk-worn, spiracle of cockchafer, eye of beetle, foot of the fly, foot of the spider, tongue of the cricket, gizzard of the cricket, tongue of the bee, tongue of the wasp, tongue of the common blow-fly, proboscis of the butterfly, and many other objects of singular interest and beauty. At the close of the paper the thanks of the meeting were unanimously given to Mr. Fiddian for his most interesting paper.

On the motion of Dr. Norris, seconded by Mr. Alcock, the thanks of the Society were unanimously given to Mr. How, of London, for his kindness in sending such a variety of beautiful micro-photographs for exhibition to the Society.

During the past and present year the following papers have also been read:

1865.

April 4th.—Rev. E. Myers, "On Trilobites."
„ *18th.*—Mr. Adcock, "On the Metropolis of the Moorlands."
„ *25th.*—Mr. Bird, "On the Caster Oil Plant."
May 2nd.—Rev. E. Myers, "On the Strata examined by the Members in the Excursion, April 17th, 1865."
„ *23rd.*—Mr. L. Percival, "On the Coal-fields of South Staffordshire," 2nd paper.
„ *30th.*—Dr. Foster, "On the Study of Anthropology."
June 6th.—Mr. Thos. Fiddian, "On the Dodo."
„ *13th.*—Dr. Norris, 'On Nervous Tissue."
„ *20th.*—Mr. E. Simpson, "On a Prolific Pond on Wandsworth Common."
„ *27th.*—Mr. C. Allen and Mr. G. Percival, "On the Mollusca in the neighbourhood of Birmingham."
July 4th.—Mr. Adcock, "On the Freshwater Aquarium."
„ *11th.*—Mr. H. Webb, "On Desmidiæ and Confervoid Algæ."
„ *25th.*—Dr. James Hinds, "On the Anatomy of Bivalve Molluscs."
Aug. 1st.—Mr. G. Price, "On Noxious Insects."
„ *15th.*—Rev. E. Myers, "On the Moon."
„ *22nd.*—Mr. W. H. Prosser, "On Suggestions for the better Preservation of Birds' Eggs."
„ *29th.*—Dr. Foster, "On the Varieties of Mankind, dealing principally with the Anatomical Classification."
Oct. 3rd.—Mr. Gansby, "What is an Insect?"
„ *17th.*—Mr. D. Smith, "On Terrestrial Radiation."
„ *24th.*—Mr. Thos. Fiddian, "On a Six Weeks' Tour in Andalusia in July and August last."
„ *31st.*—Mr. Simpson, "On Special Organs of Insects."

Nov. 14*th.*—Mr. Buckley, "On the Avocet."
„ 21*st.*—Mr. Jephcott, "Notes on a Ramble in West Somersetshire during August last."
„ 28*th.*—Mr. H. S. Scallick, "On the Capture, Setting-up, and Preservation of Insects."
Dec. 5*th.*—Mr. W. Prosser, "On the Egg of the *Dinornis ingens*, lately offered for sale in London."
„ 19*th.*—Mr. Hughes, "On Pipe Fishes."
1866.
Jan. 23*rd.*—Mr. Scott, "On Birds' Nests, and their Construction."
„ 30*th.*—Mr. Bird, "On the Application of Animal Substances to Industrial Life."
Feb. 6*th.*—Mr. H. S. Scallick, "On the Various Habits of Lepidopterous Insects," 1st series.
„ 20*th.*—Mr. S. Allport, "On Encrinites."
„ 27*th.*—Mr. F. Enoch, "Upon the Breeding of Insects."
March 6*th.*—Mr. Thos. Fiddian, "On the Solitaire of François Leguet."
„ 27*th.*—Mr. E. Simpson, "On British Birds."
April 10*th.*—Mr. J. Morley and Mr. J. Pumphrey, "On a Tour in North Wales in Search of *Trichomanes radicans*."
„ 23*rd.*—Mr. Cotton, "On Moss Agates."
May 22*nd.*—Mr. H. Scallick, "On the Various Habits of Lepidopterous Insects," 2nd series.

OBITUARY.

DR. ROBERT KAYE GREVILLE, F.R.S.E.

We depart from our ordinary rule of not noticing the death of distinguished men, as those who contribute to our pages usually find a place in the annual address of the President of the Microscopical Society. In Dr. R. K. Greville, however, the world has not only lost a distinguished botanist, and a good and a great man, but we have lost a contributor whose place we cannot hope to supply, and whose contributions have been more numerous and more constant, and, we believe we may add without offending any one, more valuable, than any other papers in our pages. These papers have been entirely devoted to the Diatomaceæ, and present a series of minute and careful observations in these minute organisms such as has scarcely been presented during the same time in any other department of natural history. The illustrations of Dr. Greville's observations were all made under his own superintendence, from the beautiful and accurate drawings of his own pencil.

He was born at Bishop Auckland, in Durham, on the 13th of December, 1794. He was much interested in plants at an early age; before he was nineteen he had prepared carefully coloured drawings of upwards of 250 of the native plants. He was intended for the medical profession, and studied in Edinburgh and London; but circumstances having rendered him independent of this profession as a means of livelihood, he did not submit to an examination, and determined to devote himself to the study of botany. In 1824 the University of Glasgow conferred on him the degree of LL.D. He delivered several courses of popular lectures on zoology and botany, and formed large collections of plants and insects, which were eventually purchased by the University of Edinburgh. A change having taken place in his circumstances, he took up landscape-painting as a profession, and several of his pictures are to be seen in well-known collections. Dr. Greville took a very warm interest in many social reforms and in various schemes of Christian philanthropy; and, as in natural history, whatever subject he undertook he devoted to it all his energies and talents. He took a prominent part in the agitation against slavery in the Colonies; he was one of the four Vice-

Presidents of the great Anti-Slavery Association of all countries held in London in 1840. His published works are very numerous: amongst the most valued are the 'Flora Edinensis,' 'Scottish Cryptogamic Flora,' 'Algæ Britannicæ,' and, in conjunction with Sir W. J. Hooker, 'Icones Filicum,' besides numerous papers in various scientific journals. He was Honorary Secretary of the Botanical Society and a Fellow of the Royal Society of Edinburgh; an Honorary Member of the Royal Irish Academy, of the Imperial Academy Naturæ Curiosorum, and of the Natural History Society of Leipzig; Corresponding Member of the Natural History Societies of Paris, Cherbourg, Brussels, Philadelphia, &c.

He died at his house in Edinburgh on the 4th of June. Seldom has a naturalist retained such peculiar powers of observation to so great an age. We heard from him only a few weeks ago, promising further contributions to his latterly favorite group of organisms, the Diatomaceæ. Our present number contains a paper read at a recent meeting of the Microscopical Society of London, and another has since been received, which will be published in our next number.

ORIGINAL COMMUNICATIONS.

NOTE *on an* UNDESCRIBED SPECIES *of* ACARUS, *found in the* PIGEON, *Columba livia*. By CHARLES ROBERTSON, Demonstrator of Anatomy, Oxford.

(Communicated to the Oxford Microscopical Society, Feb. 15, 1866.)

THE parasites which I shall briefly describe are small, oval, white, maggot-like animals, distinctly visible to the naked eye, and are found chiefly amongst the connective-tissue of the skin, the large veins near the heart, and on the surface of the pericardium. When few are found they generally adhere closely to the surface of the pericardium, and to the large veins near the heart. If the veins have been previously injected with size and vermilion, the white transparent acari are seen very distinctly on their red delicate walls. All the examples which I have examined were very transparent without any trace of well-defined digestive or generative organs, even when examined with the highest powers. The body does not generally present any trace of constrictions, but in a few examples I have observed one or two faint lines, giving the body a segmented appearance, but this may be caused by a mere folding of the soft cuticle. On the anterior and inferior surface of the body a ridge extends inwards and downwards from the base of the anterior pair of legs, and unites with a median single backward ridge. A similar ridge runs in the same direction from the base of the second pair of legs; but instead of meeting, as in the first pair in the median line, are united by a transverse ridge, and a similar ridge is continued backwards from the points where this line joins those from the limbs. This arrangement reminds one of the head of the larva of a hexapod insect. No trace of palpi, mandibles, or suckers could be found. Four pairs of short, jointed legs were found in all the specimens examined; the two anterior pairs are placed close together, on the anterior and outer extremity of the body; the two posterior pairs have a considerable interval between them and the anterior pairs, and are attached to a hard sternum-like mass, situated about the middle of the body, in the median line. Each leg consists of five short joints, the terminal of which is straight, pointed, and slightly hooked. A few hairs project from the sides of the body and the outer surface of the legs. The last

Fig. 2.

Fig 1.

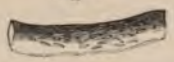


Fig. 3.

Fig. 4.

Fig.
1.—Portion of jugular vein of a pigeon, *Columba livia*, with a large number of Acari attached to its walls. Natural size.
2.—Ventral surface of Acarus. About 100 diameters.
3.—Ventral surface of the head of the same. About 400 diameters.
4.—The two posterior pairs of legs, and the sternum-like mass into which they are inserted. About 400 diameters.

joints of the legs have a considerable number of longer hairs, which come out all round the insertion of the hooked extremity.

From the above description it will be seen that this acarus agrees with sarcoptes in having a considerable interval between the second and third pairs of legs, and the absence of a furrow between them.

I have seen during last year, in the dissecting-room of the Museum, three pigeons affected with the securious parasites, one in February and two in June.* It is rather remarkable that all the examples which I have examined should have eight legs, and the other parts presenting appearances common to all. I hope shortly to meet with them in an earlier stage of development.

* I have since examined a considerable number of both the wood and the tame pigeon, and have seldom found them free from Acari.

Montagu* has described a species of acarus very similar to this, which he says is constantly found, together with the ova, in the cellular membrane of the Gannet *Pelicanus Bassanus*. It is named by Montagu *Cellularia Bassani*.

OBSERVATIONS *on the* GENERA CYLINDROCYSTIS (Meneghini), MESOTÆNIUM (Näg.), *and* SPIROTÆNIA (Bréb.) (= PALMOGLŒA, Kütz., *pro maxima parte*), *mainly induced by a paper by Dr. J. Braxton Hicks, F.R.S., F.L.S., on the Lower Forms of Algæ*.† By WILLIAM ARCHER.‡

IN a paper which I had the honour to read before this Society, in the session preceding last, on the genus Palmoglœa (Kütz.),§ I took the opportunity to bring before your notice the Irish forms of that genus, or rather those forms by which Kützing would have been referred to it, but which, as I then stated, and as I still apprehend, belong more naturally to several individually distinct but closely related genera. I gave at the same time what may be called, in some measure, an analysis of the genus Palmoglœa (Kütz.), with regard to at least the majority of the forms therein included by that algologist.

Dr. Hicks does that communication the honour of a special paper, in which he expatiates at some length on the validity of the characters which may seem available for the classification of the "unicellular" Algæ, and in doing so he touches upon some of the points alluded to by me.|| This able observer has had large experience amongst those humble forms; and I have always perused his communications with all the attention to which they are so eminently entitled, and with all the interest they are always so well calculated to excite, as well as with all the gratification their richness in novel information is sure to impart.

The paper in which Dr. Hicks does my previous one the honour of a notice abounds with observations full of im-

* 'Memoires of the Wernerian Natural History Society,' vol. i, 1808, p. 176.

† Remarks on Mr. Archer's Paper on Algæ, in 'Quarterly Journal of Microscopical Science,' N. S., Vol. XII, p. 253.

‡ Read before the Natural History Society of Dublin, May 5, 1865.

§ 'Proceedings of the Natural History Society of Dublin,' vol. v, p. 12; also 'Quarterly Journal of Microscopical Science,' N. S., Vol. IV, p. 109 (1864).

|| 'Quarterly Journal of Microscopical Science,' N. S., Vol. XII, p. 253

portance, and in it he propounds many pertinent queries. As he, however, differs with me in some of the opinions put forward in my paper, which, indeed, I do not yet see reason to change, and as I am, on the other hand, quite disposed to agree in a great measure with him on certain other points put forward by him, though not referred to by me in my previous paper, I may, perhaps, be allowed again to offer a few observations on the subject.

But I must *in limine* contend, inasmuch as my paper was not on Palmellaceæ in general, but on the genus Palmoglœa (Kütz.) in particular, that much of the reasoning and many of the questions propounded by Dr. Hicks do not therefore apply to, nor do they, I think, at all controvert, my therein-expressed views. And it is for this reason that I say I venture in some points to disagree from, and in others to agree with, Dr. Hicks; for if we conceive Palmoglœa (Kütz.), or, more properly speaking, the three genera Cylindrocystis (Meneghini), Mesotænium (Näg.), and Spirotænia (Bréb.), which, indeed, were the actual subjects of my paper, to be eliminated from the question, I think I must in a measure acquiesce in his views, though without at all consenting as yet to accept them in the aggregate.

Dr. Hicks puts forward the title of my paper—"An *Endeavour* to identify *Palmoglœa macrococca* (Kütz.)"—as, in itself, some argument for the want of stability in the Palmoglœan species. Considering this uncertainty as regards these forms as unquestionable, he would from them, as a starting-point, argue as regards Palmellaceæ generally. It is true that he attacks the independence of many of that family elsewhere on far better grounds; and it seems to me that arguments against the independence of the species of Cylindrocystis, Mesotænium, and Spirotænia, would at least be more forcible if made through the Palmellaceæ than are arguments made against the Palmellaceæ in general based upon the forms included in the three genera mentioned. For, irrespective of the question of the Palmellaceæ in general, I believe, at least as far as present knowledge goes, that these three genera seem to hold themselves quite distinct, and their species to reproduce themselves by what I must regard as a true generative act. And that I entitled my paper "An *Endeavour* to identify *Palmoglœa macrococca* (Kütz.)" seems to me not to conflict with this view, nor at all to indicate that I thought it did. If Kützing's descriptions of these forms are so scanty, and his figures so defective (I say it with all deference, and with much reverence for so indefatigable and experienced an observer)—if the diagnoses for the species given by him are but superficial, and the intrinsic and peculiar characteristics of the forms neglected—what else *could* it be but an endeavour to identify recent living examples with his? Is not, indeed, like difficulty often experienced in identifying species from descriptions, and especially if accompanied by insufficient figures, in other departments of nature, where many and more readily available characters and more tangible holdpoints present themselves, but which difficulty would probably be removed by the inspection of fresh authentic specimens? The difficulty of identifying these particular forms ranking themselves under the three genera in question with those from which Kützing wrote his descriptions does not, I apprehend, in itself speak against their individuality and distinctness; and the species themselves included in these genera are indeed, after all, but few. It is true that Kützing himself, even in regard to algæ far higher, and as to some of which an elaborate reproductive organization is now known, considered them not a *species* (I mean in the commonly understood old sense, and as Kützing himself would doubtless apply the word to the higher plants), but as merely *forms*. Yet, even in "Palmoglœa" Kützing recognises the differences from his specimens, though I think he fails to seize upon those of importance, or successfully to portray them either with his pen or pencil.

Again, Dr. Hicks seems to say, because the plant (distinct in itself, at least) which I would refer to *Palmoglœa macrococca* (Kütz.) truly belongs to Mesotænium (Näg.), one of several genera into which the genus Palmoglœa (Kütz.) should be divided, that such a circumstance in itself would seem to argue for the complete uncertainty of any of the forms included by Kützing in his genus. If we have now a more accurate knowledge of the individual forms of Kützing's genus and their intrinsic characteristics, than that distinguished algologist appears to have had when he wrote, perhaps from his not having always examined living specimens, it is surely not very wonderful that it should be necessary, or at least that it should be advisable, to redistribute certain minor groups of them, agreeing in certain common characters, into other genera. In order to illustrate this, indeed, I need but refer to the old multifarious genera, Conferva and Lichen. Because the incongruous species formerly included in these old and, as we now know, unnaturally comprehensive genera have had to be parcelled out here and there according to the special characteristics and affinities of each, notwithstanding blanks in our knowledge as regards even many of the smaller groups, it has not happened that this task has been in many respects, or on the whole, quite a hopeless one. Nor do I think, so far as I can see, that the breaking up of the species of the genus Palmoglœa which fall under Cylindrocystis, Mesotænium, and Spirotænia, has been quite unsuccessful; nor can I see how the advisability of the step can in itself be adduced as an argument as to the uncertainty of those forms, but should rather regard it as a natural consequence of their characters being happily better established; the others formerly included in Palmoglœa have to be carried elsewhere—one, I think, at least, to Chroococcaceæ; and their true nature, I quite admit, does not seem at all so well established.

Further, Dr. Hicks goes on to remark—"If by one observer the envelope of mucoid matter be taken as a specific or even generic sign—if the mode of segmentation be taken by another as of specific or generic value—if the size of the cell, or the position of the nucleus, or the mode of diffusion of the endochrome within the cell, be sufficient in the eyes of another to separate genera—if, as Mr. Archer contends, the oval shape is another important distinction—it seems to me no wonder that the difficulty acknowledged by all has arisen." These remarks are intended to be applied to the genus Palmoglœa; and I quite acquiesce with their author, that no wonder the difficulty adverted to should have arisen, when each single observer pays attention to one only of such characteristics, disregarding all the rest. The genera Cylindrocystis, Mesotænium, and Spirotænia (which are those in question), each, it is true, possesses an envelope of mucoid matter, but it indeed exists also in many Palmellaceæ, as well as Chroococcaceæ, likewise in Desmidiaceæ, &c. The transverse mode of segmentation—that is, through the shorter diameter—occurring in these genera, takes place also in Desmidiaceæ, in the elongate forms of Palmellaceæ, as well as of Chroococcaceæ. The oval shape, too, is shared by the forms in question with several other forms in both those families. The size of the cell likewise varies in these plants, within certain limits, in the same species. The nucleus is very hard to be made out—indeed, I doubt if it is always to be perceived or existent even in Palmellaceæ. Nevertheless, I hold that the forms in question are abundantly distinct; and that, when the eye becomes familiarised with them, they can be at once recognised. It is, of course, here as elsewhere, on the special characters possessed in common by certain groups of the species, combined with certain of the foregoing general characters, and not upon any one or more of the general chaaacters, as suggested by Dr. Hicks, that we must rely as of generic value, and on the ultimate individual proper characteristics of the forms themselves as of specific importance. The special characters, which, as I think, here determine the genera, exist in the peculiar arrangement of the contents, combined with certain of the general characters previously alluded to; whilst I believe the specific characters reside in the peculiar form of the cell, and in minor differences in the arrangement of the contents, and in difference of colour, &c., perceptible to the unassisted eye in the general mass or stratum.

Again, Dr. Hicks seems to convey, because of the difficulty (for the reasons before stated) of assigning some of these forms to the particular ones described under Palmoglœa by Kützing, and from there having been actually (as I conceive) included under that common generic denomination five diverse types, that therefore "no one algologist can tell distinctly what is a Palmoglœa, so as to be understood by any other algologist." I venture deferentially to deprecate this, as it appears to me much too hasty a conclusion. I must, in reply, urge that if many of the now well-established species formerly comprehended under the old incongruous genus Conferva were still referred to under the original designations, and recent researches upon the forms alluded to momentarily forgotten or ignored, that it is still more probable no one algologist could, under such circumstances, tell what was meant by another algologist. But if our plants be closely examined from their living examples, and de Bary's descriptions and figures thereof carefully studied by any two algologists, I hardly think there will be any difficulty between them in understanding what the other means when he refers to a Cylindrosystis, a Mesotænium, or a Spirotænia.

Dr. Hicks does not see how I can find sufficient ground to state that the condition of a developing lichen figured by him is not a "macrococca"—that is, as I am disposed to think more correctly designated, an example of *Mesotænium chlamydosporum* (de Bary). I judge from the figure; and I think, as I stated, because it seems to me, so far as I may venture to judge, to represent something at once sufficiently unlike both the form with which I am acquainted, as well as Kützing's description and figures of his *P. macrococca*, as to justify me in that assumption.

Again, as if it were to a certain extent evidence of the total instability of these forms, Dr. Hicks alludes to my being by no means certain what he means by *Palmoglœa Brébissonii*, because I questioned whether the plant he has in view as *Palmoglœa macrococca* is the same as *Palmella cylindrospora* (Bréb.), considered by Mr. Ralfs as equivalent to his *Penium Brebissonii,* and of which Dr. Hicks writes:—"So far as can be ascertained, Mr. Thwaites calls *Coccochloris Brebissonii,* although Mr. Archer thinks he means *Trichodictyon rupestre* (Kütz.); the exact characters of this form, it will thus be seen, are by no means settled by any one of these observers." Dr. Hicks writes, indeed, "this form;" but the supposed confusion is partly accounted for by the fact, that there are two distinct forms referred to under the foregoing names, and two forms which, as I hold, when once seen cannot readily again be confounded; for, even though the characters assigned to each should not be found presenting themselves in every specimen with absolutely unmistakeable clearness, that is, if unhealthy or deteriorated specimens should again come under consideration—yet I believe a certain *tout ensemble* will, even under such circumstances, readily satisfy the eye familiarized with their appearance in their ordinary and healthy condition of their distinctness *inter se.* The plants adverted to under the names quoted by Dr. Hicks, but adopting here the names which I regard as the correct ones, are *Cylindrocystis Brebissonii,* Meneghini, and *Cylindrocystis crassa,* de Bary. Dr. Hicks, indeed, says, as I have quoted, that "the exact characters are by no means settled by any one of these observers." I may venture to refer to my own previous efforts to describe their generic characters, and I can only appeal therefrom directly to the fresh specimens themselves.

Dr. Hicks writes that—"The question, first of all, arises, how is a single cell to be distinguished from another single cell? What reliable characters are to be fixed upon which can be considered as of generic value?" If he propounds these questions as regards the old genus Palmoglœa, or rather as regards the three genera already quoted, I should have ventured to think that my previous paper was an answer in anticipation. Though in a diffuse way indeed, I think the descriptions there given may be found to contain the characters enabling an observer to decide to which, *if* to any, of the three genera, Cylindrocystis, Mesotænium, and Spirotænia, a single cell belongs. Dr. Hicks asks—"How can we tell whether it be a fixed form, a separate entity, or merely a transitional form of some other growth?" Again I venture to reply, if this question be put as regards the forms immediately under consideration, that I should be disposed to say (so far, I think, as our present knowledge goes), that a sufficient answer is, that they each reproduce their like by a conjugative act, thus renewing the species. For, inasmuch as conjugation must be looked upon as a true generative act, as I regard it, we must suppose that this takes place when the plant has reached the end of its existence, and has arrived at the ultimate stage in its history—that is when it is at maturity—each of the conjugating pair of cells surrendering individual existence in giving origin, by the union of their contents, to the spore from which is to be evolved the primordial individuals of the next generation.

And this leads to an important point in the argument, bearing on the difference of opinion between Dr. Hicks and myself on the matter immediately in question—I mean, the value or import to be attributed to the conjugative act, as to which point I feel bound altogether to agree with Professor de Bary.*

Dr. Hicks considers it "merely an act of fusion"—that is certaily a brief but true definition of the simple act in itself; but it is not the *modus operandi* of the mere act that is in dispute, but the physiological significance or import of that act. From his saying that is "*merely* an act of fusion, not of impregnation,"† I infer that he conceives that it has no special significancy. But can a phenomenon which has been going on for years and years uncountable, since Conjugate were—restricted, with a few exceptions, as it is, to the group so denominated, and the Diatomaceæ—be simply accidental, and quite devoid of all significancy? I cannot believe it reasonable to suppose that it should be so.

I believe that the phenomenon of conjugation can be regarded as nothing less than an indication of a distinction between germ-cell and sperm-cell, the humblest manifestation (it may be) of a difference of sex, which becomes by degrees more and more forcibly pronounced in the higher organisms, yet in none more firmly established, nor more conclusively settled, and that by direct observation, than in some of the lower Algæ, which, by reason of their simple structure, range themselves (along with the Conjugatæ) in the group of Confervoideæ. It may be urged, indeed, that the conjugating cells show no so great differentiation either in organization, dimensions, or appearance, as do the spermatozoids of those Algæ in which they have been discovered, from the germ-cells which it is their function to fertilize. This to a large extent is granted; but, nevertheless, a certain amount of specialization of certain conjugating cells in some forms does occur, pointing to something more than a mere fusion, without any significance. Indeed, the conditions which accompany

* 'Untersuchungen über die Familie der Conjugaten.'

† 'Quarterly Journal of Microscopical Science,' N. S., Vol. I, p. 18.

conjugation in the different forms present a series, in their way, almost as varied as do the germ-cells and spermatozoids of other Algæ—not so pronounced, it is true, but still pointing, I think, to an analogy.

It will be proper, in pursuance of the argument, to advert to some of the varied examples; but, in the first place, it will be advisable briefly to draw attention to certain cases where a true fertilisation has been proved in other families, and then to compare that act and its results with some of the Conjugatæ.

In Vaucheria there exists a large globose germ-cell, and exceedingly minute, very numerous elongate spermatozoids, both elements of the fructification originating in neighbouring specially formed branches of the tubular filament, these not distinguishable at their first commencement from one another, or, indeed, from ordinary branches, though afterwards so highly differentiated. Here the difference in form and size between the germ- and sperm-cell is very great, and the resultant spore developes directly into a new plant. The difference of opinion between observers (Karsten,* Pringsheim,† Dippel‡) as to the *modus operandi* of the fertilisation in this genus does not seem to bear on the immediate question; for, whether the "hornlets" (antheridia) actually inosculate with the openings of the oogonia or not, the essential circumstance seems to be the union of the contents of the two organs. I certainly never have encountered any Vaucheria in which any such inosculation of the two organs seemed to exist, and Pringsheim's account appears to be the most trustworthy.

Again, in Sphæroplea the cell-contents of the very long ordinary joint of a particular filament become broken up into a number of rounded germ-cells; and the contents of another ordinary joint become broken up into an innumerable number of little biciliated subfusiform spermatozoids, which latter find their way out of their parent-cell, and into the cavity of the joint which contains the germ-cells, through lateral openings in each. The fertilised oospore eventually developes two coats, the outer beset with spine-like extensions. Here the difference in size and appearance between the germ- and sperm-cells is less than in Vaucheria, whilst the resemblance of the parent-cells in which they originate is still greater,

* Karsten, in 'Botanische Zeitung,' x, p. 85 (1852).

† Pringsheim, in 'Berichte der Berl. Akademie.'

‡ Dippel, "Ueber der Fortpflanzung der Vaucheria sessilis," in 'Flora,' 1856, pp. 481, 497.

being, in fact, but two ordinary, in no way previously specialised, joints of the filament.*

In Œdogonium, varied as are the conditions between monœcious, gynandrosporous, and diœcious, under which the essential elements concerned in the reproduction present themselves, there seems to be still less difference, on the whole, in form and size of the spermatozoid and the oogonium themselves, than in the other cases adverted to.

In *Œdogonium curvum* but one spermatozoid is formed in each antheridium-cell, and, like the oospore, it is globular; and although there is a considerable difference in size between the two, in this respect they much more nearly approach than in the previously cited cases; that is, though, of course, equally physiologically distinct, they are more nearly morphologically equivalent. In Œdogonium Cleve has shown that the oospore in germination produces, by segmentation of its contents, four daughter-cells, which become ciliated, and swim away as zoospores to reproduce the species;† while for Bulbochæte, whose fructification is gynandrosporous, Pringsheim had previously shown that here also four daughter-cells are developed from the oospores, which become zoospores, and reproduce the plant.‡

These, then, are unquestioned and unquestionable instances of a true generative act. It would be useless, as regards the subject under consideration, to travel out of Confervoidæ for further illustrative cases where a true reproduction is effected by spermatozoids and oospores, because we should be unnecessarily receding in the system from Conjugatæ.

Now, in the cases which I have just so briefly alluded to, more or less varied as may be the accompanying conditions, simple or complex, or more or less specialised as may be the accessory organization, the one pervading essential circumstance in the phenomenon beyond doubt seems to be the material union, the flowing into one, the simple fusion, of at least two primordial cells.

Now, what *less* than this is the act of conjugation in our Cylindrocystis and Mesotænium?

It may be, perhaps, answered that neither of the two conjugating cells is ciliated, and that they are apparently mor-

* Cohn, 'Berichte der Berl. Akad.,' 1855; also 'Ann. des Sciences Naturelles,' 4 ser., vi. p. 187; and 'Ann. Nat. Hist.,' 2 ser., vii. p. 81.

† Cleve, "Iakttagelser öfver den hvilande Œdogoniums-sporens utveckling," in 'Ofversigt af Kongl. Vetenskabs Akademiens Forhandlingar,' Stockholm, 1863, p. 247.

‡ Pringsheim, "Beiträge zur Morphologie und Systematik der Algen," in 'Jahrbücher für wissenschaftliche Botanik,' Band i, p. 55.

phologically equivalent—that two cells only co-operate, whilst many spermatozoids may take a share in the fertilisation of a single oospore. I can only say that these objections refer to conditions which seem to be in a measure accidental, and unessential in a physiological point of view. The mechanism of conjugation, if I may so express myself, does not require the special organization on the part of the primordial cells engaged in the act, which are found in Vaucheria, Sphæroplea, some Œdogonia, &c. In these greater or less numbers of ciliated spermatozoids are produced—ciliated, probably, because they have a distance to travel—often in multitudes, to insure that some may ultimately find their way to the oospore; whereas in the Conjugatæ two cells about to conjugate lie side by side, and are mostly joined by an intervening canal, formed by the walls of the parent cells, through which the protoplasmic contents are guided, and pass over by means of their own innate contractility, when acted upon by the marvellous impulse to coalesce the one with the other. Again, as to but two primordial cells co-operating in the act of conjugation, whilst many (the spermatozoids) may unite with one (the oospore) in the other cases cited, the mechanism of conjugation, if no other reason, places a bar to this. I have, indeed, in such free forms of Conjugatæ as Closterium and Staurastrum, seen three individuals conjugated, forming a single zygospore—nay, it sometimes happens in Zygnema that the lateral processes of two joints inosculate with a single joint of a neighbouring filament, three cells thus co-operating in the conjugation. These, however, are quite exceptional, perhaps even abnormal, cases. But this argument, even if adduced, I should regard as quite groundless, as it is, I presume, quite physiologically possible that one spermatozoid might fertilise one germ-cell. Nay, even supposing that it always required the united co-operation of several spermatozoids to fertilise one germ-cell of so much greater volume than one of themselves, might it not be supposed that, by reason of the more nearly or altogether equivalent volume of the two conjugating cells, the force or potency would be sufficient without the co-operation of a greater number, not to speak of the mechanical impossibility in most cases, or of the unnatural dimensions which a zygospore must assume, if formed by the union of a number of so comparatively large ordinary cells?

But, even though it be reiteration of already known facts, in pursuance of our argument, it will be well momentarily to carry on our examination of the phenomenon of conjugation from Cylindrocystis and Mesotænium into other genera of the family, and briefly to trace some of the modifications displayed, and to consider how far they bear upon the question. In these we find a certain greater or less amount of complexity in the conditions contemporaneous with, and subsequent to, the act, which are so constant in their recurrence as, I think, strongly to evidence, when we consider it, that the phenomenon is by no means casual or insignificant.

In the first place, in our genus Mesotænium the process of conjugation takes place by a protrusion and simple fusion of the primordial utricles and contents of each pair of cells, the parent-cell-wall slipping off in the act, and becoming discarded, and finally dissolved. The conjugating cells lie in a great variety of positions, and the different zygospores are, of course, at first of very varying outlines; but eventually they assume externally a subquadrate or elliptic figure, and a proper cell-wall. Again, in Cylindrocystis mutual lateral processes of the two conjugating cells are put forth, which inosculate, permitting the fusion of the cell-contents of each. The isthmus between the two gradually grows wider, until the zygospore, from a form somewhat like an H or an X, by-and-by assumes a subquadrate outline; eventually, the walls of the parent-cells giving way at their suture, and becoming by degrees thrown off, the zygospores having acquired a proper cell-wall. In neither genus does the zygospore bear spines. In the germination of the zygospore, in both genera, there are developed four daughter-cells, each of which becomes the primordial individual of a new cycle, thus reproducing the species.

Now, these cases—those of the plants in question, which I have thus so briefly alluded to—seem to present the simplest conditions in which the phenomenon of conjugation occurs. Here the contents of two cells, seemingly morphologically equivalent, and apparently of similar value, become fused into one, outside either parent cell; and it is at least noteworthy that the first result of the fusion of the two distinct primordial cells, as, indeed, in all cases of conjugation, is the formation of a new cellulose wall round each zygospore produced by the act; and this is precisely what takes place when the oospore in Vaucheria, Œdogonium, Sphæroplea, &c., becomes fertilised by the spermatozoids. Likewise, the circumstance of the zygospore of Cylindrocystis and Mesotænium producing in germination four daughter-cells has its analogy in the same behaviour in the germination of the oospore of Œdogonium and Bulbochæte—which fact thus, so far as it goes, seems to point to the conclusion that in each they are the result of a similar act. The daughter-cells, or primary cells of the following generation, however, in each differ in what I should but regard as a secondary and unessential circumstance, in that in Œdogonium and Bulbochæte they are for a time motile, whilst in the parallel degree of development of the spore of Cylindrocystis and Mesotænium they are, as always, still.

Examples of conditions nearly as simple are presented by many Desmidiaceæ, but also conditions more complex are met with in various species, to enter into detail here as to which would, however, be superfluous. Many of the zygospores become, as is well known, furnished with variously fashioned spine and processes, which circumstance seems to me probably to find a parallel in the less developed ones of *Œdogonium echinospermum*. As is well known, very varied conditions are to be met with appertaining to, and characteristic of, various species. Thus, the spinous or non-spinous zygospores—the simple or variously branched spines—the orbicular, or quadrate, or characteristically lobed figure of the zygospore—the relative positions of the conjugating pairs of individuals—the, so to say, double spore of *Closterium lineatum*—the conjugation following immediately on self-division in *Closterium Ehrenbergii*, *C. Pritchardianum*—the complete and persistent fusion of the parent-membrane in *Hyalotheca dissiliens*, *Closterium parvulum*—the remote outer coat of the spore of *Tetmemorus lævis*, &c., besides minor specialities of detail proper to the various forms—all these can hardly be considered as the accompaniments of an accidental phenomenon, in itself meaning nothing, and destitute of significancy.

But, in pursuing onward our examination of the conjugative process and its results, the behaviour in *Didymoprium Grevillii*, in which species, of two conjugating filaments, the cells of one are always the receiving, those of the other the giving, cells in the conjugative act, leads us to Spirogyra, in which these conditions are constant. In this latter genus the receiving cell frequently assumes an enlarged and different figure, often preparatory to, and in anticipation of, the accession of the contents of the giving cell, thus, I think, exhibiting a certain significant amount of differentiation.

In Spirogyra and Zygnema, as is well known, the act of germination consists in the inner coat of the zygospore expanding and bursting off the outer, and, while extending in length, becoming transversely divided by a septum, the lower cell remaining always undivided as a "root-cell," the upper becoming the first ordinary joint of the new plant, thus differing from Cylindrocystis and Mesotænium. But in this characteristic we have to some extent an analogy in Vaucheria, whose fertilised oospore does not develop daughter-cells, each to give origin to so many new individuals, but grows at once into a single new plant, unicellular, of course, like its parent.

But, notwithstanding all these so varied, more or less complex conditions, it may, perhaps, be still urged that, after all, such conjugation is but the union of the contents of two morphologically equivalent cells.

To this objection the conditions in the genus Sirogonium seem to afford a valid answer.

Two ordinary joints of a filament in Sirogonium mutually send out short processes, as in Spirogyra, which become united; thereupon there ensues the formation of a septum (similarly to that of the vegetative cell) in each of these united cells. In one this septum, however, unlike the septum of a simply vegetating cell, divides the mother-cell into two very unequal daughter-cells, the larger of which becomes externally expanded. This larger expanded daughter-cell is that one which bears the extension joining it to the other opposite conjugating cell, and is constantly the *receiving* cell—that is, the one ultimately to contain the zygospore. Its sister-cell—the smaller one—remains sterile, being shut off from parcipating in the conjugation. The other opposite conjugating cell also becomes divided by a septum into two daughter-cells, a short and a long one; but in this instance it is the shorter daughter-cell to which the extension joining it to the other conjugating cell belongs, and this cell is in conjugation constantly the *giving* cell; its sister-cell—the larger one—remains sterile, being shut off from participating in the conjugation. The shorter or giving cell is itself sometimes again divided into two, one of which daughter-cells is shut off from participating in the conjugation. Speedily the contents of the two connected cells become increased in quantity and density, so as more nearly to fill the cells, quite unlike the sparse, pale (yellowish-green), and narrow irregular bands formed by the endochrome of the simply vegetative cells. The contents of the two conjugated cells now become contracted from the cell-wall; the intervening septum of the tubular inosculated connecting processes becomes resorbed; the contents of the smaller of the two passes over, as in Spirogyra, and becomes formed, within that of the other, incorporating with its contents, into a zygospore.

Here, then, is a conjugation between two cells of *not* morphologically equivalent, but which are evidently specialised structures. Here the giving and receiving cells seem to be as morphologically distinct as in *Œdogonium curvum*, in which the antheridial cell gives birth to a single spermatozoid not much smaller than the oospore, the main distinctive circumstance being, that in the latter the fertilising cell is ciliated, making its exit from one, and its entrance into the other, parent-cell by an opening in each, whilst in the former neither is ciliated; and, besides, the parent-cells being apart in the one, and joined together by firm inosculation in the other.

It being admitted, then, that this case is one of a true generative process, the reproductive elements being seemingly well differentiated as germ-cell and sperm-cell, the transition downwards through the various forms of Conjugatæ is easy and natural to our Mesotænium and Cylindrocystis; and it seems to compel the admission that the process in all is a manifestation of one and the same phenomenon, with one and the same import.

But it may be further objected, that in many of the Conjugatæ spores or spore-like bodies very similar to the true zygospores, and from which young plants may be developed, are formed without any conjugation at all. However, it seems to me that these bodies may bear a relationship to the ordinary zygospores, the same as that of the ordinary zoospore of Œdogonium and Bulbochæte to the four zoospores evolved from the fertilised oospore; and both bear to the plants which produce them an analogy similar to that of the buds, bulbils, &c., of higher plants to their seeds. As to the so-called "Asteridia" (Thwaites), "Asterophæria," "Spermatosphæria" (Itzigsohn), &c., they are most probably parasitic growths, and their true nature is as yet not at all understood.

But Dr. Hicks intends his queries, first applied to Palmoglœa, to be extended to certain true Palmellacean forms; and, if applied to some of the lower forms of which, I am free to own that they cannot be so easily answered, nor can his objections be so readily met.

There is a point, however, which seems to be overlooked by Dr. Hicks, and a consequent confounding of two apparently essentially distinct groups fallen into. Dr. Hicks seems to ignore the Family Chroococcaceæ as distinguished from Palmellaceæ; thus, forms appertaining to Chroococcaceæ are sometimes, as it appears to me, indiscriminately spoken of as originating from some higher plant, whose endochrome is chlorophll, and *vice versâ* as regards Palmellaceæ. Now, in so far as we know, it seems a matter not at all to be expected that such a transformation should take place; that is, I should be disposed to hold it exceedingly unlike that a chlorophyll-bearing lichen or moss should produce a phycochrome-bearing Glœocapsa, and that, too, along with a chlorophyll-bearing Palmoglœa. Thus, *Glœocapsa polydermatica* surely belongs to Choococcaceæ, and could not be regarded as proceeding from a chlorophyll-bearing lichen. A Glœocapsa-form may possibly originate from a phycochrome-bearing lichen—for instance, a collema; and I venture to think that in many cases where Dr. Hicks speaks of Palmellaceæ he means to refer to Chroococcaceæ. Many of the forms included amongst the latter, I am myself disposed to think, show a considerable amount of instability, and may probably be but transitory or developmental stages of higher plants. But then they must, I think, at least owe their origin to phycochrome-containing plants—some, for instance may be early stages of Scytonemeæ. On the other hand, many of the forms seem to be very recognisable, and are frequently met with, season after season, precisely like their predecessors, and under the same circumstances; and one can often at a glance tell that a certain form under observation is exactly the same thing that one has seen before. But this would not in itself be an argument that they may not be, so to speak, if the phrase be at all admissible, "alternations of generation" of certain Lichens or of Scytonemeæ. In regard to Palmellaceæ, such genera as Pleurococcus, Glœocystis, and Palmella, if they are all actually but developmental stages of higher forms, could at least originate only from chlorophyll-bearing plants.

But, further, on the other hand, many of the Palmellacean genera produce a very definite structure, even what may be called a frond, and sometimes very definite forms of the individual cells themselves. So readily do these specialities strike the eye when once they have been seen, that on their recurrence they are at once recognisable. The generic names Apiocystis, Schizochlamys, Palmodactylon, Tetraspora, Monostroma (Ulva in part), Dictyosphærium, Oocardium, Hormospora, Nephrocytium, Mischococcus, Ankistrodesmus (Rhaphidium), Polyedrium, Cystococcus, Dactylococcus, Characium, Ophiocytium, Scenedesmus, Pediastrum, Cœlastrum, Sorastrum, Eremosphæra, and many more, all call to mind, in a moment, forms which, some rarely, some frequently, present themselves to notice, and maintaining their characteristics, while at the same time no true generative process has been discovered, reproducing themselves by diverse modes of cell-division, by zoospores, by "brood-families," &c. They are also found maintaining their characters in various places; and I think it is not readily conceivable what varied accidental concatenation of circumstances could, in so diverse localities, force a certain supposed gonidium of a lichen or spore of a moss now to develop into this well-defined form, now into that. Therefore, if, on the one hand, such genera, perhaps, as Chroococcus, Glœocapsa, Synechococcus, Glœothece (in Chroococcaceæ) and Pleurococcus, Glœocystis and Palmella (in Palmellaceæ), seem, from Dr. Hicks's researches, to be in jeopardy, it surely appears to me as yet, not to speak of our Cylindrocystis, Mesotænium, and Spirotænia, that it would be an incautious and too hasty conclusion to sweep away all "Palmellaceæ." Mere resemblance is not necessarily identity.

Dr. Hicks puts some queries as to the value of certain characters of cells, as affording clues to their affinities—that is, as to their use in a classification. Certainly no one character can in any case be regarded as decisive, nor is such to be expected. A combination of all, however, makes up a certain *tout ensemble*, which often tells us that it is, at least, the same form or phase of development one has seen before.

Size of the cells? It, no doubt, varies within certain, often characteristic, limits.

Position of nucleus? or of a starch-granule or a "vesicle"? The former is seldem discernible, and it can, on that account, rarely be of use; the latter, how constant and characteristic in certain Desmidians, and many other Confervoids.

Disposition of chlorophyll? This is in certain stages of very many forms a most useful character, *e.g.* Hormospora, Ophiocytium, Conjugatæ at large, &c. &c. Dr. Hicks, indeed, supposes the case of "Zygnema" (properly Spirogyra), in which the contents in conjugating lose their spiral arrangement, and become "homogeneous;" and then he says—"Supposing subdivision to take place, the contents of the resulting cells would become more or less homogeneous, and thus the spiral character lost." But this is not what takes place. The spore casts off its outer coat, and the inner one elongates, of which, upon dividing the upper cell, becomes the first ordinary joint of a new filament, and the spiral arrangement of the chlorophyll is resumed, the lower remaining undivided as a "root-cell." There is, indeed, more of a characteristic uniformity in the disposition of the phycochrome in the Chroococcaceæ.

Form of the cell? This is surely in many instances of the greatest value. Dr. Hicks points to the plate illustrating my own former paper as an example of the instability of this character. But I hardly think it is a conclusive argument against the value of this character to regard a plant in the varying phases of its development, and say that, because such differ, that *form* is of no value. The phases of growth should be taken, and the comparison made, at the same point in development; for very varied phases may certainly intervene, nor does this latter fact seem to me to conflict with my view. The zygospore of *Penium Mooreanum* figured on the plate referred to, or indeed that of any other Desmid or Conjugate, or that exceptional phase of Mesotænium, or the oospore of an Œdogonium, or even the zoospore of a Cladophora or of a Drapernaldia, &c., are not more unlike, after all, to their parent or mature forms than an acorn is unlike an oak.

Dr. Hicks further writes—"The varying forms of their divisions show that their form changes very strangely. This is observable in almost every Conferva, and the Desmidieæ are good examples." I do not quite comprehend this. If a cell of a Conferva or a Desmid during division is not actually of the same figure as one fully grown, surely it attains it when the process is completed. If he means that a Conferva or a Desmid during the act of division is able to change directly from one form to another, I hold that this is wrong, and that there is no foundation for such an assumption. Nay, "the varying forms of their divisions" seem rather in themselves to afford more or less useful characters.

To pass on briefly to consider the communication from Dr. Wallich which I have just had the honour to read to the Society (*vide infrà*), he, while contending for the greater or less instability of the Protophyta, the Desmidieæ included, does not, however, make such a demand as that just adverted to. I shall, as the opportunity here occurs, venture to add a word or two in allusion to Dr. Wallich's communication, referring mainly, as it does, to certain Desmidian forms. I have, indeed, ere now endeavoured to express my own views as fully as I could on this point; therefore I shall not here attempt to dilate at any length on the subject, as it would be but repetition.

In the first place, then, Dr. Wallich alludes to my urging the persistence of type in the Desmidiaceæ, because they are more or less constant in a given locality. On the other hand, he urges that, unless these characters are found to occur under every variety of conditions, he cannot accept them as evidence of the persistence of type for which I have contended. Now, it seems, at first sight, that it is asking somewhat too much to demand that every variety of conditions should produce no effect, when it is only under certain conditions that some forms are found at all. But he explains that by "every variety of conditions" he means "in widely remote localities." It will be admitted, I think, that the West, Centre, and North of Europe are widely remote localities; yet from these far-apart sources the same Desmidian forms have been collected, maintaining their special characters. In his lately published list of Desmidiaceæ collected in Sweden, Cleve,* while he truly enough says the specific distinctions are often founded on minute differences, states that he never found any difficulty in identifying the forms he met with with those of other countries by aid of dried specimens and figures, and he enumerates a goodly catalogue. I myself have seen some examples from other parts of Europe. Nay, I may appeal to Dr. Wallich's paper on Desmidiaceæ collected in Bengal,† where he recognises, and is able to name from their own special inherent intrinsic characters, several of the species belonging to Britain; thus, not only from still more widely remote localities, but under circumstances of climate greatly varying from that in which the same species occur here. It is true that, in regard to several of the forms which I should be disposed to regard as abundantly distinct, Dr. Wallich would often combine several of such into a single species, under a common specific designation; but yet this does not militate against this part of my argument, for he was still able to identify the forms by their intrinsic characters there as here, although he holds a different view from that which I have hitherto found myself compelled to adopt, as to the value of those characters.

Dr. Wallich thinks, "that in these forms such differences as the number of indentations, the acuteness or obtuseness of the teeth, the number of spinous processes, and so forth, indicate mere accidental variations." But these very characters, thus succinctly recapitulated, according to the degree and mode in which they are presented, are amongst the most available holdpoints for the discrimination, not of species alone, but also of genera. In what does a Micrasterias differ from a Euastrum, a Staurastrum from a Cosmarium, &c. &c., but in the mode and way, the degree and extent, in which these characters, and characters such as these, are presented—not to speak of the various forms within those genera which Dr. Wallich goes so far as to allow are really good species. Dr. Wallich, for instance, calls such forms as

* Cleve, "Bidrag till Kännedomen om Sveriges söttvattensalger af familjen Desmidieæ," in 'Öfversigt af Kongl. Ventenskaps-Akademiens Förhandlingar;' Stockholm, 1865, p. 481.

† 'Annals of Nat. Hist.,' 3rd ser., vol. v, pp. 184, 273.

Micrasterias rotata and *M. denticulata*—*Euastrum didelta* and *E. ansatum*—as in each case but varieties of a single species, &c. Why admit certain denticulations, and incisions, and processes, and lobes, in these forms to be good specific marks, and then arbitrarily stop short, and disallow other characters of the same nature possessed by one of the disputed forms, and not by the other, and which each refuses to lend to the other, and say they are of no value—although, so far as we know, the species depending on them can be recognised wherever the two forms are found in various countries of Europe and in Bengal?

Dr. Wallich believes that "such differences indicate mere accidental varieties, handed down, no doubt, from parents to progeny in the same locality, so long as physical conditions remain the same." If certain external physical conditions be the cause of such minor individual characters, and if dissimilar conditions will cause their obliteration or transference, how is it that, under all conditions in which *Micrasterias rotata* and *M. denticulata* (for instance) present themselves, they maintain, at least so far as we know, their own ultimate characters? With us here they are both about equally common in their own localities. It is clear that the greater number of subdivisions of the former, its larger middle lobe, its more acute teeth, its greater size, &c., give it no advantage over the latter in the "struggle for life," although both have the preponderance in numbers (in whatever the advantage may consist) over certain other well-marked allied forms. I think it seems to follow, from Dr. Wallich's statement of his views, that "natural selection" must in his opinion fall into the background so far as these organisms are concerned; for, according to him, characters derived from parents, however seemingly inherent here, must at once succumb to varying surrounding physical conditions.

Dr. Wallich says that the *onus probandi*, as regards that side of the question against which I contend, does not lie with those who think with him; but "that it is sufficient to show a fair number of cases (as, for instance, in the genus Micrasterias) in which unquestionable interchange of those characters is to be met with, which by Ralfs and others have been seized upon as indicative of a distinct origin." Dr. Wallich will, I hope, excuse me if I still hold that such cases have not yet been shown in the established species of Micrasterias; and that those "interchanges of characters" are founded upon assumption of what it is presumed *might be*, rather than what *is*. I venture to hold still that the interchange of characters between the various sp[...] of

Micrasterias (I do not, I need hardly say, restrict myself to that genus, but rather mention it as an example) has yet to be demonstrated. I venture likewise as yet to hold that the admission of some forms as species, and others not less well marked as varieties, in this family (I do not now, of course, refer to Protophyta in general), is, on the whole, altogether arbitrary; and I for one cannot refuse to go the length that Nature seems to me here to go, and admit as species all those ultimate forms which seem to be constantly distinct, keeping their ultimate characters to themselves; and each of which, by its own idiosyncrasies, one can at a glance perceive is the very same identical plant which, described or undescribed, one encounters more or less rarely or frequently in its own suitable localities.

It will thus be seen, while I venture very deferentially, and with the highest respect, to differ on points in relation to some Protophyta from Dr. Hicks and Dr. Wallich, that there are others on which I cannot but agree as yet with both observers. Nor does it seem to me that the views here put forward conflict with those I ventured to express in my paper read to the Society last session, on an amœboid state of Stephanosphæra, as regards the, perhaps in individual opinion, debateable but, as I still hold, by no means actually convertible, lower forms of animal and vegetable life. Because some organisms are not always what they seem to be, inasmuch as, in the course of their development, they may submit themselves to several apparently more or less diversified phases, whilst others (as our Mesotænium and Cylindrocystis) seem to be in this respect more restricted, is not, I think, in either case an argument that Protophyta, or even some Palmellaceæ, may not be subject to specific limits, not to speak of a change from one kingdom to another. With Dr. Hicks I must, indeed, wholly coincide, that in the study of the Protophyta it is especially desirable that the history of each be, as far as possible, made out, in order to discover the mature forms, and to trace out the seeming changes through which they may pass; but is not this, after all, in other words, to endeavour to find out what *are* the species and their limits, and to learn to discriminate between them? But assuredly, were all this known, many spurious "species" would have to be erased, at least among certain types. But, whatever phases they may run through, they at least must revert eventually to the parent or type-form; for the same forms turn up and vanish again and again, and season after season, each in its own kind of situation or habitat; and it seems more reasonable that we should suppose—be the intermediate phases what they may—that these would naturally begin and end their cycles in themselves, than that all the many well-defined types and well-marked forms, some more and some less frequently recurring, included under "Palmellaceæ," should need constant recruiting by the transmutation of lichen-gonidia and moss-spores. Perhaps the truth on some of the questions lies in the mean; but, be it as it may, I trust I am not too firmly attached to the views I have tried to express not to relinquish them on good evidence. Meantime, in the words of Dr. Wallich, I at least hold with him, that—"In science, as in governments, truth can never be arrived at on a large scale unless under the pressure of an opposition."

Mr. W. Archer prefaced the foregoing paper by reading an extract from a letter addressed to him by Dr. G. C. Wallich, F.L.S., on the subject of the value of characters in Protophyta, more especially in Desmidiaceæ. Mr. Archer explained that Dr. Wallich's remarks therein were in reply to observations of his own in a paper read before the Natural History Society of Dublin on the 4th of December, 1863, entitled "Observations on *Micrasterias Mahabuleshwarensis* (Hobson), and on *Docidium pristidæ* (Hobson);"* and that Dr. Wallich, having done him the honour to write him a letter containing a summary of his own views on the subject debated in the paper referred to, had requested him to read the same to the Natural History Society. The following is the extract, reference to which is made in the preceding paper:

"Pray do not for a moment think me inclined to take amiss any differences of opinion on scientific matters. Every one has a right to judge for himself; and in science, as in governments, truth can never be arrived at on a large scale unless under the pressure of an opposition. Besides, the question of specific limits is still in its infancy; and those who cling to permanent specific types are most fully justified in crying out for the amplest proofs before relinquishing their ground. You know of old that I am for no such permanence, but believe that I can trace at every step more and more conclusive evidences that there exists a constant tendency to modification by external influence.

"The point at which you and I diverge is that at which we form our estimates of the value of characters. You maintain that certain characters, because they are more or

* 'Proceedings of the Natural History Society of Dublin, vol. iv, Part 2, p. 79.

less constant under the same conditions—that is, in a given locality—afford evidence of persistence of type. On the other hand, I hold they cannot be accepted as evidence of this persistence unless they can be proved to occur under every variety of conditions—that is, in widely remote localities. I speak from experience, when I say that many—very many—of the assumed species of Protophyta and Protozoa are identical—the distinction on which their separation has heretofore been based being entirely the result of the accidental conditions under which they have been reared.

"In the Desmidiaceæ, to which you direct attention more particularly, it appears to me that such differences as the number of indentations, the acuteness or obtuseness of the teeth, the number of spinous processes, and so forth, indicate mere accidental variations, handed down, no doubt, from parent to progeny in the same locality so long as the physical conditions remain the same; but nevertheless not to be regarded as constant, or as impressed on the organisms *ab initio* as an integral feature in their physiological constitution.

"It should be borne in mind that the *onus probandi* does not rest in every example on those who think with me, but that it is quite sufficient that we show a fair number of cases (as, for instance, in the genus Micrasterias), in which unquestionable interchange of those characters is to be met with, which by Ralfs and others have been seized upon as indicative of distinct origin. For such cases prove that the law which it is assumed governs the limits of species is no law, but only a conditional direction, holding good only so long as the surrounding conditions continue the same.

"If, however, the object in view in defining varieties under specific designations is merely to render the identification of similar forms more easy, I have nothing to say against it beyond this, that I should be loth to have to make up the lists even as they stand now, and firmly believe it will be an impossibility for the coming generation of naturalists to do so at all."

Observations *and* Experiments *with the* Microscope *on the* Effects *of* Prussic Acid *on the* Animal Economy. By Thomas Shearman Ralph, M.R.C.S. Eng., &c.*

Every year as it passes away leaves behind it additional testimony to the fact that the microscope is advancing to occupy a position of importance in medical practice equal to that which the stethoscope has attained; and I feel satisfied that ere many more years have passed the regular employment of the microscope, as a means of diagnosis, will be maintained and duly acknowledged. The slow but steady progress which the use of this instrument has made in the hands of the medical profession should tend to point rather to the important nature of the results to which it is destined to lead us, than to accepting the doubts of some who occasionally assail its employment, and are unable or unwilling to avail themselves of its powers.

2. Several difficulties still remain in the way of its free reception into the circle of daily use by the profession at large, and among others, which time and increased confidence in its powers will banish, there are these, viz., that with the increased powers conferred on the microscope, a decrease in the expense, and also a diminution of the actual size of the instrument as a portable one, are great desiderata. The more readily it can be brought to the bedside, the more facilities which peculiarities of construction shall enable the observer to use it without performing the operation of a preliminary preparation and setting of it in order, the more favorable reception will it find at the hands of the medical student and practitioner; and all these requirements will be rapidly met, if only the demand for them be made to those whose occupation it is to perfect the instrument.

The object I have in view is not merely to urge on the study of disease by the use of this instrument, but also to show how much practical work yet remains to be done, and that by one class especially, the regular daily practitioner of medicine, whether attached to a hospital or moving in the circle of private practice.

3. It has been my custom to examine the blood in all marked cases of disease, with the view of ascertaining if anything could be learned by such a process, and the following communication will show that my labour has not been lost,

* Read before the Medical Society of Victoria, Dec

and, I may add, has proved rather a stimulus to further efforts in the same direction.

A healthy young child fell ill with hooping-cough, and after the lapse of a few days was brought to me labouring under an early state of pneumonia; extensive puerile respiration had set in, and there was considerable congestion of the cutaneous capillaries of the extremities. A few drops of blood were carefully taken from the back of the hand in the way I have recommended, *i. e.* cleansing the skin first by rubbing it with a wet towel, and then puncturing it and taking the blood on a glass slide, without touching the skin. The blood presented no unusual appearances, save the presence of some dark-coloured bodies larger than blood-discs, to which, however, I did not attach any definite importance. On the following day more blood was taken, and I noticed in two slides that some bright blue particles were present, resembling in colour starch when first acted on by iodine, and also some dark purple particles. The following day three slides were charged; these attracted my attention more forcibly, and occasioned me considerable perplexity, as more blue and purple coloured particles were present, and the blood had been carefully taken in every instance; the child, also, had been healthy hitherto, and had had no exhibition of iodine I knew of, and had not been in other hands than mine.

4. Prior to the second supply of blood taken, and after the first examined, I had ordered Scheele's prussic acid, and it was directed to be continued up to the third time of taking the blood. The decided character of these blue particles, their persistence for hours on the slide, their increased amount in the subsequent examination, all tended to cause considerable perplexity as to their possible origin. After some reflection and one or two chemical examinations, I instituted the following experiments, which tend to show that these blue particles in the blood are most likely composed of ***Prussian blue***, and are due to the reaction of prussic acid on the iron in the blood.

5. 1st Exp., Aug. 22nd.—Seven or eight drops of Scheele's prussic acid were given in divided doses to a rabbit; after a lapse of five hours, some blood taken from the ear exhibited a number of bright blue particles. Two more drops were given, and at the end of twelve hours, two slides of blood showed some blue particles; subsequently three drops were given at one time (the doses were all more or less diluted with water); the animal struggled under the influence of the poison, and most likely would have succumbed but for the administration

of ammonia vapour. One hour after, the blood exhibited blue particles satisfactorily.

2nd Exp., Sept. 12th.—A kitten was killed by inhalation of prussic-acid vapour. Blood found to contain many large irregularly rounded dark-coloured bodies, too dark to ascertain if of a blue color. One or two light blue flaky masses were found; also, in and about the sheath of the sympathetic nerve, one indigo-blue film of some size. This was decolorized by action of potassa; colour restored by application of acetic acid. The decided bright blue particles do not appear to yield to potassa; medulla oblongata examined; some blue points and several dark ones seen.

3rd Exp., Sept. 14th.—Tincture of iron diluted was injected into the stomach of a frog, and vapour of prussic acid was soon after administered. Died after some hours. Some decided bright blue particles were seen in the blood; also, dark particles of irregular form (peroxidized iron?) in abundance.

4th Exp., Sept. 19th.—Dog killed by prussic acid dropped on the nose and mouth; death in a minute and half. Blood from heart presented some dark-coloured bodies, and one large decidedly indigo-blue mass.

5th Exp., Oct. 4th.—Frog killed by concussion; blood gave no evidence of blue particles.

6th Exp., Oct. 6th.—A frog slowly poisoned by prussic acid administered; the animal did not die from the effects of the poison, but was killed and examined. Obtained some blue reaction in the blood, and about the larger nerves going to the extremities.

7th Exp., Oct. 7th.—A full-grown cat had three drops of Scheele's prussic acid given her, undiluted, by means of a glass tube introduced in the pharynx. In the space of a minute she lay down and gasped, and died, with the usual symptoms, in two minutes more at the furthest. Seven hours after, body quite rigid; heart removed for examination; two or three specimens of blood from it showed either dark blue coloured particles, or black ones; one large flake of indigo blue was seen. Muscular fibre from the interior of the heart gave as satisfactory evidence.

8th Exp.—A frog killed by concussion (second experiment of the kind); the blood examined showed no blue-coloured particles; a leg of the animal cut off immediately after death had prussic acid applied to the cut surface; one side of blood examined exhibited a solid amorphous body with a blue coloration at one end, while the other was colourless.

9th Exp.—A strong, recently caught frog, poisoned by $\frac{1}{4}$

gr. of cyanide of potassium, injected into the stomach. Three specimens of blood examined only showed a slaty-blue colour in one or two large flakes or patches. The blood-discs appeared to be dotted over with small oily looking dots.

10th Exp.—A blow-fly was killed by exposure to the vapour of prussic acid. The muscles lining the thorax, in the vicinity of the principal nerve-centres, were examined. Several dark blue points were seen, and one large particle of a decidedly bright blue, equal to any seen in the experiments already quoted.

11th Exp.—The same repeated, and with a bee, with similar results.

Note.—The bright blue particles are, I believe, really due to the action of the prussic acid, but I have also noticed in some flies *not* killed by prussic acid that there were present some indigo-blue coloured particles. These I refer to the natural pigment of the insect, serving, perhaps, to tinge the deep steel-blue coloured hairs; fragments of which will be met with in such examinations; hence this insect is not a fit subject for yielding positive results. With this in view I instituted the

12th Exp.—The maggot of the blow-fly, which is very difficult to kill by prussic-acid vapour, was subjected to its influence in the fluid state. Two so treated exhibited the characteristic blue masses and particles. This experiment I consider to be very satisfactory, as all the organs appear to be free from pigmentary matters.

13th Exp.—A rabbit six weeks old had four slides of blood taken from the ear; these exhibited no blue particles. It was then killed by inhalation of prussic-acid vapour, administered on two separate occasions; it was intended to examine the blood without killing the animal, but the second application of the vapour killed it very suddenly. The blood in one specimen exhibited a very large, brilliant, Prussian-blue concretion; some blue particles in the blood from the axillary vein, and also from several other sources.

6. I will now, before proceeding, give a *résumé* of the experiments, and some observations on them. Eleven experiments in all gave evidence of the action of prussic acid, by the presence of blue-coloured particles, masses, or films. When I have used the term mass, I mean a solid substance occupying a space which twenty or thirty blood-discs would cover.

The inhalation of the vapour of prussic acid goes to show that, in some of the experiments at any rate, but a very small quantity sufficed to kill, and its traces were detectable.

The object of giving the tincture of iron to a frog, and then killing it by vapour of prussic acid, was to prove that the change was due to the presence of iron in the blood, and, if so, a superabundance of iron might yield a proportionate increase in the amount of the blue particles. This did not seem to be the case, but will be noticed further on.

7. The impression left on my mind by these experiments was, that the bright blue particles were due to the action of prussic acid on the iron in the blood or tissue in some state of organic combination, and that Prussian blue had been formed.

The dark-coloured or indigo-blue masses appear to me to be a mixture of Prussian blue and perhaps some oxidized state of iron unacted on by the prussic acid. The administration of prussic acid in a concentrated state, *i. e.* without further dilution of the Scheele's strength (=4 per cent. of real acid) appeared to me to be followed by a greater formation of the dark blue particles than when given in diluted and distant doses.

The two experiments not subjected to the action of prussic acid, Nos. 5 and 8, gave negative evidence in favour of the same view.

The instances quoted of blue-coloured particles occurring in the blow-fly without previous action of prussic acid, may depend on the cause I have noticed, or on another. This roving insect may derive sufficient cyanogen materials from the putrescent substances it is in the habit of visiting, or may possibly derive them from the flowers it seeks to, which I believe it is in the habit of doing, as I have seen pollen-grains in abundance about its body while making these observations.

I would here remark that the frog's tissues contain pigmentary matters in abundance, and these might be mistaken for the dark blue particles I have instanced; but when these bright and dark blue objects have once been seen elsewhere, no mistake of the kind need occur, or be charged against the experiments. I here specially refer to examinations of the nerves of the frog.

8. For the purpose of further testing the action of prussic acid on the blood, I obtained some from a patient in the Melbourne Hospital, who was and had been taking this medicine lately for some days. I felt some objection to this case, as the tincture of iron had been freely administered prior to the prussic acid, and I thought its action might interfere with the character of the experiment.

Four slides were charged; in each of these the peculiar blue particles were distinctly seen, but it required much care and the use of a magnifying power of 500 diameters. The films of blood examined were remarkable for the great amount of black-looking particles which were present. These I am inclined to regard either as iron in a peroxidized state, or they are dark particles of Prussian blue, and due to the iron lately taken by the patient. These dark particles recall the appearances seen in the 3rd experiment. The blood on each slide was not greater in bulk than the head of a large pin.

9. In a patient of mine, a child to which I had occasion to administer prussic acid (one minim and a half in twelve hours), I took blood on four slides, and in three I found blue particles. The acid was continued to the same extent, and six more slides charged; each showed the blue particles in greater abundance, and also some dark blue or indigo-coloured films. The bright blue particles which I always look for as the most characteristic colour indicating the action of prussic acid was in this case so decidedly associated with concretionary masses peculiar to the blood, that there could be no possible doubt as to their internal origin, and not from any extraneous source. Liquor ammoniæ and potassæ and nitric acid, separately, do not appear to act on the blue particles, but the last two do so when following each other.

10. From these observations, I feel satisfied in advancing the opinion that prussic acid causes a change in some of the constituents of the blood, that it attacks the iron when in some particular condition, and, with perhaps the aid of some alkaline base, the Prussian blue is formed; that the deep or indigo-blue particles may be some mixture of iron and Prussian blue, or a state of Prussian blue not definitely known to us; for this chemical compound is not yet fully understood as to its exact composition, and is found to vary both in colour and composition in the laboratory of the chemist, and may do so also in that of the animal economy. On the other hand, I find there is a cyanide of iron known which turns blue on exposure to oxygen, and perhaps ultimately these blue particles in the blood may be found to belong to this cyanogen compound.*

11. Continuing my observations on the blood as opportunity presented, I detected the presence of these blue particles in one or two cases in which no prussic acid had been given, and I could in no way satisfactorily account for their presence. This led me to examine the blood in three indi-

* 'Watt's Chemical Dictionary,' vol. ii, p. 221, "Some of the compounds called Prussian blue have the composition of cyanides of iron; they appear to be double cyanides."

viduals who were in full health, and in all these I found the same kind of particles. The majority of these particles, as well as several obtained from the experiments narrated, were tested with oxalic acid, which readily decolourised and dissolved them away.

The evidence at this point of my observations assumed a very contradictory character; and if I had not been at the time in possession of other facts which supported me in my views, I should have been brought to an unsatisfactory standstill.

12. In the course of my experiments I took occasion to examine the prussic acid itself as to its purity, and the following observations will tend to clear up the evidence. Prussic acid, like some other powerful and effective agents in the hands of the medical man, possesses the property of rapidly undergoing a chemical change and of losing its powers as a medicine; this liability to change has been referred to the action of light, and also been noticed to occur more frequently the greater the degree of its concentration. Hence, it is now usually kept covered up from the action of light, and preserved in a certain state of dilution, and also appears to be more permanent when prepared after a certain manner.

13. If the ordinary prussic acid of Scheele be examined under the microscope under a power of 200 diameters, the acid, if pure, will present nothing worthy of remark; but occasionally specimens will be met with which contain bright blue particles, consisting, as I suppose, of Prussian blue, and also a number of starchy looking bodies, which actually turn purple with iodine. Or, supposing the acid to have been pure, these changes will be found to take place in it, if the bottle is repeatedly opened and portions taken out ever so carefully, by dipping a glass rod into the fluid; at least such is my experience.

14. These remarkable changes appear to me to be due to the renewed access of air, and minute particles of dust getting in, and to the possible electric state of the glass rod with which I have been in the habit of dipping out the acid, having always previously carefully wiped it.

If, after the occurrence of these accidents, extended over a period of many days, the bottle be shaken, and a drop placed on a slide and examined with a microscope, bright blue particles will be seen associated with a number of starchy looking bodies, which polarize feebly and turn purple with iodine, like vegetable starch.

15. On taking a drop of prussic acid, free from such contamination, as, for example, by using some [illegible] has not

been opened and has been kept undisturbed, and some organic matter be added, as blood or albuminous fluid, these starchy bodies will make their appearance. First of all a minute dot, resembling an oil-globule, will be seen, which, if steadily watched for a time, will be observed to increase in size, sometimes attaining to that of an ordinary starch-grain, oval or rounded in form, and then it will assume a thicker consistence and solidify into a starch-grain, occasionally presenting a laminated structure, or a grooved line in the long axis of the oval form.

Whenever these phenomena occur I have also noticed the appearance of the Prussian blue particles, and it appears to me that when prussic acid comes into contact with organic substances containing iron then a decomposition takes place, part of the iron combining with the cyanogen to form ferrocyanic acid, and the remainder uniting with this ferrocyanic acid to constitute Prussian blue—that is, according to the accepted chemical views on this subject; the hydrogen liberated uniting with the carbon and oxygen of the organic substance, which has brought about this decomposition, to form the starch-grains.

16. So, in like manner, when the blood of an animal which has been killed or partially poisoned by means of prussic acid is examined by the aid of the microscope for the presence of Prussian blue particles, there may be seen, in very many instances, bodies which resemble these starch-grains, varying in size from below those of a blood-disc to four or five times one in extent. These, when acted on by iodine, may be seen to turn purple, and they also polarize. So, again, in those instances which I have noticed the presence of blue particles in the blood of patients, whether they have been taking prussic acid or not, I have frequently observed similar-looking bodies, and these tested with iodine have also reacted purple.

17. From all these observations I conclude that prussic acid is more or less neutralized in the blood by the iron present in it, and in proportion to the iron thus withdrawn there is so much starchy matter set free; whether the starch in this condition is prejudicial or harmless, owing to its semi-fluid condition, yet remains to be determined.

18. 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* change, except in such cases as resemble the one of epilepsy recorded in the 'Mic. Journ.' of 1855, by Mr. Stratford, of Toronto.

19. If we refer to the history of these *corpora amylacea*, we find that they have been gradually associated with amyloid degeneration of the tissues, a condition which is regarded by Virchow as essentially different,* as the tissue becomes directly filled with a substance of an amyloid nature, possessing, however, the peculiarity of never becoming blue under the action of iodine alone, and only by a subsequent application of sulphuric acid, and, therefore, appearing to be more allied to cellulose; and this deposit, he supposes, is conveyed to the part from without, as he has been unable to discover any change in the blood from which the inference might be drawn that this was really the source of the deposits. But what he states further on goes to show that the disease in the lymphatic glands consists in a thickening and narrowing of the arteries, and in the conversion of the small cells of the follicles into *corpora amylacea*, thus linking together these bodies and amyloid deposits, and tending rather to lead us to regard their origin as traceable to the blood.

20. I think the facts which I have brought forward, showing the formation of *corpora amylacea* in organic fluids, both while in and out of the body, due to the action of prussic acid, tend rather to the view that the blood directly supplies the material from whence these starchy bodies are formed, and points out to us that a chemical change has been brought about in it. I am, therefore, inclined to the opinion that some change in the blood, analogous to that produced by prussic acid, is the most likely explanation of the mode by which these bodies are formed in the animal economy, and that we shall probably find other substances beside cyanogen possess the property of eliminating starch-grains in the blood of animals, and that amyloid deposits are only a further step of the same process.

21. From whatever point of view we look at these facts, it

* Virchow's 'Cellular Pathology,' p. 371, &c.

appears to me that a large and important field of inquiry has been opened to the investigations of the chemist, and among the speculations to which these facts may lead there is this to consider—that perhaps Prussian blue should rather be regarded as a cyanide of iron than a sesquiferro-cyanide; and that iron, perhaps, performs other functions in the blood than that connected with oxygen—that of being a vehicle or medium for holding carbon and hydrogen together, for their more ready distribution to the building up of tissues, and to the preserving them in a condition which may be more easy of change by reason of their union with the iron.

22. The fact of the formation of Prussian blue in the animal economy from the action of prussic acid should suggest the possibility of detecting this poison in cases of poisoning, remembering that, while the volatile and easily decomposable nature of this agent enables its traces soon to fade away from our chemical grasp, those portions of the poison which have gone to form Prussian blue in the blood may remain for an indefinite period as evidences of its presence. On the other hand, if it be true that in some cases prussic acid or some cyanogen compound may be formed spontaneously in the body, as has already been suggested by others besides myself, so we may have an increased difficulty presented to us in a judicial point of view in arriving at the conclusion on microscopical evidence alone, that anyone has been poisoned by this agent.

23. Again, with respect to the spontaneous formation of Prussian blue in the blood, the suggestion presents itself—may not the iron in the blood be the normal antidote to the cyanogen so formed; and supposing that iron was not present in a suitable condition or sufficient amount to neutralize the cyanogen, then spontaneous poisoning would be the result; and may we not, with this view of the process, be warranted in endeavouring to ascertain if the occurrence of some diseases of the nervous system, as chorea, convulsions, &c., may not be due to some deficiency in the blood at the time of a suitable condition or amount of iron? And, further, the pathologist will have to ascertain more particularly what organs are more especially liable to injury under the action of prussic acid.

24. Before concluding this communication it may be desirable to direct attention to the fact that some years ago the formation of indigo was pointed out as taking place both in the tissues of the body and also in the urine. The papers on this subject are by Dr. Hassall, and may be consulted in the 'Transactions of the Royal Society of Great Britain' for 1855.

The experiments I have recorded show that the blue particles in the blood answer to tests which indicate either Prussian blue or a cyanide of iron, and that no reasons exist for supposing them to be composed of indigo.

25. If, a year ago, I had been asked if it were possible to detect the effects of prussic acid on the animal economy by the aid of the microscope, I should have unhesitatingly answered for myself, I could not, and if any one else could I should be only too glad to learn how, for it seemed to me to be out of the reach of the instrument to investigate and reveal its effects. But the direction and extent the present investigations have taken encourage me to expect that ere long many more important facts will be brought to the consideration and study of the medical man armed with the assistance of the microscope, even while endeavouring to fulfil his daily duties in medical practice, and that more and more additional inducements will be held out to him to work with it, with a fair promise of receiving the due reward for his labours.

Description *of the* Peripheral Termination *of a* Motor Nerve. By W. Moxon, M.D., F.L.S.

In the spring of the year 1862 it chanced to me, in the course of observations upon the anatomy of insect larvæ, to light upon an example of a muscle on which the ending of a nerve can with certainty and exactness be seen.

So much light has since that time been thrown by Continental observers upon the manner of termination of nerve upon muscle, that in my observation there is now not much that is new. But I am induced to publish it because the weight of authority in this country at the present time determines to the total denial of such manner of termination, and because the insect on which the observation was made is plentifully distributed, and any competent microscopist can easily find the particular muscle and assure himself of the mode of motor nerve ending.

So long ago as 1836 Doyere first saw the ending of a motor nerve upon a muscle in Tardigrada. He described the nerve as ending in a conical expansion, the base of the cone resting on the side of the muscle, whilst its apex was continuous with the nerve, which approached the muscle at right angles.

His account is fully verified by Dr. Richard Greef, in Max Schulze's new journal (Bd. i).

In 1840 Quatrefages saw Doyere's cone in *Eolidina paradoxa*, and other observers in other animals, especially nematoid worms; all agree in describing the conical ending of the one fibre on the other, but the muscle was in all cases of the unstriped kind, and the nervous nature of the fibre which joined it could not be proved. The muscles of Tardigrada, in which the observation is most satisfactory, are unstriped and without sarcolemma.

In 1846 Wagner made a doubtful statement as to the ending of a nerve by piercing a muscle.

In 1858 Munk spoke of nerve-fibres in frogs disappearing like stumps broken off.

In 1860 Kühne, and Margo six months after him, described the ending of nerves by piercing the sarcolemma of transversely striated muscle, and since that time several other observers, especially Rouget, Krause, and Cohnheim, have given similar descriptions, differing in points of minute detail.

In 1860 Dr. Beale gave a description of an essentially different mode of nerve termination, in which he was supported by Kölliker, Rouget, and Krause; but the latter two observers have since described the nerves as ending directly upon the muscle-fibres. Dr. Beale has since, so lately as 1864, reaffirmed the same view, describing the nerves as continuous, with a nucleated meshwork outside the sarcolemma.

Although it is now late to appear with such a claim, yet it is quite true that the accompanying observation was made in the spring of 1862,* and was entirely independent of any other observations. Indeed, it was only recently, in reading the subject for the purpose of this paper, that I became aware of the existence of descriptions of direct union of nerve with muscle. The books used by English students do not allude to such a mode of termination.

When investigation is made upon groups of muscle-fibres there are many obvious sources of fallacy which are avoided by using an instance such as that I now offer, wherein the muscle-fibre is single, and is supplied by a single nerve-fibre.

Again, in scrutinising with the high powers necessary for these observations the muscles of vertebrata we are apt to be misled by the corpuscles of connective tissue found in the course of nerves and vessels in all animals of that sub-kingdom. On the other hand, I believe I may say that no true connec-

* The drawing was shown to Dr. Braxton Hicks in 1863.

tive tissue exists in invertebrata—certainly not in the insect larva in question—and so this source of error is absent.

Then, again, the small size and transparency of these larvæ enable an observer to examine the muscles during the life of the creature, and the muscle in moving moves the nerve attached to it, so as to render abundantly evident the fact of its attachment, and to enable the observer to be certain of the attachment or otherwise of structures lying in its immediate neighbourhood.

The muscle to which I would direct attention is the retractor antennæ of the larva of a gnat common in ponds in the spring of the year. This is a fibre about $\frac{1}{1000}$ of an inch wide, provided with sarcolemma, which itself has nuclei upon it. The transverse striation of the fibre is complete and regular. That the nuclei are upon the sarcolemma I have not known from this muscle; but in larvæ which have been made dropsical by forty-eight hours' confinement in airless water (after Doyere's method) I have seen in muscles of the trunk the appearance shown in fig. 4 (Pl. IV), the sarcous substance torn across, and the sarcolemma bearing nuclei, extending between the broken ends of it.

From the antennal lobe of the insect's cephalic ganglion comes the antennal nerve, a nerve of some size, which has a neurilemma-sheath provided with nuclei (*h*); at some distance from the base of the chitinous antennæ the nerve expands to form a long spindle-shaped ganglion full of ganglion-cells (*a*), and then in this ganglionic condition enters the antennæ, the cells still discernible through the chitin. About two thirds of the distance from the encephalon to the ganglion the nerve gives at right angles to its own course a branch (*b*) smaller than itself; this proceeds at once to the outer edge of the antennal muscle and joins the outer edge; the motor nerve is just so long as to allow the play of the muscle in its frequent contractions.

At the point where the motor antennæ nerve leaves the sensory antennal nerve there is a corpuscle (*h*), whether neurilemmar or no I cannot say, also there are two small nuclear corpuscles (*h'*) close to the end of the nerve on the muscle. The union of the neurilemma and sarcolemma is a direct continuity.

I have very carefully examined the point of union in order to ascertain what is the relation of the proper fibre (axis cylinder) of the nerve with the sarcous substance of the muscle-fibre. The muscle in contracting preserves a straight border, beautifully distinct from the sinuous folds (*gg*) into which the sarcolemma is thrown. During extreme contraction the sarcolemma is gathered up into wrinkle-li and this to a very different extent on the side to which the nerve is attached (*gg*). On the opposite side to this attachment the sarcolemma fits at all times closely to the sarcous tissue, and it requires careful observation to see the wrinkles of the membrane during contraction; but on the side to which the nerve is attached this membrane is then raised in the most obvious way into bulging folds. The inequality of the folding of the membrane on the two sides produces a puckered appearance of the sarcolemma, very striking during extreme contraction.

What it is that occupies the space which is thus shown to exist between the sarcous tissue and the sarcolemma on the side whereto the nerve is attached I could not be certain. Nuclei appeared to exist at the spots where the folds became most prominent, and these nuclei (or this appearance of nuclei) are visible at the same spots in the uncontracted or but slightly contracted state. It should be said that these nuclei (*gg*) are very distinct from the nuclei of the sarcolemma (*ee*), both in disposition and in appearance.

But it is not doubtful that the sarcolemma and neurilemma are simply continuous with each other, and that their respective contents become continuous at the point where their union takes place.

The nervous contents of the neurilemma are, then, continuous with a pellucid material disposed along the same side of the fibre between the sarcous substance and the sarcolemma.

The question of the exact mode of termination of the nerve-cylinder after entering the muscle-fibre is hotly enough contested by Messrs. Rouget and Kühne, and the points at issue have become extremely refined. In the larger fibres of vertebrata, on which their observations were made, the expanded end of the nerve-cylinder axis, which they agree to describe, may probably be rendered necessary through the larger mass of sarcous tissue to be influenced by the nerve-fibre. In the instance I am describing the muscle-fibre is so small in proportion to the nerve-fibre that such an expanded nucleated plate could not find room, and it may be that the long, clear, uneven layer seen between the sarcolemma and sarcous tissue in continuity with the nerve may represent an equivalent structure in another shape. The large proportionate size of the nerve is worthy of remark, as it is in striking contrast with the much smaller relative size of the nerves of the muscles of the trunk in the same insects. The antennæ are being constantly protruded and withdrawn, and in serving their purpose of sensory organs must be held under very complete and direct control by their muscles. It has been remarked, I think, first by

Mr. Hilton, that the nerves of muscles are large in proportion as the muscles are required to be in frequent or constant operation, and, I may add, as their action is delicate. For the first proposition the large nerves of the sphincter ani and of the deltoid, with the other muscles whose constant operation is needed to maintain the apposition of the bones at the shoulder-joint, will serve as illustrations; for the second, the size of the nerves of the muscles of the eyeball and larynx. Another general law of the relation of muscle to nerve is also prettily illustrated in this instance, the same nerve supplies the sensory organ and the muscle which moves it, just as in human anatomy the nerve which supplies a muscle supplies also the part moved.

The muscle-fibre is so far separated from others, the space about it is so clear, and its direction so different from that of any other fibre in its remote vicinity, that no doubt could exist about any further continuation of the nerve-fibre, such as is described by Dr. Beale, if such continuation existed, and this assurance is further verified during the contraction of the muscle, for then the nerve-fibre is drawn up and down, so that whilst its connection with the muscle is put beyond doubt, its freedom from any other connection is made certain; any other connection, if present, must at once strike the eye during movements of the muscle and nerve among quiescent parts.

Whether the nervous elements are throughout distinct from the muscular, or whether they join and unite with them, is a question of prime importance to any apprehension of the manner of action of nerve upon muscle. It was long ago surmised, and the supposition still lingers, that the loops of nerve believed to cross the muscle-fibres might induce in them contraction, as cross currents of electricity cause magnetic phenomena. If the view put forth by Dr. Beale were correct this theory might still find place, but the direct ending of nerve-fibres *in* muscle-fibres does away entirely with the analogy, an analogy which, though attractive, was never satisfactory, because it could not be shown how the current supposed to course in the nerve-fibres could be insulated.

In conclusion, I would remark the proof of a direct ending of nerve upon striated muscle-fibre in a single case must hold good for all cases alike, for I submit that no one can suppose that sometimes the nerve does go into the muscle and sometimes it does not.

Nothing in all the history of Nature is so astonishing as the identity of the constructive elements of the most different

From the foregoing it will be seen that the Ichthydina form an interesting, but, as yet, little known group of animals.

Ehrenberg has described three species belonging to the genus *Chætonotus,* to which Dujardin adds a fourth, *Chætonotus tesselatus.* The diagnoses and descriptions of these naturalists are too incomplete to determine certainly the differences of species; hence later naturalists, as Perty and Schultze, have merely guessed the identity of the above-mentioned species. As for the forms described by Ehrenberg, I think I am right in uniting them in a single species under the name of *Chætonotus larus,* whose chief character consists in the form of the dorsal bristles, which are not, as those described by Schultze, formed of two different parts, but consist of one single, simple, crooked bristle. That form which is described by M. Schultze, and most likely also by Perty, as *Chætonotus maximus,* must be considered as a new kind, and therefore may well be named *Chætonotus Schultzii.* If now it is considered that the dorsal bristles are the criterion of species among the forms belonging to the genus *Chætonotus,* one must consider that described by Dujardin as *Chætonotus tesselatus,* as a distinct species; and, in fact, this kind (of which I have found not a few in Charkow and in Giessen) differs remarkably from all others, in the peculiarly scaly form of its dorsal bristles. Besides these, I know another form of *Chætonotus* which I consider new, because of the peculiar form of the back bristles, one of which I have figured in fig. 6 *a.* This form, which was found in the marshes of Giessen, I name *Chætonotus hystrix;* it is 0·12 mm. long.

Of the genus *Ichthydium* I know a new one which was examined by me in the province of Charkow, and which from the peculiarities it presented I name *Ichthydium ocellatum.* This bottle-formed species as represented in fig. 4 is provided on the forepart with some pretty long hairs, and, besides this, with a ciliated covering on the ventral surface.

Besides the two forms just mentioned, I have noticed two which I consider to be representatives of two peculiar genera. One of these is stretched longitudinally, and not bottle-shaped, as *Chætonotus, Ichthydium,* and my other new genera; the head is in fact somewhat broader than the rest of the body; the back is provided with elevations which are placed one after the other. The ventral surface is covered with a tunic of cilia; on the back of the tail-end there is a row of strongly bent bristles. On the hind part of the body there are two dichotomous furcal appendages which are very characteristic of the animal.

In the summer of 1863, during my stay in my fatherland (Charkow), I noticed a single example of this, which was equal in size to *Chætonotus larus*, and which I name *Chætura* (nov. gen.), *capricornia* (nov. spec.). It was found in a marsh. (Pl. V, figs. 2 and 3.)

Another form of the family Ichthydina is also known to me from a single example which I noticed in Giessen in the autumn of the following year. This is a small species, 0·08 mm. long, which I name *Cephalidium* (nov. gen.) *longisetosum* (nov. spec.). It is also bottle-formed, and has a blunted broad head, whose foremost end has a distinct mouth-apparatus, and is provided all over its surface with long vibratile hairs. To the head follows a thin neck, which joins itself to the body; this is provided on the dorsal surface with very long and strong bristles, and on the ventral surface with small vibrating hairs; at the posterior end there are no furcal appendages, but on the side of it right and left there is a bristle placed on a little knob, which represents without doubt a sensory organ (fig. 4).

As regards the anatomical properties of the forms described, I must remark that there is generally no complexity or intricacy. The cuticula of the Ichthydina protects them from reagents, as in Rotatoria and many Infusors. It is easily dissolved in sulphuric acid, whilst in other acids, and even in alcohol, this is not the case. At least, I may so say from experiments which I have performed in a different way to other naturalists. I have placed animals which were being treated with a solution of ammonia into this fluid, together with sand granules, and was still able to distinguish the very fine and comparatively generally opaque cuticula, because through the contact with the sand granules the outline of the cuticula became plain.

The cuticula in most of the bristleless kinds is provided with fine diagonal stripes. Under the cuticula lies a granular layer which passes directly into the parenchyma, formed of simple grains. In this I could find as little trace of muscles and nerves as my predecessors; although these observations do not in any way shut out the possibility of there being such formations, yet their non-presence seems to be nothing unnatural; it is satisfactorily known that very young embryos perform the same motions by means of different tissues which are performed by the muscles in the adults. I need only call to mind the Nematodes, among which there are forms which even when in an adult state permit no signs of muscles to be seen.

One could say the same in regard t ous system;

if in our case its absence should seem to stand in contradiction to the important development of the sensory apparatus. Besides the presence already mentioned of complicated eyes and light-breaking bodies in *Ichthydium ocellatum*, the sense organs of these animals are represented by various sensitive hairs, such as the dorsal bristles of all kinds of *Chætonotus* (those bristle-formed elevations mentioned by Schultze in *Turbanella*, must also be reckoned among them), as well as the long bristles of *Cephalidium*, and those stiff erect hairs on the foremost part of the body (see in *Ichthydium ocellatum*, Plate V, fig. 1). To these belong also the above-mentioned fine bristles on the tail-end of *Cephalidium*. Besides this, the cuticula carries vibrating hairs, which in all sorts of Ichthydina are disposed on the ventral surface, and are present in *Cephalidium*, only on the head, in the form of long cilia. The vibrating hairs are either of that kind described by M. Schultze in his *Chætonotus maximus* (*Schultzii*), or are disposed as a simple covering of equal-sized hairs. Through the movement of these ventral cilia a current of the surrounding fluid is made, even when the animals themselves are at rest.

The digestive apparatus is the same in all Ichthydina. The mouth opening at the fore end, on the ventral surface of the body, is surrounded with a chitinous ring which appears in some kinds of *Chætonotus* as a body provided with vertical thickenings. In *Cephalidium* the oral aperture is placed on an expanded plate, not being provided with a mouth-ring. The mouth leads into a narrow pharynx or œsophagus, which is provided with strong chitinous walls, and which is surrounded by a thick layer, in which in some species distinct square markings are seen, whilst in others it is perfectly homogenous. The true chylus intestine follows the œsophagus. This runs straight to the anus placed on the back, and is provided with numerous oil-globules.

With regard to their generative powers I must own that my knowledge is far from perfect. But this much is certain, that all those which I have examined are of different sexes, and not hermaphrodites, as those described by M. Schultze, which, perhaps, may be only impregnated females. The female generative organs of those individuals examined by me, which were old enough to enable me to distinguish the sex, have all the same simple structure which Schultze has described in his species. As I have discovered in *Chætonotus larus*, they produce two kinds of eggs, which are clearly the so-called winter and summer eggs, phenomena which have long been known in the Rotatoria.

In the same example of *Chætonotus larus* I found in the cavity of the body a number of eggs from 0·19 mm. to 0·026 mm. long, which were without the egg covering, and were observed in the process of segmentation. We may consider these hitherto unknown forms as summer eggs. The winter eggs which have already been examined by other naturalists have, as is known, other characters; they are in the same species of which I examined the summer eggs, 0·06 mm. long, and have a thick shell.

As to the male generative organs of our animals I still remain in the dark; but still I retain the hope of finding out their relation through other experiments. I can only put forth the supposition that certain cellular bodies which I found in some individuals of *Chætonotus* represent the male genitals. This supposition cannot be proved, but still it is possible that our animals, as the Rotatoria, show a sexual dimorphism, and that the rare male has till now entirely escaped me.

Amongst different algæ, Infusors and Rotatoria, I once found a few eggs which were 0·02 mm. to 0·033 mm. long, and which were provided with a pretty thick shell, whose inside contained a perfectly formed, lively embryo in a bent-up position. These embryos, which belonged to *Ichthydium podura,* were perfectly like their parents, and were only to be distinguished from them by wanting the generative organs. This remark is at least interesting, because it shows the absence of any metamorphosis in the Ichthydina.

Having made these incomplete remarks on the interesting family of Ichthydina, I shall allow myself to make some observations on the systematic position, that is, the relationship of these animals.

Ehrenberg has already made known that the Ichthydina differ from the Rotatoria in many respects, an idea which Dujardin takes up much more strongly, separating our animals entirely from the Systolids. The difference between these two groups is in the absence of the jaws and a resistent body-covering in Ichthydina, and in the want "de cette contractilité, qui est tout-à-fait caractéristique chez les Systolides." Although the first point, namely, that of the absence of jaws in Ichthydina, on the whole is quite right, yet I do not think that we can consider this character as an important one, because we know for certain that the Rotatoria show a great variety in their digestive organs. I need scarcely remind you of the male, who is completely without these organs, or of the presence or absence of the anus in different forms of Rotatoria. We know, too, that the jaws which are constantly present in the female show often a striking variation, as, for example, in *Albertia crystallina;* but most probably the absence of jaws in the Ichthydina is a property which will always serve as a certain distinction between them and the Rotatoria.

But it is otherwise as regards the other points put forth by Dujardin, since the absence of a stout integument and a peculiar kind of contractility cannot in any way be used as a systematic character. Strictly speaking, this statement of Dujardin is not at all true, because there is no difference between the movements of some kinds of Notommata and those of Ichthydina.

I leave the idea of Schmarda, namely, that the Ichthydina belong to the Naids, without further notice, because even Schmarda himself does not try to prove his view. I am quite certain that this view is as worthy of acceptance as the supposition that the Rotatoria are stationary annelid larvæ.*

Max Schultze finds other grounds for the separation of the Ichthydina from the Rotatoria. He says, "A uniting of the Ichthydina with the Rotatoria is impossible, because of the want in the former of the vibrating organs on the mouth and the back, and of the perfection of the muscles, nerves, and water vessels, which are so characteristic of the Rotatoria."

Against the truth of the first position of Schultze I may advance the presence of cephalic cilia on *Cephalidium*, and the form of the vibrating apparatus in some wheel animals (for example, *Furcularia*, *Diglena forcipata*, and *Notommata*), where it is represented by a simple vibrating patch which lies on the surface of the belly. The other suppositions of Schultze are also wrong, because different muscles and nerves are wanting just as much in many lower Rotatoria as they are in Ichthydina. The nervous system is found in a very few Rotatoria. Moreover the water vessels in many Rotatoria consist only of contractile bubbles, and are wanting altogether in *Albertia crystallina*, as Schultze himself says.

We cannot agree with Schultze, that the Ichthydina are more nearly allied to the Turbellaria than to any other group, and we even believe that our animals bear only a very distant likeness to the Turbellaria, that is, to the Annelids.

Let us try to prove the relationship of Ichthydina with the Turbellaria by nearer comparison. As to the properties of the body, we cannot fail to remark that the typical flattening of the more or less oval body of Turbellaria does not exhibit itself in any of the animals belonging to the group of

* It is Prof. Huxley's explanation of the morphology of Rotatoria which the author rejects.

Ichthydina, whilst the peculiar bottle- or retort-like shape of the latter is entirely strange to the Turbellaria. The furcal appendages on the tail of Ichthydina present also a striking difference between them and the Turbellaria. In the same way the characteristic integuments show very constant and important differences. The outside covering of the Turbellaria consists of a soft epithelial tunic, whose cells are all or nearly all provided with vibrating hairs, amongst which there are comparatively seldom stiff feeling-hairs. A cuticula is wanting in all Turbellaria in Arhynchia, as well as in Rhynchocœla. I may state this the more safely in contradiction to Keferstein, who describes the Nemertina as having a cuticula, because I have searched in vain for it in all the Nemertina which I found in Heligoland.

But the outside covering of the Ichthydina is quite different; these possess, as I have before stated, a firm cuticula, which consists of chitin, and which bears a number of different firm excrescences. The vibrating hairs of our animal are, in comparison with those of Turbellaria, very closely distributed, and are also peculiar on account of their conjunction with the cuticula. These differences in the integument, which also give rise to the differences of form in the two groups, seem to be so striking that we may readily use them as proofs against the opinion of Schultze, whilst the anatomical properties also of these animals do not present any striking agreement. Besides this, I must remark that, as we have seen above, the peculiarly simple organisation of the Ichthydina cannot have so great a systematical worth as other naturalists think. If one were to consider the negative character, the want of muscles, nerves, and water vessels, of our animals as important in regard to their systematic position, we could use the same character in regard to Infusors, and, in fact, to all animals which show a like want.

Neither can I agree with Ehlers' idea above mentioned, since I can see no important reasons for the relationship of Ichthydina with Nematodes in the alimentary apparatus of the former. The winding of muscular tissue in the œsophagus is present in Rotatoria and Tardigrada, and the straight intestine in a number of lower animals. The secondary likeness in the formation of the digestive organs loses all importance when we compare the other organs of the Ichthydina and Nematodes, which have nothing in common.

From the foregoing remarks it is easy to see that I believe the nearest allies of our animals to be the Rotatoria. This is shown, not only by the above attempts at combating the ideas of Schultze and Dujardin, but also by a nearer comparison of the two groups of animal. Concerning the former we must admit that the bottle-shaped forms of *Chætonotus, Ichthydium,* and *Cephalidium,* are like no forms of Rotatoria; but, on the other hand, we may add that our *Chætura* bears a great resemblance to certain soft wheel animals, for example, to *Notommata tardigrada.* The furcal appendages of our Ichthydina find analogous forms only in the Rotatoria. The similarity of form of the vibrating apparatus, which becomes apparent especially on comparing the interesting ciliated apparatus in *Cephalidium* with certain wheel animals, I have mentioned and considered as a point of relationship between the two animal groups. The presence of two kinds of eggs in our animal speaks strongly for my idea; as regards the other organs, we can satisfy ourselves if we remember the above critique on the ideas of other naturalists. We add only one more proof, namely, that the highly developed sensory organs in the Ichthydina agree with the same structures in the Rotatoria. The relationship between the two groups cannot be carried into details. The absence of jaws, and the presence of ventral cilia, in the Ichthydina, together with a few secondary properties, show striking differences between them. If we reckon all these circumstances together, we come to the conclusion that the Ichthydina form a small group of themselves, which is related to the Rotatoria, and is best named Gastrotricha. If we call the wheel animals after their most striking character, Cephalotricha, then we can perhaps not unfittingly form a new class out of these two orders, which possess some relationship with the Vermes, and a still more distant one with the Arthropods.

The arrangement of the Gastrotricha consists at present of six genera:—*Chætonotus* (Ehrenb.), *Ichthydium* (Ehrenberg), *Turbanella* (Schultze), *Sacculus* (Gosse), *Chætura* (Mihi), and *Cephalidium* (Mihi).

II. Remarks on Echinoderes.—Dujardin has described under this name a remarkable animal which he found at St. Malo, which appeared to be related to the Worms as well as the Rotatoria and lower Entomostraca. The same animal was found by Leuckart in Heligoland, and was considered to be a Dipterous larva. Claperède has lately made some further remarks concerning this creature, which he calls *Echinoderes Dujardinii,* and has added some remarks on a second new form, namely, *Echinoderes monocercus.*

I have found and examined both the species mentioned, in Heligoland; but, nevertheless, have found nothing which can give any conclusive result as to the nature of these remarkable animals; therefore my wish is only to amplify or correct some conclusions of Claperède, which merely touch upon the outside skeleton.

The body of our animal (*Echinod. Duj.*) is convex on the back, and, on the contrary, concave on the belly, so that the diameter shows a kidney-like form. The three foremost segments differ in that they seem to be convex on the ventral surface. The first body-segment consists of a thin lamella, which is provided with perpendicular thickenings of the cuticula, with a bending character, and which therefore differs from all the other rings. It is a formation which is obviously necessary for the pushing in and out of the snout-like head. The following segment possesses a strong cuticula, which is simply thickened on the upper edge, and which shows on the lower edge a fine marking. The markings resemble thickened stripes on the edge of the cuticula, and form in no way, as Claperède represents, "a girdle of stiff bristles, which arise from different pieces of chitin." The third, which is also biconvex, differs from the others principally because on its thickened ring begins a division into sections. Two tergal pieces are formed by a looping on the middle line in the back, which pass to the side parts of the body, and stop again at two symmetrical loops of the unequal sternal portion. On the back surface of the third segment is a middle unpaired tuft of bristles.

The skeleton commences only in the fourth segment, and does not occur, as Claperède states, in every segment but the first. Here the sternal plate splits itself into two separate pieces by a deep crack which lies in the middle of the body, formed by bending in the concavity of the ventral surface. In this segment, as well as in all following, the above-mentioned indentation, which divides both the tergal portions, can be plainly seen—a fact which Claperède has quite overlooked, as he described the whole skeleton as consisting of only one tergal and two sternal parts.

The formation of the skeleton as described by me in the fourth is true for all the following, and for the last or furcal segment which is formed by two plates. The strong ventral and more weakly marked dorsal indentations both continue to the end of the body. The furcal parts carry on both sides a long and a shorter tuft of bristles, which, like the bristles on the penultimate segment, arise from the ridge of the skeleton. But the other bristles are placed very differently. In the middle of the back, in the neighbourhood of the dorsal indentation, there is a bristle from the third to the ninth segment, and on the sides of the body there is from the sixth to the tenth segment just such a one on each side.

Besides the *E. Dujardinii* upon which the foregoing remarks touch, I have also examined *E. monocercus* as described by Claperède. I have also a few remarks to make on this form.

This second kind is about 0·2 mm. long, and is easily distinguished through the pale colour of the skeleton, but one finds still further differences if one examines it closely. Claperède speaks as follows about it:—"Instead of the long terminal bristles of *E. Dujardinii*, we find in *E. monocercus* an unequal tail-tuft of bristles which really belongs to the back, so that the anus comes to lie underneath it; as to the rest, the exo-skeleton of *E. monocercus* agrees with that of *E. Dujardinii*." But in spite of this plain statement the skeleton of both these kinds is strikingly different; not only in *E. monocercus* is the division of the exo-skeleton into four parts wanting, but it differs from the former species in that the unequal bristles on the posterior segments increase in size. The tail-bristle in *E. monocercus* agrees therefore in no way with the last bristle in *E. Dujardinii*, as Claperède believes. The correctness of my idea is borne out not only by the circumstance that this bristle lies above the anus, but also by a peculiarity of *E. monocercus*, which Claperède had overlooked, and which first induced me to oppose his ideas. This peculiarity is that *E. monocercus* consists of eleven segments, and not twelve, as *E. Dujardinii*. Therefore the last furcal segment is wanting in *E. monocercus*, and the last segment in this species agrees with the last but one in the other. The difference in the bristle armature of the two kinds consequently reduces itself to this—namely, to the presence of the dorsal, that is, the side bristles on the last segment of *E. monocercus*.

But at the same time I think I may consider this kind to be only a young condition of *E. Dujardinii*.

As regards the inner inaccessible organisation of our animal I can only add some remarks to those of Claperède. I must first state that our animal possesses a layer of side muscles under the integument, whose single broad structureless fibres stand far from one another, and run through the whole length of the body. I may also add, that the sexual organs described by Claperède cannot be counted as male or any other part of the generative apparatus, because they consist of an ill-defined mass of cells, which lie on each side in the four last segments, and have no plain communication with a tube or efferent canal, as Claperède supposes.

As to the systematic position of this animal, through our incomplete knowledge of it, it is difficult to say much. It seems to me possible that the *Echinoderes* represents the larval condition of a perhaps unknown creature. At all events, the independence of this animal can scarcely be proved. This much is certain, that the *Echinoderes* bears no remarkable relationship to the Ichthydina, as M. Schultze believes, and still less to Nematodes, as Ehlers maintains.

III. CONCERNING THE OUTSIDE STRUCTURE OF DESMOSCOLEX.—After having spoken of a very little known animal, I will now pass on to a still less known one, which was discovered by Claperède, and named by him *Desmoscolex minutus*, which I have found in Heligoland. This animal possesses, besides the head, eighteen strongly chitinised brown-coloured rings, which are separated from one another by pale elastic spaces. From the brown rings (the head being omitted) spring peculiar tubercles, which Claperède considers to be compound Annelid bristles, and which he has used for the foundation of his ideas on the zoological nature of these animals. But the closer examination of these bristles allows us to contradict the idea of Claperède. Each such bristle forms an uninterrupted continuation of the segment ridge itself, and is not therefore planted in the space of the same, as is the case with Annelid bristles. To this may be added that the somewhat crooked and tapering bristles show in the inside a fine canal, and pass at their end to a fine flat point, which must be considered as a particular part of the bristle, but which at the same time can give no foundation for a comparison with a compound Annelid bristle. Both parts stand in uninterrupted connection with one another, and therefore present a form which I consider as a sensitive hair, and would in a certain sense compare with cirrhi and tentacular cirrhi.

After my description and elucidation of the bristles, their position on the head will lose all that is paradoxical. Besides the four head bristles, Claperède describes in his species others which are placed on each side of the second, fourth, sixth, eighth, &c., segments. This description does not entirely agree with his drawing, where there is no bristle to be seen at the sixteenth segment, but where on the other hand the following segment is provided with four.

In our species—if it represents a new kind at all—the position of the bristle is still more peculiar. Our animal bears throughout, besides the four head bristles already known, one pair on each segment (with exception of the eleventh and fifteenth). One of the bristles lies in the median line of the animal in the second, fourth, sixth, tenth, twelfth, fourteenth, and seventeenth segments, on the ventral surface, and in all the rest on the dorsal surface (compare Pl. V, fig. 9). The side bristles are placed on the left of those segments which carry the ventral median bristles, and in the rest on the right. The last, and at the same time the smallest, ring forms an exception, in that its two terminal bristles are very near one another, and arise from the under edge of the segment.

These remarks may be sufficient to show, in spite of the contrary supposition of Claperède, that these animals are not in any way allied to the Annelids, and in fact not to the Worms at all. It strikes me as being probable that Desmoscolex is the larval condition of a known or unknown Arthropod, and I can only hope that more fortunate researches may very soon give a firmer footing for a judgment on the question.

QUARTERLY CHRONICLE OF MICROSCOPICAL SCIENCE.

GERMANY.—We fear that our anticipations expressed in the last Chronicle have proved too true. We have not received any number of the 'Zeitschrift,' or of Max Schultze's 'Archiv,' since last May, and can only conclude that the excitement and pressure caused by the late war have delayed their publication.

Muller's Archiv. July.—The following microscopical papers occur in this number:—"*Microscopical Researches on the Texture, Development, &c., of Fatty Tissue,*" by Herr Czjawicz. "*On the Black Pigment of the Lung and the Lung Cuticle,*" by Herr Mettenheimer. "*On the Tracheæ of Tenebrio molitor* (*Meal worm*)," by Drs. Landois and Thelen. "*On Spiral Bundles in the Sympathetic of the Frog,*" by Dr. J. Sander. "*On the Typical Structure of the Echinodermata,*" by Dr. Dornitz.

FRANCE.—**Comptes Rendus.**—"*On the Reproduction and Embryogeny of the Aphides,*" is the title of a paper lately laid before the Academy by M. le Dr. Balbiani. The author remarks that, "according to the ideas which observers have formed of the nature of the reproductive organs of these insects, their multiplication has been referred sometimes to the phenomenon of alternate generations, sometimes to those of parthenogenesis. As regards the opinion which assumes an androgynous condition in these animals, and is still maintained by some authors, as well as by Leeuwenhoek, Cestoni, and Réaumur, it rests upon a mere hypothesis which has not yet received its demonstration by the detection of the male element in the viviparous Aphides." It is this last view which M. Balbiani defends in his paper, by adducing observations which he considers afford the positive proof for which science

has waited since the time of the illustrious observers who first pronounced in favour of the hermaphroditism of these creatures. He believes that this state is the normal condition of the Aphides throughout the viviparous period of their existence, and that, under certain determinate conditions, a separation of the sexes is effected, and their mode of reproduction reverts to the law common to the generality of species of animals.

The ovary of the viviparous Aphis is minutely described by the author, and the changes undergone by the ovum or pseud-ovum, in its earlier stages, in the first part of his paper. In the second, the embryonal development is entered upon, and the evolution of a seminal vesicle and two male glandular cords is described. The seminal corpuscles are stated to be developed from larger coloured cells which constitute the mass of the male organs situated in the vicinity of the ovaries. They have an amœboid form, and sometimes break up into small, unequal bacilli, ·005 mm. in length. M. Balbiani states that several times he has succeeded in seeing some of these corpuscles in the ovarian tubes, or forming small groups at the bottom of the terminal chamber of the ovigerous sheaths.—The third portion of the paper is devoted to the consideration of the oviparous-sexual Aphides. Up to the period of birth, the development of both oviparous and viviparous Aphides is stated to be the same. It is only when their development has become considerably advanced that the first tendency to the separation of the sexes is manifested. The separation is not effected by the atrophy of one of (what M. Balbiani considers to be) the sexual apparatuses. The male apparatus is said not to disappear, but is found after birth, in individuals of both sexes, with characters scarcely differing from those which it presents in the viviparous Aphides. M. Balbiani says that this male embryonic organ must not be confounded with an ordinary testis; but he will not say what it is until another occasion. He maintains that this male organ arrives at maturity even in the females which are to produce eggs in the usual manner, to be fertilised by copulation, and that it, in some mysterious manner, fecundates the ovum within the female before copulative fertilisation has occurred. It really would be very desirable that we should hear a little more about this extraordinary male organ, which is not a testis, and which nevertheless is said to impregnate the ova of viviparous and oviparous Aphides, which possess it. Surely it is not correct to apply the term hermaphrodite to a female simply because she may possess this very questionable organ. Like too many of

his countrymen, we notice that M. Balbiani pays very little regard to what previous observers have written on the same subject.

Annales des Sciences Naturelles. Tom. V.—"*On a New Parasitic Crustacean, belonging to the order Lernæida, forming a new family,*" by M. Hesse. The very remarkable crustacean described by M. Hesse was observed by him very commonly burrowing in the scales of the Green Wrasse (*Labrus Donovani*). It has five thoracic and six abdominal segments; the head terminates in a round point, and has a single median eye. The male is unknown. M. Hesse systematises this form as follows among the Lernæida:—"Family *Lernæosiphonostomeæ.* Females fixed upon their prey by means of the scales of the latter, in which they hollow out a residence. Several footjaws placed around the mouth. Head not horned. Oviferous pouches, large and flat.—Genus *Lepidophilus*. Body fusiform, divided into eleven segments which are very distinct, with the exception of the third and fourth; of these five are thoracic and six abdominal; all surrounded by a transparent border. Head small, rounded at the apex, bearing above a median eye, and beneath presenting the buccal orifice, which emits, in a proboscidiform process, some denticulated jaws adapted for the trituration of objects, and laterally three pairs of prehensile footjaws. Antennæ very small, rounded at the end, and terminated by divergent hairs. Abdominal segments retractile and capable of invagination; last segments terminated by divergent appendages. Embryo ovulate, furnished with three pairs of feet. Eggs agglutinated, and forming a broad flat mass.—Species *Lepidophilus Labri*. Colour varying from yellow to pale red. Length about 10 to 12 mm."

July.—"*New Observations on the Multiplication of the Cecidomyiæ,*" by M. F. Meinert.—The author gives an abstract of two papers published by him on this subject, of the greatest value; they appeared in M. Schjödte's 'Naturhistorisk Tidsskrift,' 3rd ser., vol. iii. In the first, entitled "*On the Origin of the Germs in the Larvæ of Miastor,*" he maintains, contrary to the opinion of Pagenstecher, that the germs of the larvæ originate in the adipose tissue (see former Chronicles). The second, which is entitled "*Some further Words on the Miastor,*" contains some remarks on the formation of the germs in another larva of the Cecidomyiæ, and on the formation and the development of the egg in animals in general. And here the author describes more minutely the relation between the germs and the *corpus adiposum*. He also was the first to show that two forms of two very different genera [illegible] been the subject of the researches of different authors;

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That of Wagener is the *Miastor*, that of Pagenstecher and Leuckart is *Oligarces*.

In *Miastor*, the cells which become germs form part of the adipose tissue; but in *Oligarces* they are a little separated from it, though they do not form an ovary properly speaking, for all the cells develope into eggs and larvæ, and none serve to form the stroma, or envelopes of the eggs, nor any analogous functions. M. Meinert explains the peculiarities of the Cecidomyia larvæ by the following general views:—The egg is composed either of a single cell, the "germinative cell," or of the germinative cell accompanied byothers—"vitelline cells," or their secretion the "vitelline mass." The mammalian egg, and that of most inferior animals, belongs to the first category. That of other animals, and especially that of birds, belongs to the second, and that of most insects to the third sort. The single "germinative cell" of which the nucleus is the "germinal vesicle" is subject to the vitelline segmentation so much discussed. The "vitelline cells" and the "vitelline mass" are never broken up, but pass without any form of development to the nutritive vitellus. The germinative cell divides by "vitelline segmentation" (or, as one ought by rights to call it, "segmentation of the germinative cell") into minute cells (embryonic cells). One part of these embryonic cells, which are not absorbed by the formation of the embryo, furnish the material for the new ovaries and testicles; and generally some of the cells form a stroma which separates and encloses a more or less considerable quantity of other cells. The non-separated cells which remain form, among the insects, what one calls "the adipose tissue." Another element, the sperm, is necessary among most animals in order that the egg, or rather the germinative cell of the egg, may be able to develope; but this stimulus is not always necessary among a large number of inferior animals. The development of the egg does not depend at all upon a certain more or less advanced point of development of the maternal animal, or of its ovary; for the maternal animal attains sometimes a complete development, even with the external and internal genital marks (parthenogenesis, the Bee); sometimes it advances only to the larval condition without genital marks, and this may repeat itself through several generations—in some cases under the same larval form (our Cecidomyia), sometimes under a diverse exterior (alternating generation, or rather metagenesis, Trematodes). M. Meinert does not at all admit that there is a marked limit between parthenogenesis and metagenesis, and that one can, for example, explain in two ways the mode of

propagation in the Aphides. In relation to other insects, he considers it as characteristic, that whilst it is necessary in general to draw a distinction between the epithelial and vitelline cells, and that these last serve solely to nourish the embryo, the epithelial cells in this case, on the contrary, serve for the epithelium and vitelline cells of the larvæ.

Journal de l'Anatomie et de la Physioligie (Robin's).—In the number of this periodical issued for the months of July and August, will be found a paper "*On the Organisation of the Linguatulæ of Serpents,*" by M. Jacquart, the best part of which is the plate. The nervous system is well figured, the author having established the fact of the existence of a sub-œsophageal ganglion, but he has failed to trace any cerebriform ganglion. The embryos of the Linguatulæ described are figured, and the author remarks that they are quite similar to those of the Lernæans.

The number for September and October contains some good papers.

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"*Researches on the Structure of the Pulmonary Vesicle, and on Emphysema,*" by M. Villemin.—This paper appears to be of some pathological interest. It was originally communicated to the French Société de Micrographie.

Among the miscellaneous extracts and notices at the end of Robins's Journal, we would draw attention to—

"*Hæmatozoa found in the right Heart of a Dog,*" by M. Collas.—It appears that the dog in question fell down dead, when a post-mortem showed a mass of entozoa, fourteen to fifteen in number, packed together in the right ventricle, auricle, and pulmonary artery. The largest was 230 mm. in length. When the worms were crushed, little worms came out from them 72 mm. in length, very fine and thread-like. The parasite appears to be the *Pseudalius filum* of Dujardin, common in the Porpoise.

"*On the Action exercised by Electricity on the Noctiluca miliaris,*" by MM. Ch. Robin and Ch. Legros.—In the first place, the authors feel satisfied that the phosphorescence exhibited by *Noctiluca* is not localised at any particular spot, but is exhibited at the centre of irritation. If the irritation is increased, the phosphorescence becomes general. A current of electricity was made to pass through a vessel containing *Noctiluca*. The effect produced was a line of phosphorescent *Noctilucæ* between the poles of the battery used, the phosphorescence ceasing and recurring with the making and breaking of the electric circle.

ENGLAND.—**Annals and Magazine of Natural History.** July.—"*On the Affinities of Peridinium Cypripedium, Jas. Clk., and Urocentrum Turbo, Ehr.,*" by Prof. H. James Clark, A.B., B.S., Soc. Am. Acad.—In this paper Mr. Clark replies to an attack upon his identification of Peridinium, lately made by Mr. Carter in the 'Annals.' An abstract of the original paper was given in these pages.

"*On the Rhabdocœla,*" by E. Mecznikow.—This is a translation, by Mr. Dallas, of an interesting paper by this hard-working observer. In the first part of his paper he discusses the reproductive organs of *Prostomum*, describes a new species, *P. Heligolandicum*, and states that he met with Claparède's *P. Caledonicum* in Heligoland. Secondly, he briefly describes a marine species of *Acmostomum*, a genus established by Schmarda on two North American brackish-water forms. Thirdly, he describes a remarkable Turbellarian allied to the *Alaurina prolifera* of Busch, once found at Malaga, and similar also to a form described by Claparède as a larval Turbellarian occurring on the Scottish coasts. Both these animals were sexless. Herr Mecznikow's specimens were composed of four parts, the foremost being longest, the total length of the animal being 1½ mm. The anterior part was furnished with a tactile proboscis, differing in colour from the body, and in the absence of the fine coat of cilia by which that was covered. There were no strong vibratile hairs as in Claparède's animal, but there was a long posterior seta similar to those of Busch's *Alaurinæ*. The pharynx was muscular, and the intestine straight; no trace of a nervous system occurred. On either side of the body was a fine water-vascular stem. This *Alaurina* is evidently not a larva, since in each segment hermaphrodite organs were present. The four parts are not to be considered as buds which will separate, but as analagous to the joints of the animal colonies of *Cestoda*, as suggested by Prof. Leuckart to the author. He would classify the *Microstomæ* and *Alaurinæ* as allied families under the Rhabdocæla.

August.—*Observations on the Microscopic Shell-structure of Spirifer cuspidatus, Sow., and some similar forms*," by F. B. Meek.—This abstract from 'Silliman's American Journal' for May, 1866, is of considerable interest as bearing on the late controversy between Dr. Carpenter and Professor King as to the structure of *Rhynchopora Geinitziana*. Mr. Meek shows that the shell of *Spirifer cuspidatus*, both of American and Irish specimens, is clearly punctate, contrary to the decision of Dr. Carpenter. It must, however, be borne in mind that the statements of so practised and able an observer as Dr. Carpenter are not lightly to be called in question either by Mr. King or Mr. Meek.

September.—"*On two New Species of Freshwater Polyzoa*," by Edward Parfitt. The species described and figured are called *Plumatella lineata*, and *Pl. Limnæ*. The first is from a pond, the second from the canal at Exeter.

British Association.—Microscopical papers were not abundant at Nottingham, but we have one or two to chronicle.

"*On the Movements of the Protoplasm of the Egg of Osseous Fishes*," by Dr. Ransom, of Nottingham.—This and the paper the title of which is given below are, to a certain extent, parts of a memoir lately presented by the author to the Royal Society, of very great interest, and the result of very careful researches. The contractions exhibited by the yelk were shown to be independent of the action of spermatozooids, and to be reactions following the entrance of water into the breathing chamber; and this not only as regards the rhythmic waves which pass over the surface of the food-yelk, but also the fissile contractility of the formative yelk, by virtue of which it cleaves into irregular and unsymmetrical masses, and which the author conceived only to be *regulated* by the influence of the seminal particles. The cortical layer of the food-yelk, or inner sac, shown to resist in a remarkable manner osmosis, is found to be the rhythmically contractile part, although requiring for the manifestation of movements the presence of acid food-yelk upon its inner surface. Evidence was given to show that the contractile property of the yelk of both kinds requires, as an essential condition of its manifestation, the presence of oxygen in the surrounding medium. Proofs were given that a certain moderate rise of temperature increases the activity of these contractions. The reactions of the yelk under the stimulus of galvanism were also recorded, the food-yelk and cortical layer alone being excited to contraction by it. Poisonous agents had very little effect on the yelk-protoplasm: carbonic acid, however, rapidly destroyed the contractility, and chloroform arrested it for a time.

"*On the Structure of the Ovarian Ovum of Gasterosteus leiurus*," by Dr. Ransom.—This paper will be published in full, with illustrations, in the next number of this Journal.

"*On the Question, Whether Carbonate of Lime exists in an Amorphous or Crystalline State in the Egg-shells of Birds*," by Dr. John Davy.—The author gave his observations, which led him to conclude that the condition was amorphous. In the discussion which followed, Mr. Charles Stewart, of Plymouth, maintained that the polariscope revealed a crystalline structure in what Dr. Davy regarded as amorphous particles.

"*On the Action of Carbonic Oxide on the Blood*," by Dr. A. Gamgee.—When carbonic oxide is passed through venous blood, it acquires a persistently florid colour, which was first pointed out by Claude Bernard; and the colouring matter, although it possesses a spectrum identical with that of ordinary blood, is distinguished from it by not yielding, when treated with reducing agents, the spectrum first described by Stokes as that of reduced or purple cruorine. This property of carbonic oxide blood was first published by Hoppe. As a result of his own investigations, Dr. Gamgee has found—First, that the peculiar compound of carbonic oxide and blood colouring matter is formed even when the latter has been reduced, and is still in the presence of a large excess of a reducing solution. Secondly, that when the compound of carbonic oxide and colouring matter is treated with acetic acid, whilst hæmatine is formed, carbonic oxide is disengaged. Thirdly, that carbonic oxide, besides modifying the optical properties of the colouring matter of blood, affects in a remarkable manner the point at which it coagulates, so that, under its influence, an almost perfect separation of the hæmatoglobulin (using the term to express the normal colouring matter of the blood) from the albumen may be effected. Normal ox's blood, when diluted with nin[illegible] its volume of water, becomes turbid at 145° Fahr.; and when the temperature has reached 172° Fahr. its colour is completely destroyed. If such a blood solution have been treated with carbonic oxide, whilst, when the temperature has been raised to 172°, the albumen has separated in flakes, the blood colouring matter remains wholly unchanged. It is only when the temperature is raised to about 185° that the colouring matter commences to coagulate. The coagulum which is obtained on further heating is of a reddish colour, unlike that of normal blood. Fourthly, if blood be saturated with CO, and evaporated to dryness at a temperature below that at which the colouring matter coagulates, the dry residue yields its colouring matter to water, and the solution presents all the optical properties of carbonic oxide blood. When this solution is boiled, the compound with the colouring matter yields carbonic oxide gas. Fifthly, poisoning by pure carbonic oxide, or by the fumes of charcoal, invariably leads, before death occurs, to those changes which are characteristic of carbonic oxide blood, becoming quite irreducible. *Sorby's micro-spectroscope* answers admirably for these investigations; and the solution which Dr. Gamgee recommends for this special process is one containing tin, in preference either to sulphide of ammonium or protoxide of iron. Sixthly, whilst it results from Dr. Gamgee's researches that no gas or poisonous agent exerts the peculiar action on blood colouring matter which is produced by CO, it is specially to be noticed that prussic acid and laughing gas, which have the power of rendering blood florid, do not prevent its being reduced. Thus, the question which Claude Bernard suggested some years ago, as to whether prussic acid exerts on blood a similar action to that of carbonic oxide, is answered in the negative.

"*Remarks on the Rhizopoda of the Hebrides,*" by Henry B. Brady, F.L.S.—The author stated that whilst the question was still occasionally raised as to the amount of good resulting from the annual money-grants of the associations for aiding researches in marine zoology, it was obviously the duty of those who had facts of interest obtained by their means to bring them before that section. It was with this view that he presented a few points concerning the Foraminifera contained in Mr. Jeffrey's dredgings in the Hebrides. He proposed merely to touch on the subject, leaving details to a future paper, when he should have had time to conclude his examination of the material. Of the total number of species and tolerably permanent varieties hitherto numbered in the British fauna—which might be regarded as 121—seventy-six had occurred in the Hebrides dredgings. In

has waited since the time of the illustrious observers who first pronounced in favour of the hermaphroditism of these creatures. He believes that this state is the normal condition of the Aphides throughout the viviparous period of their existence, and that, under certain determinate conditions, a separation of the sexes is effected, and their mode of reproduction reverts to the law common to the generality of species of animals.

The ovary of the viviparous Aphis is minutely described by the author, and the changes undergone by the ovum or pseud-ovum, in its earlier stages, in the first part of his paper. In the second, the embryonal development is entered upon, and the evolution of a seminal vesicle and two male glandular cords is described. The seminal corpuscles are stated to be developed from larger coloured cells which constitute the mass of the male organs situated in the vicinity of the ovaries. They have an amœboid form, and sometimes break up into small, unequal bacilli, ·005 mm. in length. M. Balbiani states that several times he has succeeded in seeing some of these corpuscles in the ovarian tubes, or forming small groups at the bottom of the terminal chamber of the ovigerous sheaths.—The third portion of the paper is devoted to the consideration of the oviparous-sexual Aphides. Up to the period of birth, the development of both oviparous and viviparous Aphides is stated to be the same. It is only when their development has become considerably advanced that the first tendency to the separation of the sexes is manifested. The separation is not effected by the atrophy of one of (what M. Balbiani considers to be) the sexual apparatuses. The male apparatus is said not to disappear, but is found after birth, in individuals of both sexes, with characters scarcely differing from those which it presents in the viviparous Aphides. M. Balbiani says that this male embryonic organ must not be confounded with an ordinary testis; but he will not say what it is until another occasion. He maintains that this male organ arrives at maturity even in the females which are to produce eggs in the usual manner, to be fertilised by copulation, and that it, in some mysterious manner, fecundates the ovum within the female before copulative fertilisation has occurred. It really would be very desirable that we should hear a little more about this extraordinary male organ, which is not a testis, and which nevertheless is said to impregnate the ova of viviparous and oviparous Aphides, which possess it. Surely it is not correct to apply the term hermaphrodite to a female simply because she may possess this very questionable organ. Like too m—— —f

his countrymen, we notice that M. Balbiani pays very little regard to what previous observers have written on the same subject.

Annales des Sciences Naturelles. Tom. V.—"*On a New Parasitic Crustacean, belonging to the order Lernæida, forming a new family,*" by M. Hesse. The very remarkable crustacean described by M. Hesse was observed by him very commonly burrowing in the scales of the Green Wrasse (*Labrus Donovani*). It has five thoracic and six abdominal segments; the head terminates in a round point, and has a single median eye. The male is unknown. M. Hesse systematises this form as follows among the Lernæida:—"Family *Lernæosiphonostomeæ.* Females fixed upon their prey by means of the scales of the latter, in which they hollow out a residence. Several footjaws placed around the mouth. Head not horned. Oviferous pouches, large and flat.—Genus *Lepidophilus.* Body fusiform, divided into eleven segments which are very distinct, with the exception of the third and fourth; of these five are thoracic and six abdominal; all surrounded by a transparent border. Head small, rounded at the apex, bearing above a median eye, and beneath presenting the buccal orifice, which emits, in a proboscidiform process, some denticulated jaws adapted for the trituration of objects, and laterally three pairs of prehensile footjaws. Antennæ very small, rounded at the end, and terminated by divergent hairs. Abdominal segments retractile and capable of invagination; last segments terminated by divergent appendages. Embryo ovulate, furnished with three pairs of feet. Eggs agglutinated, and forming a broad flat mass.—Species *Lepidophilus Labri.* Colour varying from yellow to pale red. Length about 10 to 12 mm."

July.—"*New Observations on the Multiplication of the Cecidomyiæ,*" by M. F. Meinert.—The author gives an abstract of two papers published by him on this subject, of the greatest value; they appeared in M. Schjödte's 'Naturhistorisk Tidsskrift,' 3rd ser., vol. iii. In the first, entitled "*On the Origin of the Germs in the Larvæ of Miastor,*" he maintains, contrary to the opinion of Pagenstecher, that the germs of the larvæ originate in the adipose tissue (see former Chronicles). The second, which is entitled "*Some further Words on the Miastor,*" contains some remarks on the formation of the germs in another larva of the Cecidomyiæ, and on the formation and the development of the egg in animals in general. And here the author describes more minutely the relation between the germs and the *corpus adiposum.* He also was the first to show that two forms of two very different genera have been the subject of the researches of different authors;

That of Wagener is the *Miastor*, that of Pagenstecher and Leuckart is *Oligarces*.

In *Miastor*, the cells which become germs form part of the adipose tissue; but in *Oligarces* they are a little separated from it, though they do not form an ovary properly speaking, for all the cells develope into eggs and larvæ, and none serve to form the stroma, or envelopes of the eggs, nor any analogous functions. M. Meinert explains the peculiarities of the Cecidomyia larvæ by the following general views:—The egg is composed either of a single cell, the "germinative cell," or of the germinative cell accompanied byothers—"vitelline cells," or their secretion the "vitelline mass." The mammalian egg, and that of most inferior animals, belongs to the first category. That of other animals, and especially that of birds, belongs to the second, and that of most insects to the third sort. The single "germinative cell" of which the nucleus is the "germinal vesicle" is subject to the vitelline segmentation so much discussed. The "vitelline cells" and the "vitelline mass" are never broken up, but pass without any form of development to the nutritive vitellus. The germinative cell divides by "vitelline segmentation" (or, as one ought by rights to call it, "segmentation of the germinative cell") into minute cells (embryonic cells). One part of these embryonic cells, which are not absorbed by the formation of the embryo, furnish the material for the new ovaries and testicles; and generally some of the cells form a stroma which separates and encloses a more or less considerable quantity of other cells. The non-separated cells which remain form, among the insects, what one calls "the adipose tissue." Another element, the sperm, is necessary among most animals in order that the egg, or rather the germinative cell of the egg, may be able to develope; but this stimulus is not always necessary among a large number of inferior animals. The development of the egg does not depend at all upon a certain more or less advanced point of development of the maternal animal, or of its ovary; for the maternal animal attains sometimes a complete development, even with the external and internal genital marks (parthenogenesis, the Bee); sometimes it advances only to the larval condition without genital marks, and this may repeat itself through several generations—in some cases under the same larval form (our Cecidomyia), sometimes under a diverse exterior (alternating generation, or rather metagenesis, Trematodes). M. Meinert does not at all admit that there is a marked limit between parthenogenesis and metagenesis, and that one can, for example, explain in two ways the mode of

propagation in the Aphides. In relation to other insects, he considers it as characteristic, that whilst it is necessary in general to draw a distinction between the epithelial and vitelline cells, and that these last serve solely to nourish the embryo, the epithelial cells in this case, on the contrary, serve for the epithelium and vitelline cells of the larvæ.

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PROCEEDINGS OF SOCIETIES.

Dublin Microscopical Club.

April 19*th*, 1866.

Dr. E. Perceval Wright exhibited portions of the ambulacral feet, lining membrane of the intestine, and ovaries of several species of Echinidæ, showing the very peculiar arrangement of spicules which appeared to be characteristic of each. His attention had been called to this subject by his friend Mr. C. Stewart, of Plymouth, who had read a very elaborate paper on these structures as they occur in the Regular Echinoidia before the Linnean Society, and from what he (Dr. Wright) had been able to observe he had little doubt but that the comparative form and structure of these spicules would be of vast importance in helping to discriminate not only between the families, but also between the genera of these Echinoderms. He regretted not being able to show a series of these preparations from Mr. Stewart himself, as he had at first expected, as he had not succeeded in mounting his specimens at all in the same manner as those he had seen prepared by that gentleman: but the specimens he brought to the meeting would still be quite sufficient to justify the remarks he had made. Specimens were shown of the following:—Leiocidaris papillata, Psammechinus microtuberculatus, Psilechinus variegatus, Toxopneustes lividus, Tripneustes ventricosus, Echinometra lucunter, and Acrocladia mammillata. The importance of drawing up diagnoses of the Genera of Echinidæ, not as is usually done, simply according to the number and position of the ambulacral pores and the characters of the spines, but based upon details of all the structures met with in the recent animal, was strongly insisted on. Until some such plan is adopted nothing but an appeal to type specimens will determine genera and species that have been insufficiently described, even by such authors as Dujardin and Hupé, Forbes, Agassiz, and others.

Mr. Archer drew attention again to the Rhizopod he had shown at the January meeting, and which he referred, as yet somewhat doubtfully, to *Difflugia corona*, in order to point out a peculiarity

propagation in the Aphides. In relation to other insects, he considers it as characteristic, that whilst it is necessary in general to draw a distinction between the epithelial and vitelline cells, and that these last serve solely to nourish the embryo, the epithelial cells in this case, on the contrary, serve for the epithelium and vitelline cells of the larvæ.

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glass, a shade wider in diameter and rather thinner than an ordinary slide, is cemented, thus again closing the aperture through the box at one of the surfaces. The upper surface of this circle of glass forms the table on which the object for examination is placed. At the right hand side, just beyond the edge of this circle of glass, and near the lower edge of the box, a small hole is drilled through the upper plate of the box, which is the feeding hole for the water, which is introduced into the box by a small opening ground away at the lower right hand corner. The object is now covered by a square of thin covering glass in the usual way; one angle of the cover extends at the right hand side beyond the circular table, and reaches so far as to cover the little feeding aperture in the box, and the flow is established. There is a little strip of glass cemented at the lower side to prevent the square cover slipping. This plan has the advantage of allowing the light to come up from the mirror, not through a stratum of water, however thin, but directly through a thin plate of glass, permitting, too, the use of the achromatic condenser if needful. Dr. Barker stated he had found this plan to act very well.

Dr. E. Perceval Wright exhibited also Smith and Beck's new modification of Smith's principle of Growing Slide.

Mr. Yeates exhibited a soap-bubble under the microscope, forming a very gorgeous object, owing to the magnificent and ever-changing play of colours which was presented.

17*th May*, 1866.

Mr. Archer exhibited specimens fully conjugated, and in various stages of conjugation, of a filamentous form, which at first sight might be supposed to belong to the genus Zygogonium, as modified and explained by de Bary in his 'Untersuchungen über die Familie der Conjugaten,' p. 79. But though de Bary employs the name Zygogonium, he does not do so in the same sense as Kützing. The name Zygogonium is one of Kützing's, and his genus so denominated may be most briefly defined by saying that it comprehends those Zygnemata in which the zygospore is formed in the middle space, half-way between the conjugating cells; whereas to the genus Zygnema, as understood by him, Kützing would consign those forms only in which the zygospore becomes formed within one of the parent cells, the endochrome in both presenting the characteristic doubly stellate arrangement. Now, there can be no doubt but that de Bary is quite right in doing away with this distinction as a generic one, nor would the distinction be, manifestly, at all available as regards a barren filament. Therefore, although de Bary refers the genus Zygogonium to Kützing, Zygogonium (Kütz.) is not the same thing as Zygogonium, de Bary.

Now there could be almost no doubt, Mr. Archer ventured to think, but that the plant now exhibited would fall under the genus *intended* to be established by Prof. de Bary under this name—that is, had this distinguished observer been present and asked to what genus the plant exhibited should be referred, that he would doubtless have replied that it belonged to Zygogonium, as laid down in his work. There could not be any doubt but that the present, though not the same plant, was at least congeneric with de Bary's. But, on the other hand, if Prof. de Bary be correct in his appreciation of the characters of his plant, and in his views of the genus founded thereon, Mr. Archer thought the present plant could *not* fall under Prof. de Bary's genus as laid down by him, that strict attention being paid to the characters given by him which is enjoined by a rigid scientific accuracy. In other words, assuming the present plant to be really congeneric with that examined by de Bary, then his genus must be regarded as based on a somewhat erroneous foundation; and, if it should be retained at all, it should be so, not for this plant, but for the typal form *Zygogonium ericetorum*, Kütz., or possibly for some others of Kützing's forms in which no conjugation has been seen and whose special characteristics, therefore, in this regard, are, of course, as yet problematical.

In order to draw attention, then, to the reason why Mr. Archer had formed this opinion and ventured on this statement, it would be necessary to give the characters of Zygogonium as modified by de Bary, then to describe the plant now exhibited, and afterwards to compare it with such diagnosis and endeavour to point out its divergencies therefrom, and, finally, to indicate what appeared to Mr. Archer to be its proper location.

The diagnosis of Zygogonium, as given by de Bary (*op. cit.*), is as follows:—"Cells cylindrical or barrel-shaped, with thick often many-layered cell-wall: towards the middle at each side an irregular chlorophyll-corpuscle, furnished with a starch-granule, both often confluent into an axile string (in the very thick-walled filaments mostly covered with granules). Union of the conjugating filaments ladder-formed. The processes of the two cells of the filament which grow opposite one another and take up the chlorophyll contents, become cut off as fructification-cells by septa, which then become fused together to a non-contracted zygospore." ('Untersuchungen,' &c., p. 79.)

The type of this genus so defined is supposed to be the common *Z. ericetorum;* but, as it appears, according to de Bary, that the typical *Z. ericetorum* has not been found conjugated, his allusion to the process in the generic diagnosis is founded on dried examples, from Professor Rabenhorst's collection, of a form named *Z. didymum*, which he (Professor de Bary) considers very closely to resemble the water-form of *Z. ericetorum.*

Now, the plant exhibited by Mr. Archer had short cells varying in this regard from nearly quadrate to three or four times longer than broad, according to the interval of time elapsed since division; the contents bright herbaceous green, forming an axile compressed band (never separate stellate chlorophyll bodies, as in Zygnema); the conjugation taking place by short, wide processes, which, along with the shortness of the cells or joints, gives the pair of conjugating filaments somewhat the appearance of a perforated ribbon-like structure; the total cell-contents of each pair of conjugating joints become massed together into an elliptic zygospore within the inflated transverse tube; the longer diameter of the zygospore placed vertically to the length of the filaments; the cavity occupied thereby not shut off by any septum from the cavities of the parent joints.

That the total cell-contents, "primordial utricle" and all, wholly coalesced to form the zygospore, Mr. Archer had completely satisfied himself both by there being no granular matter whatever left behind in the parent conjugated joints, and by no further contraction of any contents taking place on the application of re-agents. In the same way it was equally evident that there was no septum separating the zygospore from the cavities of the parent-cells, but it lay freely in the inflated transverse process, though frequently in contact with its walls about the middle.

A seemingly fair figure of this type is given in Rabenhorst's 'Kryptogamen-Flora von Sachsen,' &c., p. 162; but the plant is referred by that author to Zygogonium in the Kützingian sense, and de Bary's characters are not taken into consideration. Little information can be drawn from the figure referred to as regards the arrangement of the endochrome in the unconjugated joint, whether doubly stellate or forming a compressed band. If the former it would be a Zygnema, with the zygospore in the middle. It may be assumed, however, that the figure may represent the broad or flat view of the band of endochrome as towards the observer. Therefore, Rabenhorst's figure would be still more likely to represent a plant congeneric with the present, seeing that here the whole cell-contents are represented as fused into the spore, which is not shut off by any septum from the cavities of the parent joints.

Now, the foregoing characters of the plant now exhibited, as has been described, would seem at once so decisive that it should be referred to Mougeotia (de Bary, non Agardh), and not to Zygogonium in either sense, that it might almost be asked why there should be any question on the subject, or any allusion to the genus Zygogonium, de Bary, or Zygogonium, Kütz., as connected with it. For the definition of this well-marked genus (Mougeotia, de Bary, non Ag.), see de Bary's already quoted work (pag. 78, t. viii, figs. 20—25), also Mr. Archer's observations thereon, and on the only hitherto established form therein, *Mougeotia glyptosperma*, de Bary, in the 'Microscopical Journal,' vol. xiv, p. 65 (in the separate copies of the Club Proceedings,

p. 27). In the examples now shown we have a plant whose endochrome forms an axile band, whose zygospore is formed by the total fusion of the entire cell-contents of two conjugating joints into the zygospore within the transverse tube, and without any septum between it and the cavities of the parent joints, This plant is not a Mesocarpus, being quite shut out from that genus for the last reason mentioned. It is in truth a Mougeotia, in the de-Baryian, but *not* the Agardhian sense. It is to be distinguished from *Mougeotia glyptosperma*, de Bary, by its much shorter and wider cells, much wider transverse tubes, by its cells not becoming kneed or curved during conjugation, but presenting (as before mentioned) the appearance of a perforated ribbon-like structure, not a wide-looped network, and above all, by its zygospore being simply elliptic and destitute of the grooves and ribs, and the somewhat acute keel which form so distinguishing features of that of *M. glyptosperma.*

But another reason for bringing Zygogonium, de Bary, into the question in connection with this plant, besides its no doubt considerable general resemblance thereto, was that at certain stages of the process of conjugation the present plant presented appearances so like de Bary's figure (*op. cit.*), but perhaps still more like Rabenhorst's, as to lead to the view, as before mentioned, that it and his plant are congeneric, notwithstanding that de Bary made a separate genus of his plant.

This circumstance alluded to is a standstill, as it were, sometimes noticeable, of the globular mass of the contents of each parent joint, just within the connecting tube, where they became definitely bounded, to appearance as if distinct individualised cells, ultimately, however, coalescing into the zygospore.

Now, the question arises—May de Bary's figures (it will be noted, made from dried specimens) have been possibly taken from examples arrested at this stage of advancement of the process of conjugation, and, from the same cause (that is, dried and deteriorated specimens), may he not have supposed these bodies, thus partially advanced towards conjugation, to be portions only, not the total cell-contents, wholly retracted from the cell-wall? May some external granules have lent to the specimens an appearance of certain granular contents left behind within the parent conjugating cells; and, as regards the two bodies, not yet coalesced, represented by him as specially coated by a cell-wall and separated by a septum from the parent-cells, may they not have been, just as in the specimens now exhibited, simply the contracted total cell-contents, without any special coat, arrested or caught at the point just before mutual fusion?

But great as is the resemblance of the plant figured by de Bary, when we reflect on the beauty and accuracy of his observations in general, it is indeed with difficulty that we can bring ourselves to believe in his having misconceived the character of the plant he describes and calls *Zygogonium didymum;* and if there be really after all no such misconception, then the present plant now exhibited cannot be *Zygogonium ericetorum*, nor any variety, nor can it indeed fall under the genus Zygogonium at all, either as Zygogonium (de Bary), or as Zygogonium (Kütz.); for as already mentioned, as will be seen from the characters above detailed, it must find its place truly in Mougeotia (de Bary, non Agardh). If, on the other hand, de Bary have really erred as regards his plant, the genus Zygogonium, as constituted by him, may possibly not stand, or at least it may have to remain contingent on its being necessary to retain it for the common plant *Zygogonium ericetorum* (Kütz.), for it should not certainly be maintained for those species of Zygnema only, which form their zygospores within the transverse tube.

In endeavouring to identify this plant with any form already described, Mr. Archer ventured to think that it comes quite close enough to *Zygogonium læve* (Kütz.) as to render it probable that they are indeed one and the same thing, though Kützing describes only the barren plant. And if this view be correct, adopting the genus Mougeotia (de Bary, non Agardh), this plant should be henceforth called *Mougeotia lævis*.

Mr. Archer had to apologise for the present somewhat roundabout description of this plant. It is not easy without a figure to convey at once a definite idea of the points dwelt upon, but he trusted his meaning would be sufficiently apparent to observers who have made themselves acquainted with the peculiarities and the characters of these interesting Algæ. Those who have become familiarised with these forms will well know that these distinctions are by no means imaginary, and will, he thought, accord with him in feeling that they each possess an individuality, and that we can know and recognise the same thing, time after time, when it offers itself to observation, although we may not be always able to tell exactly why. And that feeling seems to be increased and strengthened when, as in the present instance, we are able to follow up the characters of a perhaps tolerably familiar form to its fructification, compare it in its various stages with its allies, and, though they are sometimes hard to describe, note its differences and its idiosyncracies.

Rev. E. O'Meara exhibited a species of Coscinodiscus found in a frond of *Vanvoorstia spectabilis*, Harv., from Ceylon. In its general appearance it so much resembles *Coscinodiscus symmetricus*, Greville, that Mr. O'Meara was disposed to identify it with that species. There are, however, slight differences worthy of notice. In the case of *C. symmetricus* the fasciculi of radial beaded lines are seven in number, whereas in the form now presented there are eleven such fasciculi of lines; the marginal portion of the disc in the present case is smooth; in the case of *C. symmetricus* it is striated. This form seems of exceedingly rare occurrence in the material, only one specimen of it having been found.

Dr. Moore showed fine and numerous specimens, perfectly unmixed with other forms, of *Closterium Pritchardianum* (Arch.), which species had presented itself copiously in one of the warm tanks in the Botanic Garden, watered from the River Tolka.

Read, the following extract from a letter from Professor Hodges, of Belfast, dated 27th April, 1866, accompanying a sample of the material alluded to therein:

"Some time ago I received a specimen of the enclosed substance for analysis; and on submitting it to the microscope I was surprised to find that it consisted almost entirely of Diatomaceæ. The person who forwarded it to me stated that it appeared on the surface of a lake near Seaforde, Co. Down, in May, 1865, and covered about 500 square yards, forming a layer three or four inches in thickness, having been driven by the wind into a sort of estuary. The smell was so intolerable that the people were obliged frequently to leave off work in the adjoining fields. I found it to consist, in the 100 parts, of—

Water	87·50
Organic matters	10·30
Inorganic matters	2·20
	100·00

"The mineral matters were chiefly oxide of iron and silica. You will find the substance very rich in Diatoms."

Mr. O'Meara had carefully examined a sample of this very bad-smelling stuff, and had found the following Diatoms:—*Cyclotella operculata*, *Synedra radians*, *S. capitatum*, *S. delicatissima*, *Cocconema lanceolatum*, *C. parvum*, *C. cymbiforme*, *Navicula cryptocephala*, *Diatoma elongatum*, *Tabellaria flocculosa*, *Fragillaria capucina*, *Epithemia Argus*, *E. gibba*, *Cocconeis placentula*, *Pleurosigma attenuatum*, *P. Spencerii*, *Himantidium bidens*, *Nitzschia parvula*, *Gomphonema constrictum*. Also a few sponge-spicules; and he suggested that Spongilla might have had something to do in producing the very bad odour proceeding from this curious deposit.

Mr. Archer exhibited a number of fresh examples of the zygospores of some Desmidiaceæ, which, so far as he was aware, had not yet been met with.

Amongst these novelties was the zygospore of *Xanthidium fasciculatum*. Of this he showed the only two specimens he had ever seen; for, although the plant itself seems to be pretty common in suitable localities, he had never before met it conjugated, nor did he think the zygospore was recorded. It is orbicular, large, beset with very long slender spines, broadest at the base, and tapering in a concave manner upwards (Eddystone Lighthouse like) to the bifid apices. This formed an extremely pretty object.

Besides that of this fine species, and in the same gathering, he was [illegible] to show, not yet recorded, the zygospore of *Xanthidium aci*[illegible] [illegible]t, too, is large, and beset with spi[illegible] base like those of *Xanthidium fasciculatum*, but somewhat broader, and tapering upwards to the blunt and uncinate extremities.

In the same rich gathering the zygospore of *Arthrodesmus convergens* presented itself, and it also does not seem to be before known. It forms a contrast to both the foregoing, being quite smooth, and altogether destitute of spines. This is a fact somewhat singular in the free short forms of Desmidiaceæ.

Mr. Archer was likewise able to show fresh specimens of the zygospore of *Cosmarium margaritiferum* in many stages. It is arrayed with spines very like those of the zygospore of *C. Botrytis*.

Sphærozosma vertebratum, too, was there also conjugated, and it was worth noting that the zygospore of this species is beset with numerous slender, subulate, acute spines. This was the third occasion in which Mr. Archer had taken this species conjugated; and, that the zygospores are spinous deserves a note, making an exception amongst filamentous genera in that fact, just as *Arthrodesmus convergens* and a few others make, on the other hand, rare exceptions amongst the *short* free forms, in having smooth zygospores. In all books *Sphærozosma vertebratum* is, unfortunately, erroneously stated to have smooth, non-spinous zygospores.

In this same gathering Mr. Archer was also able to show fresh zygospores of *Staurastrum controversum* and *Staurastrum Dickiei*, both rare, as well as of *Euastrum binale*, and several others more frequently met with in the conjugated state.

Mr. Archer was quite disposed to hold that, if we were only as familiar with the zygospores of the different species of this Family as with the mature forms themselves, we might be able to deduce from the former quite as good characters as are presented by the latter; for instance, the difference between the spines of the zygospores in the two related species, *Xanthidium fasciculatum* and *X. aculeatum*. It was indeed very beautiful to see all these varied species distributed over the slide, sometimes in pairs ready for conjugation, the contents now partially emerged, and again, the zygospore more and more advanced and in different stages, each parent individual unerringly making choice of its own species—the rare, as it were, seeking out the rare, and the abundant freely conjugating with the abundant.

Resolved, that the members of the Club desire to express and place on record their unfeigned sorrow at the announcement of the death of Professor Harvey, one of their two honorary members.

June 21*st*, 1866.

Dr. Moore showed samples of the substance found in some quantity, scattered on the ground, houses, &c., by Mr. R. A. Duke, C.E., in the neighbourhood of Templemore, County Sligo, after a night's rain, and which had been sent to the Rev. Professor Haughton under the impression that it was sulphur. This turned out to be pollen of Pines, indeed that of the Scotch Fir, which Dr. Moore verified by showing some pollen of that species side by side under another microscope; nay, Dr. Moore had found that several of the grains at first thought to be sulphur, and then by some regarded as possible insect's eggs, upon being moistened developed a pollen tube.

Mr. Crowe exhibited a very minute Cosmarium from Bray Head, which was sufficiently puzzling, as it seemed to come exceedingly close to *Cosmarium tuberculatum* (Arch.), and yet not to be truly that form. The plant is very minute, segments broadly elliptic, constriction very obtuse and shallow, isthmus broad, surface smooth.

Mr. Archer said this seemed, no doubt, a very puzzling little form; indeed, as much so as he had ever met. Leaving the minute tubercles and somewhat smaller size of *C. tuberculatum* out of view, the present plant seemed fairly to agree with that form. It is to be drawn attention to that the figure of *C. tuberculatum* ('Proceedings Nat. Hist. Soc. Dub.,' vol. iii, pl. ii, figs. 11—15; also, 'Quart. Journ. Mic. Sci.,' N. S., vol. ii, pl. xii, figs. 11—15) gives these very minute tubercles as much too large and prominent and pellucid. They, on the other hand, are exceedingly minute and opaque. However decidedly Mr. Archer felt disposed to rely on the permanence of these forms, he would not insist too strongly in any case, without a much closer acquaintance with the forms in question than he had as yet been able to make. Tbe plant now shown by Mr. Crowe may indeed be but a variety of *C. tuberculatum*, for the actual differences are but slight, but it may be premature to pronounce until these little forms are more frequently met, and any characters deducible from their zygospores discovered. But, be it as it may, Mr. Archer thought that this plant could be mistaken for no other than *C. tuberculatum*. Nor could either (if they should indeed turn out distinct) be at all confounded with any other species.

Mr. Porte exhibited some pupa cases of aphides, all of which had been inhabited by Ichneumons, leaving the well-known curious aperture by which these insects made their exit.

Dr. E. Perceval Wright exhibited sections of the pitcher of *Sarracenia purpurea* and *S. flavans*, showing the peculiar arrangement of the cellular tissue of these strangely metamorphosed leaves, and especially the glands, which were found underneath the outside layer of the epidermis. He alluded to Vogl's paper in 'Sitzungsberichte der k. Akad. der Wissenschaften,' Band l, p. 281.

Dr. John Barker showed the (with us rather rare, and withal very elegant) *Micrasterias Americana*, Ehr., gathered on the occasion of the Glen-ma-lur excursion.

Dr. Frazer, referring to a former instance in which portions of the pulp of an orange had been sent to him as hydatids taken from the human stomach, mentioned another instance of the same blunder having been made within the last week. This was a good instance of how easy it is to fall into an error from want of a sufficiently accurate diagnosis of various objects, which may more or less simulate each other, without having the smallest affinity or community of nature.

Mr. Archer had an opportunity to show specimens of *Coleochæte orbiculare*, quite barren, unfortunately. These were, indeed, mainly remarkable for the great number of bristles issuing from the frond, whereas Pringsheim, whilst he justly regards this character as of little importance, describes this species as remarkable for the fewness of the bristles.

Mr. Archer would here venture to observe that it seemed to him quite probable that the plant lately recorded by Dr. Gray in Seeman's 'Journal of Botany' as a Phyllactidium, is in reality a Coleochæte; but without figures it would not be easy to form a definite opinion, and it is to be hoped that Dr. Gray may fulfil his promise by giving a plate of his plant.

Mr. Archer showed, likewise, a Bulbochæte in fruit, which he regarded as Pringsheim's *Bulbochæte gigantea*, these specimens being chiefly remarkable for the very short "foot" to the antheridium, and the somewhat varying sizes of the oogonia, as compared with Pringsheim's figures and descriptions of his species.

Mr. Archer drew attention to the record in de Bary's recent work treating of Lichens, in Hofmeister's 'Handbuch der physiologischen Botanik' (Band ii, p. 270), of what he (Mr. Archer) conceived was nothing else than the plant we know as *Chroolepus ebeneum*. As Mr. Archer had already exhibited this plant, and showed its structure, and referred to it on two occasions at the Meetings of the Club ('Quart. Journ. Mic. Sci.,' vol. xiii, p. 168), indicating reasons why it may be considered a lichen rather than an alga, and predicating for it an apothecium whenever it may be found fruited, he thought it right to mention that that idea was not then borrowed, and that until he saw de Bary's work a few days ago, he did not know that lichenists had already claimed this species.

Mr. Archer showed also a number of dried Desmids from Italy, thanks to the kindness of Professor Gagliardi, which were quite identical with British species.

QUEKETT MICROSCOPICAL CLUB.

At the Annual Meeting held at University College, July 24th, Dr. Lankester in the Chair, the following Report of the Committee was read by the Secretary :—

"In making this their first report of the progress and present state of the Quekett Microscopical Club, your Committee consider it a subject of congratulation that the Club has not only made a great step towards the carrying out the objects for which it was started, but can also, from the earnestness with which the advantages of the Club have been accepted by the members, entertain the most sanguine expectations that in the future its objects will he fully realised.

"So rapidly has the number of members increased, that your Committee found it necessary to announce through the chairman at the seventh meeting—what was already evident to the members generally,—that the room in Sackville Street was no longer capable of accomodating the Club ; and our grateful acknowledgments are due to the Council of University College for their kindness in permitting use the us of their noble Library for our meetings.

"No small amount of our success has been due to the influence of our President. Ever foremost in any movement having for its object the advancement of popular science, Dr. Lankester at once placed himself at our command, and although from his numerous public engagements his attendances here have not been so frequent as he and ourselves would have desired, he will vacate the chair this evening (in accordance with our Bye-Laws), carrying with him the sincerity and hearty thanks of your Committee and yourselves.

"The Committee regret to announce for the first time the loss of one of the members of the Club by death. At the June meeting, Mr. Joseph Toynbee, F.R.S., was proposed, on the recommendation of the Committee, as President for the ensuing year. At the July meeting it becomes their melancholy duty to record that his services are lost to them for ever. The circumstances under which this unfortunate deprivation took place are generally known to members, and nothing is left us but to mention his name with honour, mingled with expressions of the deepest regret.

"The subject of class instruction has been tested with the greatest success. Through the kindness of our Vice-President, Mr. P. Le Neve Foster, a room at the Society of Arts was placed at the service of a class formed under the direction of Mr. Suffolk, who has generously given much time and patience to impart to the members of it a thorough grounding in those important and fundamental principles necessary to working with the microscope, and there is little second class, which that gentleman has signified his willingness to undertake, and for which there have been numerous applications, will be equally successful.

"Field excursions, which have been long established in the north of England, have not been forgotten by your Committee. Two experiments have been made under the superintendence of Mr. M. C. Cooke (Vice-President) and Mr. W. W. Reeves. The first excursion was to Hampstead on the 2nd ult., when about twenty members and their friends attended, and an excellent collection of objects was made. The second excursion was to Darenth Wood and Northfleet marshes, on the 26th ult., when about the same number attended. Having the advantage of Mr. M. C. Cooke as their guide in the wood, and Mr. Joseph Smith as their guide in the marshes, the members were able to lay in ample stores for microscopical work at home.

"With regard to the formation of a Library of Books of Reference, &c., your Committee have to announce that they have already received several donations from Messrs. R. Beck, W. M. Bywater, M. C. Cooke, R. Hardwicke, and S. Highley, in furtherance of that object.

"The formation of a Cabinet of Objects has been most successful, the following slides having been presented, viz. :—

"From Mr. Hislop, 39 slides; Mr. Marks, 24; Mr. Quick, 24; Mr. Archer, 11; Mr. Hailes, 8; Mr. Bockett, 6; Mr. Bywater, 6; Mr. Breese, 5;—making the number 123; and through the liberality of Mr. Charles Collins, in presenting the Club with a cabinet, those slides are now rendered accessible to the members on the evenings of meeting.

"The following are the papers which have been read during the year, evincing much careful research and patience:—

> "Mr. M. C. Cooke, on 'Work for the Microscope;' R. Beck, on 'Spiracles of Insects;' M. C. Cooke, on 'Five New Forms of Microscopical Fungi;' M. C. Cooke, 'The Application of the Microscope to the discrimination of Vegetable Fibres;' J. Bockett, on 'How to Arrange and Keep a Cabinet;' W. Hislop, on 'A New Form of Microscope;' J. T. Suffolk, on 'Class Instruction;' J. A. Archer, on 'The Respiratory Organs of Insects;' D. E. Goddard, on 'Manipulation with Canada Balsam;' M. C. Cooke, on 'Universal Microscopical Admeasurements;' S. Highley, on 'The Application of Photography and the Magic Lantern to Microscopical Demonstrations;' H. Wigg, on 'Some Motions in the Pale Blood-corpuscles;' N. Burgess, on 'The Pigment Cells of Plants in some of their varied Forms and Structure.'

"In December last a Sub-Committee was appointed for the examination of vegetable fibres. They gave considerable attention to the subject during the past winter, and at the termination of their investigations an interesting Report may be looked for.

"From the 14th of June, 1865, when eleven gentlemen held the preliminary meeting, until the present time, 155 members have enrolled themselves in the Quekett Microscopical Club, and their unabated interest in its proceedings has been manifested, not only by the good attendance at the meetings, but also by the free discussion and friendly intercourse which has been maintained, and which it is hoped may be still further increased by the genial influences of a soirée at no long distant day.

"Satisfied with the past, hopeful in the future, it only remains for us to remind the members that it rests chiefly with themselves individually to advance the interests of the Club. Let the pleasure which they may have experienced at these meetings be extended by the introduction of their friends, and as new members are enrolled, we shall be multiplying the sources of enjoyment, and at the same time be enlarging the usefulness of the Club.

On retiring from the office of President, Dr. Lankester delivered a short address; and the following gentlemen were elected officers for the ensuing year:—

"*President*—Ernest Hart. *Vice-Presidents*—Arthur E. Durham, F.L.S.; Tilbury Fox, M.D., M.R.C.P.; William Hislop, F.R.A.S.; K. Lord, F.Z.S.

"*Treasurer*—Robert Hardwicke, F.L.S. *Secretary*—Witham M. Bywater.

"*Committee*—J. A. Archer; Richard Beck; J. Bockett; C. J. Breese; P. Le Neve Foster, M.A.; W. Gibson; H. F. Hailes; S. Highley, F.G.S.; E. Jaques; T. Ketteringham; W.W. Reeves; Joseph Smith. *Excursion Committee*—W. J. de L. Arnold; W. W. Reeves; Joseph Smith; W. T. Suffolk."

The first meeting of the second session, 1866-67, was held in the Library of University College on Friday evening, August 24; Ernest Hart, Esq., President, in the chair. After the usual preliminary business, the Secretary announced that the special classes open to all members for the instruction of beginners in microscopic manipulation, which had been so successful during the last session, would be continued; Mr. Suffolk having again kindly consented to undertake the direction of them. It was proposed to limit the number in each class to fifteen, and, if necessary, several classes would be formed. The next field-day excursion into the country in search of living natural-history specimens will be advertised, with the time and place of meeting, in the September number of Hardwick's 'Science Gossip.' Dr. Tilbury Fox, one of the Vice-Presidents, then read a paper "On Human Vegetable Parasites." The author's chief aim was to elicit from the members information in regard to the part played by fungi in the production of diseased conditions of plants, men, and insects; and he confined his remarks to the following points —first, the probability of the frequent existence of the germs of fungi in the textures of healthy living beings, and in situations to which the external air has no access; the modes by which fungi effected an entrance to those spots; the fact that parasitic germs enter the systems of plants and animals at a much earlier date than is generally believed, through the soft textures of the young issues; that fungi lie dormant a long time in the system, until favourable conditions occur to promote their growth; that fungi only become sources of inducers of disease when they develope to an undue amount; that fungi will not flourish on a healthy surface; the distinctive features of vegetable and animal structures, especially artificial germination; and the effects, chemical and other, produced by the growth of fungi. Dr. Fox illustrated all these different conditions by a reference to the phenomena of "ringworm" and allied diseases. Mr. M. C. Cooke gave a number of very interesting facts in reference to the parasitism of plants, entirely confirmatory of Dr. Fox's observations, detailing cases in which the germs of mildew and rust must have entered very early indeed into plants, and even been contained in the seed, developing as the "plant grew up;" also where the elements of rust entered through the first pair of young (cotyledonous) leaves. He also stated that he never looked for parasitic fungi on those plants that appeared vigorous and healthy, but was sure to find them on those which looked sickly or grew in unhealthy places. After a few complimentary remarks from the President and others, d and short paper was read "On a New Mode of Mounting," N. Burgess, who exhibited a number of beautifully pre- pecimens in illustration of the process which he recom-. Mr. Burgess uses slides of a much larger size than usual, hat the whole area of a large object can be displayed in the ie specimen, and his method is one well worthy of adoption amateurs. The meeting terminated with the usual microscopic *conversazione.*

TRANSACTIONS.

Descriptions *of* New *and* Rare Diatoms. Series XVIII.

By R. K. Greville, LL.D., F.R.S.E., &c.

(Communicated by F. C. S. Roper, F.L.S., &c.)
(Read Nov. 8th, 1865.)

(Plates I & II.)

Plagiogramma.

Plagiogramma decussatum, n. sp., Grev.—Valve elliptic-oblong, with 2 central costæ and numerous pervious striæ composed of minute granules, so arranged as to form decussating lines. Length ·0022″. (Figs. 1—2.)

Hab. St. Helena, in fifteen fathoms; Dr. Wallich. Shark's Bay, west coast of Australia, in stomachs of Ascidians; Dr. Macdonald. Zanzibar; Professor Hamilton Smith.

This species is so exceedingly like *P. Gregorianum* (*Denticula Staurophora*, Greg.) that it requires careful examination to detect the difference. One character, however, is amply sufficient to separate them. In *P. Gregorianum* the pervious striæ are merely obscurely moniliform, whereas in the species under consideration, under the same magnifying power, they are seen to be composed of distinct, somewhat transversely oblong granules, so regularly arranged that they form distinct longitudinal and transverse decussating lines. The valve is also considerably more robust than that of *P. Gregorianum.* The discovery of this species is due to Dr. Wallich, in whose notes and sketches it is clearly indicated.

Plagiogramma Barbadense, n. sp., Grev.—Valve narrow, elongated, contracted in the middle, then dilated, and again contracted into linear subacute extremities; costæ 2, strong, centrical; structure showing exceedingly fine longitudinal and transverse lines (dots) and another series of numerous very fine transverse pervious striæ. Length ·0035″. (Fig. 3.)

Hab. Barbadoes deposit, Cambridge estate; in slides communicated by C. Johnson, Esq.; exceedingly rare.

I regret to say that no perfectly entire valves of this species have been obtained; but the only deficient part is the striation of the inflated portion of the valve. The sutural ends of the striæ are, however, quite evident, and there can be no reason to conclude that they differ from those of the narrower portion. In form it is allied to *P. lyratum.* In structure it varies from the other members of the genus, having, in addition to a groundwork of exceedingly delicate decussating rows of dots, a series of transverse pervious striæ. Fine illumination and careful adjustment is required to bring out the characters.

MASTOGONIA.

Mastogonia Actinoptychus. (Fig. 4.) Ehr., 'Bericht. d. Berl. Akad.,' 1844, p. 269; 'Mikrog.,' pl. xviii, fig. 19. Kütz., 'Sp. Alg.,' p. 25. Ralfs, 'in Pritch. Infus.,' p. 814, pl. v, fig. 59.

As the figure published by Ehrenberg is not quite satisfactory, I have been induced to offer one taken from a fine example in my friend Mr. L. Hardman's cabinet. The station given by Ehrenberg is Virginia. Mr. Hardman obtained his specimens from the celebrated Monterey deposit in California. They exhibit a minutely punctate structure, and a very variable number of radiating lines or segments. Ehrenberg fixes them at 13, but his own figure has 19. The valve I have copied shows 25, and I have seen another with as many as 30. It is evident, therefore, that number in this case is not a trustworthy character.

XANTHIOPYXIS.

Xanthiopyxis? umbonatus, n. sp., Grev.—Disciforme, circular, broadly umbonate, the umbonate portion more or less covered with strong short setæ. Diameter about ·0040″. (Fig. 5.)

Hab. Monterey deposit; cabinet of L. Hardman, Esq.; R. K. G.

Of this fine diatom, which is by no means rare in the Monterey deposit, I have seen no specimen with the valves *in situ,* and I am consequently by no means certain that it is a genuine *Xanthiopyxis.* The curve of the umbo is variable, as well as the proportion of the disc which it occupies; and the setæ, although generally confined to the centre, sometimes occupy two thirds of the radius. The substance appears to be fragile.

COSCINODISCUS.

Coscinodiscus elegans, n. sp., Grev.—Disc small, with a smooth irregular umbilicus; granules rather large, equal, in radiating, not very close lines, which terminate in a narrow belt of minute crowded puncta; border strong, finely striate. Diameter about ·0030″. (Fig. 6.)

Hab. Monterey deposit; Laurence Hardman, Esq.; R. K. G.

Allied, apparently, to *C. Lunæ* and *gemmifer* of Ehrenberg, having, in common with those species, a smooth umbilicus and a narrow belt of minute puncta between the termination of the radiating lines and the border; but differing from both in the strong, finely striated border, which appears double in consequence of a fine dividing line. The narrow punctate belt is scarcely so broad as the border. Granules large, circular, conspicuous, about 8 in ·001″ in the radiating lines.

Coscinodiscus pulchellus, n. sp., Grev.—Large; valve convex, largely reticulate; cellules hexagonal, somewhat smaller near the margin, the last row more or less oblong; border strong, rather broad, with strong, subremote striæ. Diameter about ·0050″. (Fig. 7.)

Hab. Barbadoes deposit, Cambridge estate; C. Johnson, Esq.

A fine species, with a regular, somewhat delicate hexagonal cellulation, which becomes smaller only near the margin, the cellules of the last row being not wider, but only longer. The strong striæ of the border pass for a short distance into these oblong cellules.

Coscinodiscus robustus, n. sp., Grev.—Large; disc convex, cellulate; cellules large, roundish-hexagonal in the middle, becoming smaller, rounder, and more remote towards the margin; border very strong, broad, elevated, with irregular striæ. Diameter ·0045″ to ·0055.″ (Fig. 8.)

Hab. Monterey deposit; cabinet of L. Hardman, Esq.

A rather singular species, strong and robust in its general aspect with a broad elevated rim. The cellulation is coarse, and the hexagonal spaces are continued nearly equal in size to the margin; but the cellules themselves have a roundish appearance, large in the central region, then becoming gradually smaller as they approach the margin. The walls, of course, become correspondingly thicker, until at length the cellules look like mere circular perforations in the middle of the hexagonal spaces. In the centre of the disc the cellules are 4—5 in ·001″.

Coscinodiscus oblongus, n. sp., Grev.—Disc more or less oblong, having the centre depressed, and an umbilicus containing a number of subremote granules; surface filled up with radiating granules, which diminish in size next the umbilicus and towards the margin, where they resemble minute puncta. Length ·0028″ to ·0050″. (Figs. 9, 10.)

Hab. Barbadoes deposit, chiefly in Springfield estate; C. Johnson, Esq.; L. Hardman, Esq.; R. K. G.

This beautiful little species is liable, on account of its similarity in form, to be taken for a variety of *C. punctatus* of Ehrenberg; but on a close examination it appears to be essentially different from the figures of that diatom in 'Mikrogeologie.' The granules forming the radiating lines, for example, become smaller as they approach both the margin and umbilicus. The latter is not smooth, but always contains a number of granules, which, in the more elongated valves are generally arranged in lines. The centre of the valve is also much depressed. *C. punctatus* itself, however, is not very clearly established. Ehrenberg gives two figures ('Mikr.' Tab. xvii, figs. 40, 41), the first of which is oval, but neither of them exhibits the slightest indication of one of the most conspicuous characters contained in the description, viz., cellules "very densely crowded at the margin, and forming a broad yellowish-white border." At present I am under a very strong impression that two or three oval or oblong species belong to the American deposits, one of which may be the diatom Ehrenberg had in view.

BRIGHTWELLIA.

Brightwellia Johnsoni, Ralfs, MS.—Valve with the border composed of radiating lines of cellules diminishing in size from the coronal circle to the margin, and of ridge-like ribs at subregular intervals. Diameter about ·0035.″ (Fig. 11.)

Hab. Barbadoes deposit, Cambridge and Springfield estates, most abundant in the latter; C. Johnson, Esq.; L. Hardmann, Esq.; R. K. G.

This exquisitely beautiful diatom is similar in size to *B. elaborata*, but is at once distinguished by the radiating lines of cellules becoming smaller towards the margin, and by the dark ribs which radiate, at short intervals, parallel with them. The coronal circle of larger cellules and the spiral arrangement of the central cellules are very like the same parts in the species above mentioned. It is seldom that a good view of the spine-like character of the ribs can be obtained; but the disc now figured happened to be tilted up in such a way as to show it very conspicuously.

ACTINOPTYCHUS.

Actinoptychus minutus, n. sp., Grev.—Minute; valve 8-rayed; the compartments alternately slightly raised and depressed, very minutely punctate; umbilicus in the form of a minute cross, with the ends truncate. Diameter ·0017″. (Fig. 12.)

Hab. Monterey deposit; cabinet of L. Hardman, Esq.; very rare.

The smallest species of the genus, with the surface nearly even, and the cellulation so minute as to justify the term punctate.

HELIOPELTA.

Heliopelta nitida, n. sp., Grev.—Disc with six compartments, the cellulate ones with 4—5 marginal spines; central space obtusely hexagonal, containing a circular umbilicus; margin narrow, with a fine line running through it, and no perceptible striæ. Diameter ·0040″. (Fig. 18.)

Hab. Deposit at Los Angelos, California; L. Hardman, Esq.; very rare.

To my friend Mr. Laurence Hardman we are indebted for the discovery of what appears to be an unquestionably new species of this fine genus, and individually I have to thank him for enriching my cabinet with a specimen. Whatever view may be taken of the species described by Ehrenberg, the Californian disc differs from all of them in the non-striate rim and in the well-defined non-stellate centre. The latter is an hexagonal umbilicus, containing a circular nucleus, and of a thicker and more opaque substance than the stellate central space in the other *Heliopeltæ*. The margin is relatively narrower, and the cellules larger.

EUPODISCUS.

Eupodiscus minutus, n. sp., Grev.—Small; disc slightly convex, obscurely cellulate, with four circular, submastoid processes, distinguished by a prominent lip on their marginal side. Diameter about ·0020″. (Fig. 13.)

Hab. Barbadoes deposit, Springfield estate; cabinet of L. Hardman, Esq.

Considerably smaller than *E. obscurus*, and, like that species, possessing four processes, but is not otherwise allied to it. I place our present little diatom provisionally in *Eupodiscus*, but am doubtful whether that be its true position. The processes, which are situated near the margin, are somewhat similar to those of the genus *Craspedoporus*, having the edge next the margin of the disc considerably raised, and with a thickened lip. The structure is rather obscure, but can be made out to be a faint, uniform, minute, roundish cellulation.

AULISCUS.

Auliscus Hardmanianus, n. sp., Grev.—Large; valve circular, with two processes; whole surface more or less granulose; umbilical space four-angled, the angles attenuated, two of them passing to the base of the obovate ridges within which the processes are placed, the other two passing into rough transverse lines, terminating in a sort of capitate mass of radiating short lines and granules. Diameter ·0040″ to ·0055″. (Fig. 17.)

Hab. Monterey deposit; cabinet of L. Hardman, Esq.

There is no genus of diatoms in which a greater variety of sculpture occurs in proportion to the number of species than in *Auliscus*. The present most remarkable disc, of which I have seen a number of examples, is quite unlike any of those previously described. The most striking peculiarity is the attenuation of the angles of the umbilicus, especially those which are intermediate with the processes, which are prolonged into more or less distinct linear channels, ending in intra-marginal knobs or rough clusters of short radiating lines. These knobs are connected with the ridges surmounting the processes by a few fine, sometimes obscure lines, stretched, as it were, across from one to the other.

BIDDULPHIA.

Biddulphia Johnsoniana, n. sp., Grev.—Large; frustules oblong, turgid; valves broadly oval, very minutely scabrous, destitute of spines, with large, very shortly produced, broadly truncate processes. Diameter of valve ·0040″ to 0055″. (Figs. 14, 15.)

Hab. Moron deposit; very rare; C. Johnson, Esq.

This very rare species has considerable affinity with *B. tur-*

gida, which it resembles in general form and dense structure, and especially in the short, broad, flat processes. I have been unable to perceive any trace of spines, nor is there any indication of a rough line or fringe of apiculi, like that in the valve of *B. turgida*. Like most of the other members of the genus, our new species varies greatly in size.

Biddulphia? mammosa, n. sp., Grev.—Valve in front view produced at the angles into large, elliptical, mammæform, minutely punctate processes; median surface slightly convex, and transversely remotely striate; the rest of the surface smooth. Length of valve ·0040″. (Fig. 16.)

Hab. Barbadoes deposit, Cambridge estate; in slides communicated by C. Johnson, Esq.

We have here another of the dubious forms of which so many occur in the Barbadoes deposit, and of which it is desirable to place on record. It is fortunate that although, in the absence of the end view of the valve, we cannot describe the exact contour, characters amply sufficient for the determination of species are obtained from the front view. At least this has been found to be the case in the fossil *Biddulphiæ* and *Hemiaulidæ* from Barbadoes. The end view of the valve of the present species must be very beautiful, being apparently composed of a series of long, linear, transverse cellules, traversed by a median line.

TRICERATIUM.

Triceratium Robertsianum, n. sp., Grev.—Large; valve with gibbous sides and subobtuse, slightly produced angles, a short, horn-like process at each angle, and 1—2 strong spines, arising from the surface within the margin on each of the sides; cellulation hexagonal, large, equal; margin broad, elevated. Distance between the angles ·0042″. (Fig. 22.)

Triceratium grande?—'Brighton Mic. Jour.,' vol. i, p. 249, pl. iv, fig. 8.

Hab. Woodlark Island, South Pacific; in a dredging communicated by Dr. Roberts, of Sydney.

For nearly two years I have refrained from making any use of the drawing of this diatom, in the hope that I might be enabled to come to some satisfactory understanding relative to *T. Favus* and its varieties. In the mean time multitudes of that species have come under my observation, and I have met with no form which tended to unite the one under consideration with that species. *T. Favus* frequently occurs with the sides of the valve "slightly convex," in accordance with the specific character adopted by Mr. Ralfs ('Pritch. Inf.,'); but a slight convexity is very different from the prominent gibbous curve in the valve now before me. The presence of strong spines also, by themselves of very uncertain value, contributes, in connection with the other characters, to confer upon it great *primâ facie* distinctness. Size alone is of little importance, but it may be well to state that it is scarcely more than half that of *T. Favus*, as figured in the 'Synopsis of British Diatomaceæ.' At the same time the margin is far more decidedly defined, and the reticulation more delicate. After all, however, it may turn out to be nothing more than an extreme form of *T. Favus*, to which Mr. Ralfs seems disposed to refer *T. grande* of Brightwell.

Triceratium Stokesianum, n. sp., Grev.—Large; valve with slightly concave sides and subobtuse angles; surface with subremote, roundish, irregularly radiating cellules, minute in the centre, becoming large towards the sides and angles; angles imperfectly cut off by two vein-like lines springing from the margin on each side, obscurely united in the middle; margin strong, remotely striate. Distance between the angles ·0062″. (Fig. 23.)

Hab. Moron deposit, Province of Seville; Rev. T. G. Stokes; extremely rare.

This fine species appears to be allied, as my kind correspondent Mr. Stokes remarks, to *T. areolatum* of the Barbadoes deposit, being of the same form, and having a very similar radiating cellulation; but it differs in being a very much larger species, and in having the angles partially cut off by a pair of vein-like undulating lines given off on each side, which become faint and obscure towards the middle. The pair next the angle are less distinct than the others, and would probably be found obsolete in some specimens. The cellules are sometimes oval, and are larger and more regular as they approach the angles. The Moron deposit is remarkable for the small number of individuals of the new species which have been found in it. No one but Mr. Stokes has been so fortunate as to discover the subject of the present notice.

Triceratium inelegans, n. sp., Grev.—Small; valve pulvinate, with straight sides and broadly rounded angles; whole surface filled with irregularly radiating, somewhat remote, oblong, rather large granules, except the angles, which are minutely punctate. Distance between the angles ·0025″. (Fig. 21.)

Triceratium obtusum? Ehr., 'Mikrog.' Tab. xviii, fig. 48.

Hab. Monterey deposit; cabinet of L. Hardman, Esq.

Allied to *T. tesselatum* and *robustum*, and more nearly to *T. obtusum* of Ehrenberg; but that close observer would scarcely have omitted in his figure of the latter species the crowded puncta in the angles of the Monterey diatom. Nevertheless I think it right to quote it as a doubtful synonym.

Triceratium dulce, n. sp., Grev.—Small; valve with slightly convex sides and subacute angles, the margin with oblong striæ; surface depressed, with radiating lines of remote punctiform granules; angles raised, and filled with minute puncta. Distance between the angles ·0030.″ (Fig. 20.)

Hab. Barbadoes deposit, Cambridge estate; in slides communicated by C. Johnson, Esq.; very rare.

A very elegant species, of which but few examples have occurred. It is remarkable for its depressed surface, so that when the angles are in focus the central puncta are scarcely perceptible. The angles do not appear to be very prominent, but are so abruptly elevated that the vertical view of the side might be taken at first sight for a transverse line. The central puncta are minute, faint, and remote, becoming a little larger towards the margin. The latter is rather broad, and marked with elegant, oblong striæ, 8 in ·001″.

Triceratium mammosum, n. sp., Grev.—Minute, with thick, produced, rounded angles, filled with minute puncta and straight sides (reckoning from the base of the angles); the central space hexagonal, marked with remote and scattered puncta. Distance between the angles ·0015″. (Fig. 19.)

Hab. Barbadoes deposit, Cambridge estate; in slides communicated by C. Johnson, Esq.; extremely rare.

Very conspicuous at a glance, from the large, produced, mammæform, hemispherically rounded angles, which, being covered with puncta, appear out of all proportion to the rest of the valve. Central puncta circular, irregularly scattered.

AMPHITETRAS.

Amphitetras elegans, n. sp., Grev.—Small; valve with the sides slightly concave in the middle; angles rounded, terminating in a small, ring-like pseudo-opening; cellulation minute, radiating from the depressed centre, somewhat smaller and more crowded within the angles. Distance between the angles ·0025. (Fig. 24.)

Hab. Monterey deposit; L. Hardman, Esq.

A most beautiful small species, elegantly radiate, with a very narrow simple margin. The pseudo-openings have the appearance of being the ends of short hyaline tubes.

Further Observations on the VEGETABLE PARASITES, *particularly those infesting the* HUMAN SKIN. By JABEZ HOGG, F.L.S., M.R.C.S., &c.

(With Plates III & IV.)

(Read Nov. 8, 1865.)

MR. PRESIDENT,—Since you did me the honour to ask for a contribution to the 'Transactions of the Microscopical Society' during your term of office, I thought I could not better engage an evening than by putting together a short account of some further observations I have been making, during the recess, on the identity of the parasitic fungi infesting the human skin. And I must request the members to receive the few remarks I am about to make as a continuation of the investigations I communicated to the Society at the end of 1858, and which were published in our 'Transactions,' January, 1859, wherein I endeavoured to show the true character of the so-called parasitic diseases of the skin, their common origin and identity, and also the universal distribution of these parasites throughout nature.

You will, I am sure, pardon a small degree of vanity, when I say that it is exceedingly gratifying to me to find that the publication of the paper just referred to seems to have been the cause of directing the attention of other observers to this very important subject. For by the labours of scientific men diseases of the skin have been gradually rescued from the hands of the empiric; and as they are now acknowledged to be constitutional rather than local affections, a simpler and more effectual method of treatment for the cure of some of the greatest ills that flesh is heir to, is distinctly pointed out, and at once resorted to. But whether future investigations will tend to confirm an opinion now gaining ground, to the effect that the poison-germs which produce the more alarming infectious diseases are likewise of a *fungoid nature,* I am not at all prepared to say. But of this we may be quite certain, that it is only by the aid of the microscope, in the hands of those who will patiently sit themselves down to interrogate nature, "that we can ever expect to make out the character of those poisons which, generated in one body and conveyed to another, produce such terrible destruction to our race."* For these microscopic germs, in-

* Dr. Beale, in a highly valuable series of lectures "On the Passage of Germinal or Living Matter from one Organism to another," published in the 'Medical Times and Gazette,' 1864, enters into the question of contagion. He believes that when *germinal matter* has its powers of growth perverted or

visible though they be to the unaided sight, are nevertheless produced in myriads in the earth, air, and water around us, and are so diminutive that ordinary motes floating about in the atmosphere are large in comparison. And when we reflect on the very remarkable powers of life possessed by all —and the fungi in particular—which are found to resist a moist heat equal to that of boiling water, and also an intense frost, without at all losing their powers of germination, we can no longer feel surprised that their spores are found penetrating the hairs of the head or the hair-follicles and epidermic cells of the body; nor, indeed, that they should penetrate the internal parts, even where the hard textures, the bones, do not escape their destructive influence. For the very reason that these pests, botrytaceous or mycodermatous fungi, are found both upon the external and internal surfaces, it is proposed to divide them into *Epiphytes* and *Entophytes*.

Although, as I have before pointed out, it is not possible that in either of these cases fungi originate disease, it is pretty certain that they frequently aggravate it, and once let the spores establish themselves on any part of the body where the secretion is not sufficiently active or healthy, and it is a difficult matter to throw off the intruder.

These, then, were exactly the conclusions I had arrived at seven years ago, and since this subject has engaged the attention of our countrymen, it appears that men who are deservedly eminent on the Continent have been led to examine into the truth of these researches, and the result has been that Bazin, Hebra, and others, have considerably modified their views and reduced the number of species.

It will, however, assist our investigation if I enter very

degraded, it may obtain a power of indefinite multiplication, like the pus of an abscess or the secretion from purulent ophthalmia. Such pus, that is, such degraded germinal matter, he has shown to have the power of independent growth under various conditions, and to be capable of maintaining its vitality for long periods, if not completely deprived of moisture. When introduced into another animal's body, offering favorable conditions, it increases and multiplies. It would appear, then, that the growth of ill-conditioned germinal matter may be accompanied by the development of poison in the organism that supports it; just as the growth of mould changes the quality of bread, or cheese, or other substance, on and in which it is found. He does not, however, assume the existence of spores or other bodies, whose presence he has not yet discovered, but appeals rather to the germinal matter whose existence and growth he has demonstrated; and although he does not look for the extinction of all contagious diseases, yet he does expect that much good will be derived from keeping the body in an unsusceptible state —by living in good and pure air, by dryness and plenty of sunlight, and especially by general cleanliness, as preventives of these forms of disease.

briefly into the early history of the parasitic diseases, and their recognised division into species.

It is now more than a quarter of a century since Bassi, of Milan, discovered the vegetable character of a disease which caused great devastation among silkworms; and, about the same time, Schönlein, of Berlin, was led to the detection of certain cryptogamic vegetable formations in connection with skin diseases. The observations of this distinguished man have been abundantly confirmed by Gruby, Remak, Robin, Küchenmeister, Bennett, Jenner, and others, most of whom attempted to identify the fungus with the disease which they believed to be produced by it, and in this way separate and detach some of the most common skin diseases from the rest, and so regard them simply and almost exclusively as *fungoid or parasitic diseases*. Thus, the parasite supposed to be peculiar to, and productive of, each disease has been minutely described, and honoured with a name derived from the name of the disease which it is supposed to have originated, as appears in the following table:

Willan.	Bazin.	Wilson.	Parasite.
Porrigo favosa and lupinosa	Tinea favosa	Favus	*Achorion Schönleinii.*
Porrigo scutulata	Tinea tonsurans	Trichosis furfuracea	*Tricophyton tonsurans.*
Porrigo decalvans	Tinea decalvans	Alopecia	*Microsporon Audouini.*
Mentagra	Tinea sycosa	Sycosis	*Microsporon mentagraphytes.*
Pityriasis versicolor	Pityriasis	Chloasma	*Microsporon furfur.*

Now, this very tempting theory involves an important principle of pathology, inasmuch as it places the parasitic fungi above described in a category by themselves, and invests them with characteristics entirely at variance with those of the natural history of the family of fungi, whose leading feature appears to me to be that of selecting diseased and decayed structure as the soil most essential to their existence; whereas this hypothesis assigns to them healthy organized matter to live and prey upon, and thereby establishing specific diseases. In examining into the truth or fallacy of this theory by the light of physiology, we must bear in mind that the surface of the human body is supplied with a delicate covering, one office of which is to excrete, and another to eliminate or exude, effete matter from the blood. The excretion consists chiefly of epithelial scales, and the exudation is mostly made up of fluid and gaseous matters, which sometimes become condensed and dried on the surface of the epidermis. The epithelial scales are friable and separable by very slight friction during health, and the transpired fluid makes its free escape, under ordinary circumstances, without any assistance from without. But want of cleanliness, deficient exercise, and much more frequently a deranged state of the health, especially a vitiated condition of the body, interfere with the natural processes of elimination; and then the skin itself becomes diseased, and in this diseased condition may become infested by parasitic fungi, the spores and filamentous threads of which find a nidus in an abraded portion of the cuticle; or, what is more generally the case, the shafts and roots of the hairs are invaded, the hairs become brittle and stunted in growth, and at length perish and fall off.

Dr. Tilbury Fox, who in 1863 published an excellent work on 'Skin Diseases of Parasitic Origin,' was the first to call the attention of the profession to a point of considerable practical value in conjunction with parasitic growths, namely, that whenever we find fungus in connection with a skin disease we must look upon it as a something superadded to the diseased condition—" a complex condition, an eruptive disease *plus* a tinea" (parasite). By taking this definition as our guide, we may say without hesitation that "the pathognomonic sign of parasitic disease of the surface is the infiltration and destruction of the hairs by the spores; and the diagnosis can in nowise be considered perfect until spores or mycelia have been detected by the microscope." For the future, then, we must look upon parasitic disease as *non*-existent without this test. I cannot, however, admit that this complex condition at all invalidates, as Dr. Fox would seem to imply, the opinion expressed by me in my former paper, namely, *that the growth of a fungus is not necessarily pathognonomic of any special form of skin disease;* nor do I quite think, with him, that the complex eruptive condition is so entirely of a secondary character simply because in *tinea decalvans* we sometimes find the parasite in the perished and falling hairs unaccompanied by any eruption of the skin. In the course of my experience, which appears to slightly differ from Dr. Fox, I happen to have seen in my friend Mr. Hunt's practice cases of alopecia, sycosis, porrigo decalvans, &c.,* with a scaly desquamation preceding the perishing and falling of the hairs, and at the same time unaccompanied

* See former paper, Vol. VII, 'Quart. Jour. Micro. Science,' 1859.

by parasitic growth; therefore I still believe that an eruptive condition or an abraded secreting surface is a very necessary part of the disease, and that then the skin affords a more particularly favorable soil for the development of the fungus; but leaving this part of the subject for the present, I shall proceed to show in an experimental and, I trust, a satisfactory way that the same species of fungus often exhibits varieties of character, as well as form, at different stages of development and under varied influences; so much so, "that neither size nor outline affords any basis for distinction into species until it has been ascertained, from extensive comparison of forms brought from different localities in the widest area over which the species can be traced, what are the average characters of the type, and what their range of variation." (Bentham.)

First, with regard to collecting and taking fungi, I find that the prevalence of damp or moist close weather is especially favorable for the purpose; while in an opposite condition of the atmosphere—fine frosty weather—I have rarely been able to secure a supply; and, moreover, my experience has proved to me that in the winter season diseases of the skin accompanied by parasitic growths disappear from among the poor who frequent our skin infirmaries. Mr. Hunt also finds that season brings with it its own peculiar type of skin disease.

It appears that at particular periods of the year the atmosphere is, so to speak, more fully charged with microscopical atoms than it is at others. The spores of the moulds, *aspergilli, penicillia,* and *puccinia,* are perhaps the most widely distributed bodies, and towards the end of the hot weather, or about autumn time, they are very abundant. Among those who have taken them at this period of the year we must ever associate the name of one of our body, the Rev. Lord Godolpin Osborne, who, I believe, first experimented in this way during the cholera visitation of 1858. He exposed prepared slips of glass, slightly moistened with glycerine, over cesspools, gully-holes, &c., near the dwellings of those where the disease appeared, and caught what he named *aërozoa*—chiefly minute germs and spores of fungi. I was favoured with a few specimens, one of which I have placed under a microscope on the table for the purpose of comparison with the more recent specimens taken by myself two months ago; a drawing made from this (see Plate V, fig. 4) exhibits spores almost identical with those found in the skin, &c.

From the year 1858 to the present time I have amused myself by catching these floating atoms, and, so far as I can judge, they are found everywhere, and in and on every conceivable thing, if we only look close enough for them. Even the open mouth is an excellent trap; of this there is ample evidence, since we often find on the delicate membrane lining the mouth of the sucking, crying infant, and on the diphtheritic sore throat of the adult, the destructive plant *Oïdium albicans*. The human or animal stomach is invaded, and in a certain deranged condition we find the *Sarcina ventriculi*, with its remarkable-looking quaternate spores, its torulæ, &c., seriously interfering with the functions of this organ. I may mention a curious fact in connection with stomach fungus, the discovery of Lehmann, namely, if an emulsion of casein (the casein of sweet almonds) be mixed with a small quantity of amygdaline and then introduced into the stomach of the animal, it very soon ferments, and the yeast-fungus quickly changes the chemical constituents of the mass into the poisonous substance *oil of bitter almonds*, and thus destroys the life of the animal.

In specimens of the vomit from another fearful disease, the *yellow fever*, sent to me from Bermuda, I found a large admixture of spores and torulæ, with altered blood-corpuscles and disintegrated epithelial scales.* Here, then, we have striking examples of the ravages committed by the fungi, but I think no one will say we are justified in attributing either fever, thrush, or diphtheria, to the presence of the Oïdium found in connection with these diseases. I might go on multiplying examples of a similar kind; but as that would inconveniently extend my paper, I will rather proceed to give the results of experiments made with the *favus* fungus taken from the human body.

At the time I read my former paper I was unable to show the results of any examinations, or, indeed, make more than a passing allusion to favus, although a well-known form of disease, from the circumstance of its having attracted the attention of Schönlein, who found a fungus growth always

* My own observations on the presence of fungi in these vomits receive confirmation from Dr. Buchanan, who was sent by the Privy Council to make inquiries into the outbreak of yellow fever at Swansea last September. Upon making a microscopical examination of the vomits he discovered large quantities of fungus-spores, changed blood-cells, &c. Last year I met with fungus-spores in the chamber of the eye, a still more remarkable portion of the human body, than any above alluded to. A man fifty years of age, came to me complaining of impairment of sight. His attention was first directed to the defect by the very unusual appearance of a small "plant-like body" always before him. By a careful examination of the eye with a magnifying ophthalmoscope I was quite able to satisfy myself of the presence of a small group of puccinia spores in the vitreous humour.

mixed with favus crusts. The disease is one commonly known as *cupped ringworm*, or honeycomb scall, and is now rarely seen in this metropolis; therefore I consider myself fortunate in having been able, through the kindness of my friend Mr. Hunt, to investigate three cases, from each of which I collected scales for microscopical examination. I have here a few of the peculiar-looking crusts, and it will be observed that they are cupped in appearance, and of a dingy yellow colour. The crust is almost entirely composed of the *Achorion*, mixed with epithelial scales and broken hairs. When the fungus once establishes itself, so fearful are its ravages that in a very short space of time the whole of the cutaneous surface, with the exception of the palms of the hands and soles of the feet, becomes covered with it. I attempted to obtain a photograph of one of the patients, but cannot say very successfully; the print gives but a faint idea of the disagreeable picture really presented to the sight. Large masses of the crusts fell off daily, each one leaving its mark behind. As the spores penetrate the hair-follicles they destroy the sheaths of the hairs, which shrivel up and lose their colouring matter, and then break off, leaving the surface bald.

The fact of the surface becoming so entirely denuded is explained in this way:—The shaft of the hair is less in circumference than the bulb, and consists of hardened, shrunken epithelial cells, almost devoid of germinal matter; and the further removed from the bulb the less of vital power does it possess, and consequently, when its nutrient supply, small even at first, become interfered with and lessened by the increasing spores, it loses the little vitality it ever had, dies, and drops off. And in this, as in other cases, the fungus feeds upon the dead, and not the living, material.

If we now take a crust and examine it more closely, it will be seen to be made up of an outer and older part, thick and dark in colour, the fungus being here in a more advanced stage, and chiefly composed of sporangia, spores, and mycelia, with fragments of several hairs imbedded in them. The under or inner and younger layer is paler in colour, and consists of spores mixed with epithelium, fatty and granular matters, and sometimes pus; and I suppose we may consider that in some cases a very large quantity of the latter ingredient (pus) has been mixed up with the outer parts of the crusts. Mr. Wilson started a new theory, founded on this exceptional condition, namely, "*that the favus matter is produced from the development of the nuclei of pus-cells;" that the parasite is not a vegetable, or that, if it be, it might be* *looked upon as an example of the conversion of an animal into a vegetable product.* It is quite possible, without a careful microscopical examination, to mistake the stroma, always present in large quantities in favus crusts, for pus. This, I think, is a mistake often committed by the more casual observer. We will not, however, enter into any discussion upon this theory, nor upon one still more improbable, "the spontaneous generation hypothesis"—of all hypotheses the most gratuitous; I was almost about to say *absurd.*

I must now be permitted to add a few words upon the physical aspect of persons suffering from *favus,* because, as I have already stated, and not without proof, that such diseases are the embodiment, or rather the impersonification, of a weakly, unhealthy state of the body, well understood as the scrofulous habit; and associated with a dirty or neglected state of the skin in the majority of cases. Hebra, the great authority on skin diseases, lays much stress upon the feature of *dirtiness* as a cause of favus, and goes so far as to say that this accounts for its rarity among the upper classes of society. "The subject of one of the worst cases," says Mr. Hunt, "was a puny, half-starved boy of seventeen, whose appearance was that of a child of nine or ten. When he was taken from his miserable home into purer air, and well fed, the crusts died and dropped off; but when he returned to the wretched habitation of his parents, situated in one of the filthiest parts of Lambeth, and was insufficiently fed, the vegetation grew again most rapidly—flourishing in the vitiated fluids like a vine in a mass of stercoraceous mould." From this boy I obtained, in 1859, large supplies of the fungous crusts, and at that time, to make sure of the results of my examinations, I sent portions of the same to friends upon whose experiments I could rely for the confirmation of my own. Having perfectly satisfied myself, and not by one but by many trials, that the achorion (favus) produces as good a ferment, and nearly as briskly, as healthy yeast, when added to barley-wort, with only a slight difference of size and form "a difference of degree, and not of kind," my next experiment was one slightly varied, for the purpose of observing the modifying influence of light over these fermentations, and at the same time ascertaining if this agent at all affected the character of the results. I was, perhaps, led to make this observation from finding that yeast requires for its more perfect growth, not only a proper temperature, but almost occlusion from daylight—a fact that appears to hold good in the development and growth of most fungi. I therefore, in April last, procured a supply of fresh wort from a brewery, which

I divided into three equal portions, and, for the sake of convenience, numbered 1, 2, and 3. Into Nos. 1 and 2 I put a few favus crusts; No. 1 was put carefully away in a darkened place, the temperature of which was about 70° Fahr.; Nos. 2 and 3 (the latter being simple sweetwort only) I exposed to a good light in my sitting-room window, where the temperature ranges from 65° to 75° Fahr.; and each bottle was closely corked. On the second day, upon examining a portion of 1 and 2 with a ¼-inch power, I found fermentation had commenced, a film spreading over the whole surface of the liquid. In No. 1 were seen a fair quantity of yeast-cells, varying in form and size; shown in Pl. III, fig. 1, *a*. No. 2 was in a more advanced stage, and some of the spores were rather larger than in No. 1. On the 4th and 5th days I took portions from all three bottles. That from No. 1 gave the best results; the spores, yeast-cells, were more numerous and spherical in form, well filled with granular matter and numerous moniliform chains of smaller spores and amorphous stroma, shown in fig. 1, *b*. Compared with a small portion of fresh yeast from a beer-barrel, fig. 3, the cells and spores appeared about half the size (in the drawing, however, they are represented too small). In specimen No. 2 spherical cells were fewer and smaller, with groups of ovoid spores mixed with torulæ, and bacterium-like bodies floating rapidly about; here and there were seen tufts of penicillium, represented in fig. 2, *a*. In the sweet wort No. 3 were numerous ovoid spores, without granular matter, but highly refractive, and not unlike fat-globules.

On the 10th day the changes seen in specimens taken from each bottle were still more marked. From No. 1 the spores were more numerous, but certainly rather smaller, and variable in form, and the greater portion of them were filled with granular or nuclear matter; there were also groups of torulæ mixed with still smaller spores, fig. 1, *c*. This specimen when the cork was removed from the bottle, gave indications of the presence of carbonic acid, and the odour was that of good fresh beer, and the greater portion of the heavy yeast had fallen to the bottom of the bottle. No. 2, on the contrary, had become quite of a dark colour, smelt sour, and the spores had much decreased in size, granular matter with bacteria being by far the more numerous; represented in fig. 2, *b*. The wort in No. 3 was still sweet—of a somewhat vinous sweetness—and the top was thickly covered over by a whitish, flocculent, filamentous-looking mass of mould.

A fortnight or rather more elapsed, and then another examination gave somewhat similar results. No. 1 was still perfectly sweet, while No. 2 was more sour, and of a dark red colour; the filamentous masses were broken up, and had fallen to the bottom of the fluid, and the surface was slightly covered with a mould. No. 3, although smelling somewhat like bad wine, was not much altered in colour, but on its surface the aspergillus was growing. Six months later No. 1 was perfectly sweet, exhibiting well-marked spores and torulæ; No. 2 was rather more decomposed than it was on the former examination; and No. 3 remained the same.

Now, upon comparing the fermentation of the achorion fungus with that of good healthy yeast, it will be seen to be almost identical. In the first place, it is as actively carried on by the former as by the latter. There is, however, just a slight difference in the size of the spores or cells already mentioned, those from yeast being the larger and more nearly spherical, with a greater number of reproductive spores, that is, cells with a single, clear, nucleated cell in their interior, while others are filled with a darker granular matter, and having only a slight tendency to coalesce or become filamentous, while the achorion are for the most part ovoid and very prone to coalesce and produce elongated cells or torulæ. Now, with reference to the slight difference in size, we must look upon this as a matter of very little importance; for to the presence of light in the one case, and its almost total exclusion in the other, this difference, I have no doubt, is almost entirely due. It would be more trustworthy if comparisons of this kind could be made at the same stage of development; for be it remembered that yeast obtained from a brewery is in a more favorable state, inasmuch as it is stopped at a certain stage of growth or development, and then *set* to begin its fermentation over again in fresh supplies of a new pabulum, which gives increased health and vigour to the plant; while, on the other hand, the achorion, or favus fungus, is obtained and used in an exhausted state from an already ill-nourished or starved-out soil. Neither can we attach much importance to differences of size and form of the spores, for even this occurs in yeast ferment; and although the ovoid is most frequently seen in achorion, it is equally common to yeast when exhausted. This is strikingly exhibited in Pl. IV, fig. 2, a drawing made from a drop of exhausted yeast taken from porter; here we have the oval and elongated cell with torulæ. To ensure success in these and similar experiments, the fungus or yeast should be left floating on the surface of liquids; the process is either carried on very slowly or is entirely arrested by *submersion*.

Turpin and others, in their experiments on yeast, noticed that the cells become oval and bud out in about an hour after being added to the wort; but this change depends as much upon temperature and density of the solution as upon the quality of the yeast. It is a well-ascertained fact that when yeast is added to distillery wash, which is worked at a higher temperature than brewers' wort, fermentation commences earlier, and the yeast-cell grows to a much larger size. It is, indeed, forced in this way much as a plant in a hothouse is, and then obtains to greater perfection in a shorter time. It will, however, be seen that it sooner becomes exhausted; and now, if we take a portion of this yeast, and add it to barley-wort, and at the same time keep it in a temperature of from 60° to 65° Fahr., it ferments languidly, and small yeast-cells are the produce. If the yeast is allowed to stand in a warm place for a few days it partially recovers its activity, but never quite. With such a yeast there is always a good deal of torulæ mixed with the degenerated cells, and sometimes a filamentous mass, which falls to the bottom of the vessel; from this stage it readily passes to that of *must* and *mildew*, and then becomes a wasteful feeder or destroyer.

With yeast passing to the stage of exhaustion I have seen a crop of yeast fungus produced in the head of a strumous boy, seven years of age, who was much out of health, and had suffered from eczema of the eyelids, with impetigo. The disease had obstinately persisted in spite of well-directed efforts to remove it. The scabs were frequently examined, but no fungus found. The mother, by the recommendation of a friend, washed the boy's head every morning for a week with *stale beer*. I saw the child a few days after these washings were discontinued, and warm water only used to soak the scabs off. On placing portions of the broken hairs on a glass slip, and moistening with a drop of liquor potassæ, spores and torulæ were seen in abundance. Represented in Pl. III, fig. 4.

I have made frequent microscopical examinations since, with the same results. Two years have passed, and the disease remains, although parasiticidical washings have had a fair trial. A change to country air and good diet always does more good than medicine in this case. I do not look upon this single experiment as at all sufficient to prove the production of the yeast fungus by transplantation into the human skin, although it is not very unlike the achorion fungus, or that of tinea tonsurans (*tricophyton*); but, taken with many negative trials that I made, to introduce both yeast and achorion into *perfectly healthy* skins, without any abrasion of surface, I think it has an important bearing on the subject of my paper. At all events it is a fair illustration of change of type,* for when Mr. Hunt saw the boy, after the disease had persisted for at least twelve months, he at once pronounced it to be *pityriasis rubra* or *versicolor*. Had the fungus played any part in bringing about this change in the character of the disease?

In another experiment I took portions of some *penicillia* and *aspergilli* moulds, and upon adding these to sweet wort I obtained results confirmatory of Dr. Lowe's,† which were pretty much as follows. Having placed small quantities of spores in the wort, I stood them by in a warm room. On the second day in one of the solutions, and on the third in the other, fermentation had fairly set in; the surface of the solution was covered with a film, which proved to be well developed ovoid spores, filled with smaller granular spores (*conidia*) (fig. 5, Pl. IV). On the sixth day the cells changed in form, and were more spherical. Again removing these to another supply of fresh wort, the results obtained were quite characteristic of exhausted yeast ferment.‡

* The Rev. Mr. Berkeley, in his 'Outlines of British Fungology,' writes:—"It is not possible that in these cases fungi originate disease, though it is pretty certain that they frequently aggravate it." Nevertheless, after this clearly expressed and positive statement, we find, a few pages further on, the following contradictory assertion:—"That a few spores rubbed into the skin or inserted in it will soon produce the disease known as *porrigo lupinosa*" (favosa?). And he cites Dr. Lowe as his authority for this statement; but on looking over this gentleman's writings, what do we find? Why, that in the course of a somewhat extended inquiry into the causes of diseases of the skin he only met with two cases in brewers' draymen, and one in a dirty cellarman, of parasitic growths, with sycosis and favus, and which, he tells us, *commenced with a sore*. I would ask any one conversant with these diseases if this at all justifies the above assertion, or proves that the parasite can be communicated to, and grown upon, the *healthy* human skin. For my own part, so thoroughly satisfied am I of the utter fallacy of such a statement, that I should have no hesitation in submitting my own skin to be experimented upon to test the truth of what I have stated.

† It is only right to say that *I did not follow* Dr. Lowe, as some writers have stated, in this field of inquiry. My observations on skin diseases were commenced at the suggestion of my friend Mr. Hunt, in 1856, and continued for three years before my first paper appeared in print. At that time, 1859, neither Mr. Hunt nor myself had heard of Dr. Lowe's researches, which, it appears, were communicated to a local society, and published in the 'Edinburgh Botanical Society's Transactions,' 1857.

‡ *Directions for preparing and mounting.*—The mode of preparing specimens of fungi for the microscope.—After having removed a small portion of the crust or a hair from the affected part, place it on a glass slip, and gently separate the mass with needle-points, and add a drop of liquor potassæ, which will render it transparent; then cover with a piece of thin glass and remove any superfluous fluid with a small piece of blotting-paper.

From these experiments I believe that it matters little whether we take yeast, achorion, or penicillium spores, the resultant is the same, and depends much more on the food or nourishment supplied whether the pabulum contains more or less of a saccharine, albuminous, or nitrogenous material, lactic acid, &c., together with light and temperature; whether we have a mould (green or blue), an achorion or yeast fungus produced. Diversity of form in the cells, as well as quality and quantity of their material contents, is certainly due to, and in a manner regulated and controlled by, the beautiful law of *diffusion*, which admits, separates, sifts, and refines the coarser from the finer, the lighter from the denser particles, through the porous structure of the cell-wall.

In conclusion, I trust I have satisfactorily shown that—

1st. There exists but one essential organism, a fungus whose spores find a soil common alike to the surface and the more secluded parts of the human or animal body.

2nd. That variations in skin diseases associated with parasitic growth are due to differences in the constitution of the person affected; to the moisture, exudation, soil, and temperature, under which the development of the fungus takes place. Consequently it is neither correct nor desirable to separate and classify them as "*parasitic diseases of the skin.*"

3rd. The parasitic growths vary but little in any case, and that only in degree, not in kind, some soils appearing to be better suited than others for their development, that furnished by the eruptive or secreting surface being in every way the most congenial; while diversity of form, in all cases, arise from growth taking place either upon a sickly plant, a saccharine solution, or an animal tissue.

Should there be fatty matter mixed up with the specimen, it will be necessary to remove the cover and add a drop of ether; then wash it with distilled water. Other reagents will, from time to time, be found requisite, and enable us to avoid errors in interpretation; as, for instance, on the addition of a drop of hydrochloric or acetic acid all earthy particles are dissolved out. Ether, chloroform, or alcohol, readily remove fatty matters. A solution of potash or soda will dissolve out pus, epithelium, &c., and more quickly so if the specimen be slightly heated, while fungus-spores are not affected thereby, but, on the contrary, are better seen. In some chronic cases of skin disease we find the epithelium-scales involved in a kind of *fatty degeneration*, minute fat-globules, which at first sight bear a very strong resemblance to spores; these must be got rid of by soaking in ether, and then washing with strong liquor potassæ. Like other vegetable cells, spores sometimes require the addition of a drop of iodine, which renders them distinctly visible. View all specimens, first, with monochromat light, and afterwards with polarized light. The latter shows up the starch-granules, if present, and distinguishes the granular particles of earthy matters. For mounting and preserving the specimen, use glycerine jelly, or glycerine diluted with one third of camphor water.

4th. That fungi generally excite chemical decomposition in the soils on which they feed, and that it is the exclusive province of a certain class, when spread on the surface of an albuminoid, saccharine or alcoholic, or slightly acid liquid, to develope and grow, and during growth to give rise to either the alcoholic, acetic, or putrefactive fermentation.

NOTES *on the* GREGARINIDA.

By E. RAY LANKESTER.

(With Plate V.

(Read Dec. 13th, 1865.)

THOUGH the minute organisms known as Gregarinida are remarkable for the great range of their distribution, appearing in various animals, both terrestrial and aquatic—from the Turbellarian worms up to the Brachyourous Crustacea and Mollusca, and even in Vertebrata—very little indeed has been added to our knowledge of their structure, development, or habitats, during the last few years. This is a matter not only for surprise, but also for regret, inasmuch as there are some important points in the history of these parasites still to be examined, and doubtless many new and interesting forms to be discovered. There is nothing to be recorded as having been ascertained with regard to Gregarinida since the short article which I published nearly three years ago in the 'Quart. Journ. Mic. Sci.' The researches of Lieberkühn * are generally accepted, and the great difficulty now is to discover the true sexual reproduction of these animals.

Probable sexual reproduction.—The encystation of a single or of two Gregarinida, and their gradual resolution into a number of minute cells, at first circular, and afterwards, in the case of *Monocystis Lumbrici*, at least, assuming a navicula-like form, are well known. The pseudo-naviculæ issue from the sac, and become free organisms. They have been formed by a process analogous to *gemmation* in the cyst; and it is in *their* history, I believe, that the *sexual* reproduction of Gregarinida must be sought. It was formerly considered that the pseudo-naviculæ individually developed into Gregarinæ by a single process of growth; Lieberkühn† showed that they undergo certain changes, their contents becoming con-

* Since writing the above I have seen a short paper by Lieberkühn, in 'Muller's Archiv' for the last quarter of 1865. An abstract of it will be found in the "Chronicle."

† 'Mém. de l'Acad. Roy. de Bruxelles,' 1854.

centrated towards the centre, after which the envelopes of the pseudo-navicells become flaccid, and allow their contents to escape, which grow into Gregarinæ, passing through an amœbiform stage. As far as Lieberkühn ascertained, the whole process was simply one of gemmiparous reproduction, or analogous to it. The pseudo-naviculæ were produced by gemmation, and the young amœboid Gregarinæ were produced from the pseudo-naviculæ also by gemmation. The pseudo-naviculæ of the Gregarinæ of the earthworm, which are the only species readily attainable for study, are so minute that there is great difficulty in defining their contents, even with a powerful objective, and it is impossible at present to ascertain satisfactorily the structure of those contents. I have, however, observed that many pseudo-naviculæ have, when they have passed some time in the free state, an apparently viscid substance occupying the greater part of the cavity enclosed by their thick enveloping membrane, while the finely granular substance (which is aggregated near the centre in most pseudo-naviculæ) is deficient. The gradual formation of this nucleus of protein matter is described by M. Lieberkühn, but he does not seem to have observed that in many cases it is absent, and that there appear to be two forms of these bodies. Is it not probable that the contents of these two forms of pseudo-naviculæ respectively play the parts of male and female elements? It appears that in no other phase of the existence of the Gregarina is there a possibility of sexual reproduction taking place. The large parent Gregarinæ have been so carefully watched, and the process of encystation so attentively observed, that it may be confidently stated that under these aspects the Gregarina presents no phenomena comparable to those of true sexual reproduction, and hence some observers have been led to suppose that the pseudo-naviculæ pass from the "bearer" in which they are produced and attain a sexual form in some other habitat. Lieberkühn's observations, however, which I have confirmed, seem to indicate that in the case of *Monocystis Lumbrici* the changes in the pseudo-naviculæ which he has recorded are the only ones which take place, and that these occur without the intervention of a fresh host. If this view of the case should be true the Gregarina which is developed from the amœboid young might be considered as the parent-stock, the pseudo-naviculæ as sexual zooids, and we should thus have a case very easily classed with the other instances of alternation of generations. I would, however, merely wish to offer this as a suggestion, since at present we have not, nor, I believe, can we have, proof that the contents of the pseudo-naviculæ are to be regarded as male and female elements.

Large size of some species.—It appears that the *Monocystis Lumbrici* has an almost indefinite power of growth, limited only by the cessation of the supply of nutrient material. In Pl. V, fig. 1, is drawn a specimen from the posterior portion of the perivisceral cavity of the earthworm, which was found floating there with two others, being of unusually large size. One of the specimens was the $\frac{1}{25}$th of an inch in diameter, the contained vesicle of proportionate size, and the granules also much more conspicuous than is ordinarily the case. In the same worm the seminal vesicles and testicular sacs were found to be occupied by several individuals of Monocystis of enormous size, the whole of the cavities appeared to be filled by them, and the nourishment diverted to their use which should have been employed in the development of the seminal secretion. One of the largest of these Monocystes was $\frac{1}{5}$th of an inch in length, being of a linear form (fig. 2). When it is remembered that the ordinary length of a *Monocystis Lumbrici* is $\frac{1}{120}$th of an inch or less, the strangeness of this large growth will be admitted. It appears that, when free to develop equally in all directions, the Gregarina assumes a more or less spheroidal form, as in the first instance, but that when growing in a confined space in company with other individuals a linear increase is induced.

The granules in the elongated form were much fewer than in the spheroidal one, and poured freely about in the interior. A considerable amount of activity was shown by this specimen, and the tunic or enveloping membrane was thick, and occasionally showed striations, while in that from the perivisceral cavity the membrane appeared much thinner and there was no movement. As a rule, it seems that the granules are developed in the Gregarinæ at the expense of the investing tunic, and that the larger the bulk of the granules the less is the activity of the Gregarina.

Structure and function of the investing tunic.—I was induced some time since to believe, with Dr. Leidy, that the investing membrane of the Gregarinida is double, inasmuch as an appearance tending to prove that such was the case was witnessed both by him and myself in the *Gregarina Blattæ*. I have now, however, reason to believe that the striations visible in the posterior sac of that species are produced merely by the contraction of a portion of the viscid material which fills it; in fact, the investing membrane must merely be regarded as a dense layer of the same sarcodic material which forms the whole creature. The membrane which invests the whole Gregarina appears to be excessively thin and ill-defined, and more or less continuous with the viscid substance contained by it, which is denser nearer the exterior, and, in fact, seems to form a layer beneath the investing tunic, intermediate in density as well as position, which in one or two cases becomes considerably developed. This occurs in the Monocystis of the annelid Nereis (figs. 4, 5), where the granules occupy a smaller portion of the sac than is usual, and the sarcodic substance in which they are imbedded becomes very remarkably differentiated, so that there is a broad fleshy prolongation of the sac at one extremity, exceedingly mobile, which indicates the direction in which progression is always made. Distinct striations, giving the appearance of fibrillation, may be detected in the substance of this prolongation. It seems that here that portion of the viscid material filling the sac which is nearest to the enclosing membrane is denser than is usual, and has much of the character of sarcode, while the granules, which are excessively fine, float closely packed together in the *inner* portion of the same viscous material, which is less dense. This species of Monocystis, it should be remarked, is very active. This, again, would tend to show that the development of granules is in opposition to the activity of the animal, which is further borne out by the fact that young Gregarinæ, in which there are but very few granules, are always by far the most active. The striations on the investing membrane, which are noticeable in many species, such as *M. Serpulæ*, *M. Sabellæ*, &c., are similar to those occurring on the tunics of many Infusoria. In some species they occur in immature specimens only, and are not traceable in fully grown individuals. This is the case in *M. Terebellæ*, and in an undescribed form abundant in *Cirratulus borealis* (figs. 8, 9), while in certain stages of the development of *M. Lumbrici* a series of filamentous processes, or sometimes of small conical bodies, appear to be developed from the exterior of the investing membrane and afterwards cast off.* The prolongation of part of the sac into a proboscis provided with hooks or a broad flattened extremity, as in *G. Sieboldii* and *G. Heerii*, also shows the plasticity of this portion of the saccule constituting a Gregarina. The movements of a Gregarina do not depend on the mere elasticity of the envelope, but on the contractions of the dense portion of the viscid sarcodic substance contained by it, which is continuous with it, and the development of which is opposed to the development of the granules.

Specific distinctions.—It is a matter of very great difficulty to decide on specific differences in higher animals possessing many more points of character than can be found among Gregarinida, and, indeed, among these latter it becomes almost

* These filamentous bodies do not form part of the Gregarina, but are sperm-cells of the *Lumbricus*, in M. Liebe[illegible] opinions.

impossible to speak of a species with that definite meaning which zoologists attribute to the word. A difference of habitat is all that can be understood, generally speaking, from a specific name, among the Gregarinidæ. Nevertheless, there are many forms which are very definite in their character, and appear to confine themselves to the same host. Such are *M. pellucida*, *M. Aphroditæ*, *G. Sieboldii*, *G. Heerii*, *G. Blattæ*, &c. There can be little doubt, however, that very many species have been named which are identical with others previously known, but are merely found in a new bearer. The form which is met with in *Ommatoplea* and *Convoluta* (Turbellarians, figs. 6, 7) occurs in many other Annelids, and I was surprised to find one of these in a specimen of *Aphrodita hystrix*, whilst in twenty or thirty specimens examined by me in Guernsey not a single individual contained any other Gregarina.

Gregarinida observed in Guernsey.—Having devoted some study to the Annelida obtained while with the dredging committee of the British Association in Guernsey this year, I have a few additional notes to offer on the Gregarinida which infested some of the species.

Monocystis Cirratuli, n. sp. (figs. 8, 9).—The perivisceral cavity of specimens of *Cirratulus borealis*, which were abundant in some muddy shores, was invariably infested by large numbers of a simple form of *Monocystis*. No Gregarinida have been previously observed in this Annelid, and hence I name the form after its bearer. The largest specimens were $\frac{1}{40}$th of an inch in length. The young forms showed a striation of the investing membrane, and did not present that anterior enlargement which was noticeable in the more fully grown specimens. The length of the smallest observed, which was almost entirely free from granular matter, was $\frac{1}{160}$th inch (fig. 9).

M. Nemertis, Kölliker.—In *Ommatoplea* and *Convoluta*, and once also in *Aphrodita hystrix*, I met with a form of Monocystis which may be referable to Kölliker's species (figs. 6, 7). The most marked characteristic was the very frequent enlargement of the anterior extremity into a circular or spheroidal form; this, however, was not persistent. The contained granules were coarse, and the vesicle distinct; its average length was $\frac{1}{120}$th of an inch. Kölliker describes *M. Nemertis* from a Nemertian worm. It seems inadvisable to complicate the nomenclature by using a different specific name for the Gregarina of each genus of Nemertians, and hence I retain Kölliker's name, though this form appears to differ somewhat from that which he figures. It is remarkably abundant in the very common Nemertians, *Ommatoplea gracilis* and *O. rosea.*

M. pellucida, Köll., *Nereidis,* Leidy.—In *Nereis pelagica* I observed several fine Gregarinida in the intestinal canal (figs. 4, 5). Kölliker's *M. pellucida* appears to be a young form of this same species, since he obtained it in Nereis and observed its paucity of granules and small size. The larger individuals which I have observed have a very dense mass of fine granules, which, however, does not appear to occupy so much of the cavity as is usual. There is a broad semi-transparent margin of contractile sarcodic substance, which appears to give this species a greater activity than is observable in other well-grown forms. The vesicle is small, but clear and conspicuous; the largest specimens noticed had a length of $\frac{1}{120}$th of an inch.

M. Eunicæ, n. sp.—In the intestine of *Eunice Harassii* I noticed the Gregarina drawn in fig. 10. Its length was $\frac{1}{100}$th inch; the contained granules were coarse, and the tunic was produced posteriorly into a somewhat pointed wedge-shaped body.

M. Phyllodocæ, Claparède.—M. Claparède figures Gregarina from Phyllodoce in his 'Recherches sur les Annelides, Turbellaries, &c.' The form, however, which I observed in several species of *Phyllodoce* differs much in appearance from that which he figures (fig. 12). Its usual length was $\frac{1}{120}$th of an inch, the granules pale and indistinct, and the vesicle elongated.

It is extremely difficult to point out any characters by which any two of the forms of Gregarinida above noticed could be distinguished, excepting as regards that found in *Nereis,* which differs materially from the others. There are, however, small indications in the general appearance and habit of these creatures which at once appeal to the observer, and enable him to recognise some of the more dubious species as distinct from each other. I was thus easily able to recognise the Monocystis of *Ommatoplea* when occurring in the intestine of *Aphrodita hystrix* without any hesitation; the sea-mouse had probably taken it in with food, since Turbellarians are remarkably common in the same locality in which the Aphrodita occurs. It is a fact worth noting, that only one instance of this was observed in various examinations of more than thirty specimens of Aphrodita. *Aphrodita aculeata,* which has a peculiar form of Monocystis,* did not occur off Guernsey.

* 'Quart. Journ. Mic. Science,' April, 1863.

TRANSACTIONS.

On a Method *of* Dry Mounting. By James Smith, Esq., F.L.S.

(Read December 13th, 1865.)

(Abstract.)

The object of this paper was to show how to prepare cells for mounting dry objects, so as to be ready for use at any time, and capable of an immediate application to glass slides.

The author proposes to take a piece of card-board of six or more inches square, according to the number of cells required, and rule a series of perpendicular and parallel lines $\frac{5}{8}$th of an inch apart, so as to divide it into squares. The centre of each square is then to be perforated with a $\frac{1}{2}$ inch punch, and both surfaces of the card-board covered with a cement formed of shellac or marine glue dissolved in naphtha; one to three coatings of this cement being usually sufficient, care being taken that one is perfectly dry before the next is applied. The cells being thus prepared, they can be cut off, and by the application of heat and slight pressure are easily attached to a glass slide. The object being placed in the cell, a thin glass cover may be heated and so fixed, or this and the edges of the cell itself covered with a coating of cement. The author concluded by stating that leather or thin wood might be readily converted into cells in the manner described, but that for all ordinary purposes, those prepared of card-board would be found quite efficient.

A short Description *of an* Acarus *and its* Agamic Reproduction.* By Richard Beck.

(Read December 13th, 1865.)

After keeping one or two species of acarus for a very considerable time, and having no difficulty in increasing or diminishing their number according to the treatment I pursued, it was much to my surprise when about the middle of last summer they began rapidly to disappear, and in a comparatively short time I was quite unable to obtain from the whole of my stocks any living specimens.

On one occasion, when making a general search to see whether the acari had merely moved their quarters, I found in the thread of a spider's old cocoon a species of acarus, so entirely different from those I was looking for, and presenting to me such novelty in appearance that I lost no time in carefully securing this and one other specimen which were all I could find; one of these, however, was injured in its capture, and died immediately.

The general appearance of the one still left was that of a female, but without a male I thought there would be no chance of obtaining any reproduction of its species, and I had moreover no clue to the food it required. Instead, however, of following the often too hastily adopted plan of merely making a mounted preparation of my specimen, I determined to preserve its life as long as possible, and I am now not only enabled to prepare a specimen whenever I like, but also to supply some facts as to its life-history which could only have been obtained by keeping it for some considerable time in a living state.

The question of food puzzled me for some time, as I naturally confined myself to obtaining supplies from the locality where I found the acarus, but a part of the cocoon, the eggs of a spider, and their first cast skins, were all alike refused. It was only as a last resource and judging from the remarkable size of its falces, together with its peculiar movements, that I gave it some living acari of a different species, these I soon saw were quickly seized, the disappearance of my colonies of acari which I have mentioned was at once explained, and I continued to supply my new specimen with food, hoping it would turn out to be an impregnated female.

In a few days it laid some eggs, and these duly hatched,

* Since reading this paper Mr. Bockett has shown me a specimen of the same acarus, mounted by J. Bourgoine, of Paris, which he names "Cheyletus des pilleteries (rare)."

and many subsequent generations have been produced by them. I am now able to supply the following facts connected with this acarus, which I believe are new.

The eggs as compared with those laid by other species of acari with which I am acquainted are rather small in proportion to the parent; they are of a bluish-white colour, transparent, and adhere to the substance they are laid upon by a short thread at one extremity. At the age of two or three days in summer time, the young may easily be detected inside the egg, which hatches according to my memoranda in five, six, or seven days from the time it was laid; the variation in this and other periods of development being due I believe in great measure to the temperature of the atmosphere.

The young as it comes from the egg has only six legs, it is white, perfectly transparent, and very active, wandering about in every direction. At the age of seven days it casts a skin, and then acquires eight legs, at a further interval of seven or eight days it casts a second skin, and then arrives at maturity; before each of these moultings the individual remains sometimes for one or two days perfectly stationary and apparently dead; I mention this circumstance so that any one who likes to repeat these experiments may not disturb the acarus in this important operation.

This acarus soon after arriving at maturity assumes a yellowish-green colour, and I will endeavour to describe some of its more remarkable features at this stage of its life.

That which strikes one at first sight is the size of the falces, for I presume they cannot be correctly termed mandibles; they are largely developed, apparently very powerful and move in a horizontal direction; the two when spread out forming a complete semicircle. The free extremities of the falces are somewhat complicated in structure; on the outside edge is a strong claw, with two short spurs at its base, and immediately within this or the inner side are two combs, very similar in general appearance to the pectinated claws at the extremities of some spiders' feet; the inner one is smaller than the other, but the two move simultaneously and independently of the outer claw. There are also a few strong hairs situated near the combs.

When this acarus seizes another one of a different species, which it does by its falces, laying hold of a leg or any other part indiscriminately; the prey after a lapse of about fifteen or twenty seconds becomes poisoned or paralysed, the legs bend up under the thorax, and no part of its body makes any resistance to the pulling backwards of the devourer, who, when she finds this passive condition of her prey, deliberately seeks out the fluids with an apparatus at the mouth, and does not leave it until it is entirely empty and shrunken. The poisoning process, however, does not occur when this acarus feeds, as it frequently does, upon one of its own species. In this case the prey continues to move and show signs of life as long as any fluids appear to be left in its body, and even, when a very small one has been devoured, I have noticed a movement of the legs full half an hour from the time of its first seizure.

The parts of the mouth project from the bases of the falces and two sharp pointed and close fitting lancets, answer the double purpose of piercing and conveying the fluids, which appear to be sucked up by a muscular movement at the base of the piercers. The acarus is sufficiently transparent for the process to be watched under the microscope, and the fluids may be distinctly traced in their passage from one acarus to the other.

The external structure of this acarus appears to be very simple, and there are but few features to notice besides those of the head. Two rows of short hairs, about twenty in all, run in parallel lines and a short distance apart, leaving a broad central band, underneath which a large vessel is easily detected, and appears more or less filled with white floculent matter. In no part can I detect any spiracles or tracheæ.

Of the legs, the first pair are during life constantly raised and lowered in a vertical direction, and from this peculiar action, combined with their two unusually long terminal hairs, I presume they are employed as feelers. The last joint of each tarsus is furnished at its extremity with two hooks and two longitudinal and parallel rows of delicate tenent hairs; by the aid of these this acarus walks with some little hesitation in an inverted position upon glass.

The anus I believe to be represented by two slightly projecting flaps at the free extremity of the abdomen, immediately below which is a longer aperture, from which I presume the egg is emitted.

Wherever this acarus in a natural state deposits its eggs, in that part it takes up its quarters and remains for a considerable time; this is in fact necessary for the protection of its eggs, which would otherwise be devoured by acari of the same and probably other species. They will frequently destroy their own eggs themselves when disturbed, or when pressed for food.

Having these acari now well established in a cupboard, I mostly find them partially concealed in some small cavity, and when in a mature state standing over a quantity of eggs in every stage of development; the empty egg shells from their extreme thinness reflecting a brilliant blue light, which catches the eye more quickly than the acarus itself.

My object from the first in securing this acarus, and in keeping it alive was to obtain specimens of both sexes, but I have never yet been able to detect a male. I was much surprised to find that every specimen I selected laid eggs, all of which duly hatched, and to make sure whether this was really a case of agamic reproduction, I determined to isolate some individuals very carefully, and I obtained the following results. In all these experiments I have employed the "live traps" which I described in the last number of the Microscopical Journal of Science, and they have answered perfectly, not only in completely isolating the specimens, but also enabling me to put them under the microscope, or to supply them with food at any time without disturbing them in the least.

On July 10th, of this year, a young acarus of this species was taken from a trap in which there was only a mature female; it was completely isolated, and on the 29th of the same month it laid eggs, which hatched on the 4th of August. One of these on the day it was hatched was removed to a trap and also completely isolated; by the 13th of September it had laid eggs, and some had hatched. On the 19th of September two of the young from the last mentioned trap were separated and secured; these I now have living and in a mature state, neither have as yet laid eggs, but I fully expect they will do so unless the approach of colder weather retard the process of reproduction, which I think is very probable, or it may perhaps stop the increase altogether.*

The securing a succession of three generations, including some accidents, have with me extended over a period of about five months, and I am quite prepared to admit that the proof of agamic reproduction in this acarus would have been more satisfactory if continued through a longer period, but after reading Professor Huxley's Paper on the Agamic Reproduction of Aphis, in part of which he states that "in Myriapoda and Arachnida the process is not known,"† I have thought that the few facts I have just given were of sufficient value to bring before your notice.

* (March 16, 1866.) Since writing the above, one of the specimens last referred to was killed; the other laid eggs which hatched on the 29th of December, and one of these young ones is still alive, but isolated in the same way as its predecessors. The cold of the winter has retarded the development of these acari very considerably, and so much so as to allow the other colonies of acari to appear again in their wonted numbers.

† 'Linn. Trans.,' vol. xxii, part 3, p. 216.

I am, moreover, in a position now to supply a limited number of living specimens to any one who is anxious or willing to investigate the subject, and I can at any rate promise a certainty in the supply of food, for I find that they are perfectly satisfied with the common cheese-mite.

A further investigation, therefore, into this subject, only requires the expenditure of a moderate amount of time and care, and the importance of agamic reproduction may be estimated by the attention it has already received from the most scientific naturalists.

An IMPROVED GROWING CELL.

By RICHARD BECK.

(Read December 13th, 1865.)

I WAS shown by Mr. Suffolk at our last meeting a new growing trough contrived by Mr. Smith, of Kenyon College, U.S. A description of this piece of apparatus has been given in 'Silliman's American Journal of Science,' September, 1865, and it has also been republished in the last November number of the 'Annals of Natural History.'

I think every one will admit that the principle on which the growing trough is contrived is very ingenious, and that it will prove of no little importance in many microscopical investigations.

The few suggestions which I shall make refer to the construction only, and to make them intelligible I must first quote Mr. Smith's description which is as follows:—

"The whole slide, as I have constructed it, is a trifle more than $\frac{1}{8}$th of an inch in thickness. It consists of two rectangular glass plates, 3×2 inches, and about $\frac{1}{25}$th of an inch thick, separated by thin strips of glass of the same thickness, cemented to the interior opposed faces, as shown in the figure.

"The upper plate has a small hole, *a*, drilled through it. One corner of the upper glass is removed, as at *b*, and a small strip of glass cemented at *c* serves to prevent the thin glass cover placed over the edge from sliding. To use the slide, fill the space between the two plates with clean water, introduced at *b* by means of a pipette, and also place a drop on *a* to remove the air. The object being put on the top of the slide and wetted, is now to be covered with a large square of thin glass, *c*, at the same time covering the hole, *a*. The slide can now be placed upright, or in any position, as no water can escape. It is, in fact, only a new application of the old principle of the bird fountain. As the water evaporates from under the cover, more is supplied through the hole, *a*, and from time to time an air bubble enters at *b*; thus a constant circulation is maintained."

This arrangement has, I think, one or two disadvantages. When the water sinks as low as the position of the object, the water line may become a considerable annoyance in viewing the object, and in those cases when it is necessary to use impure water there must be a considerable obstacle to the best illumination. I also think there will be a difficulty under some circumstances in cleaning the trough thoroughly. The plan I now propose is as follows:—An annular glass cell (fig. 1), formed by cementing two glass rings (*a* and *b*) upon a circular piece of glass (*c*), with a central aperture (*d*) the size

FIG. 1.

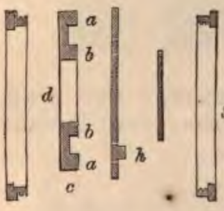


FIG. 2.

of the smaller ring, is securely fastened into a brass plate (fig. 2, *e*), which has a projecting ring, on which a screw is cut; upon this a cap (*g*) screws and fastens down an upper circular glass plate, which is provided with the two necessary holes, and a ledge (*h*) for the thin glass. By this arrangement there is no more than the ordinary obstruction to the illumination. The supply water can never come across the field of view, and the piece of apparatus can be taken to pieces in a minute, either for adding fresh water or for thoroughly cleaning the cell.

Mr. Smith only mentions the suitability of the "growing trough" for small objects such as can be retained under the ordinary thin glass, but by employing a cell of between one and two-tenths of an inch in thickness, or more, upon the upper plate, a considerable quantity of water may be preserved; his contrivance is therefore equally well adapted to comparatively large objects, and it is impossible to tell at once how far its sphere of usefulness may extend.

January 10th, 1866.

An extract from a letter from Professor H. L. Smith, of Kenyon College, Gambia, Ohio, U.S., was read by Mr. E. G. Lobb, giving a description of the method of using a new illuminator for opaque objects. The apparatus sent over by Professor Smith was exhibited by Mr. Lobb, a description of which is given in 'Silliman's Journal' for September, 1865. The apparatus of Professor Smith, which consisted of a metallic reflector to be fitted between the object-glass and the compound body, he requested might be placed in the hands of Messrs. Powell and Lealand, as he had no doubt they might improve upon it, and these gentlemen, as well as Messrs. Smith, Beck and Beck, have invented a plan for substituting a glass plate for the metallic reflector, which obviates many of the difficulties in the illumination to which the metallic reflector is subject.

The Object-Glass *its own* Condenser; *or, a* new kind *of* Illumination *for* Opaque Objects *under* High Powers. By Richard Beck.

(Read January 10th, 1866.)

This method of illumination has been recently introduced by Mr. Smith, of Kenyon College, U.S.;* but I believe the best effect may be obtained by the following exceedingly simple plan:—

A piece of thin glass (fig. 3, *b*), attached to a small brass milled head, fits into the side of an adapter (fig. 1), and when in position, as in figs. 1 and 2, the light coming through a small circular aperture (*a*) may be reflected down and through the object-glass, by the thin glass which makes no obstruction to the rays passing upwards again from the object-glass to the eye-piece, nor even affects the definition to any perceptible degree.

The adapter (fig. 1) is used, as shown in section (fig. 2), between the nose-piece (*c*) and the object-glass (*d*); it has a rotating fitting at the milled ring, and this movement, in combination with that of the small milled head to which the thin glass is attached, is sufficient for the nicest adjustment of the illumination.

* 'Silliman's Journal,' Sept., 1865.

By means of a slot (*e*, fig. 1) in the side of the adapter the thin glass may be readily removed for the purpose of being wiped, as its perfect freedom from dust or smear is most essential.

I don't know of any illumination connected with the microscope that requires more care and thought in its use than this. We have to consider, in the first place, that all the light thrown upon the object passes through the object-glass, which consequently regulates the direction of the illumination, and thus the obliquity can never exceed the angle of the pencil of light admitted by the aperture of the same

FIG. 1.

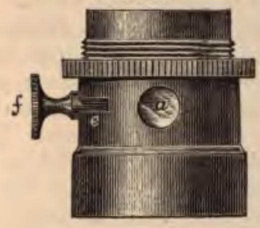


FIG. 2.

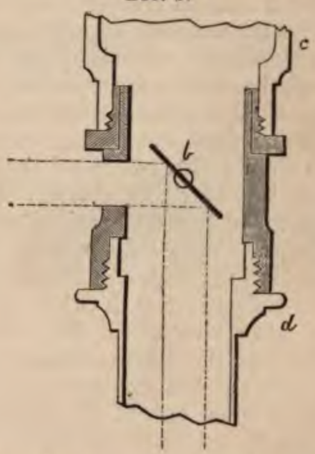


FIG. 3.

object-glass; and, secondly, it must be remembered that an object, or any part of any object, that lies in a plane at right angles to the axis of the body of the microscope, and possesses a reflecting power, will merely return the light into the instrument, not only giving a more or less milky appearance to the picture, but also a very deceptive representation of the specimen.

A striking illustration of this fact is given when a piece of thin glass is over the object, this so thoroughly reflects the light that little can be seen beyond it, and especially so with object-glasses of large aperture. With this illumination therefore all objects should be uncovered, and even then success is not always certain. I have tried to get a view of the tracheal vessels in the flea by this method, but the horny plates reflect so much light that hardly anything can be seen beneath them. The proboscis of the blow-fly, when simply expanded by pressing the head between the forceps is very remarkable, so much so indeed that I made a rough sketch of the appearances, which are nevertheless perfectly unintelligible to me, unless we have here an entire reversion of the correct appearance, or that those parts which appear light should be dark. The definition, however, with this object is perfect, and the deceptive appearances must be due to our not understanding the illumination. I have seen the fly's eye with this piece of apparatus in a way that I have never seen it before; but by slightly varying the direction of the illumination the surface of each lens might easily be made to appear, either concave or convex, and the same may be said of the glands in fractured specimens of coniferous wood.

The Diatomaceæ supply admirable proofs of the efficiency and perfection of this illumination, and the markings may clearly be seen upon *Pleurosigma formosum, angulatum,* and *fasciola;* but such specimens are best viewed when mounted on some dark absorbing material, and not on glass. The plan should also admit of the specimen being moved accurately into various positions. In looking at a valve of *Heliopelta,* for instance, the raised portions show decided hexagonal walls, the depressed portions giving merely dots or points of illumination; but one cannot find out where the two structures merge into each other without tilting the specimen so as to get a view of the otherwise vertical plane.

Perhaps the most striking objects are the scales from lepidopterous and other insects; they can be seen by this method in a manner not to be approached by any other. I must confess to only a casual glance at a few specimens for their general beauty; but I noticed how remarkably well the long vertical and short transverse ribs could be seen on the scales of *Morpho menelaus,* and from what I have yet been able to see of the Podura scale, there is no reason for altering the description I have already given of it.

We have been so long accustomed to the examination of objects that either are or have been made flat, that some persons hardly appear to understand the condition of many unprepared specimens.

With this illumination, especially suited as it is for the highest powers, we often cannot expect to have more than a very small portion of the object in view at once, and in such cases the parts out of focus cannot be prevented from reflecting light, and giving a kind of indistinctness to the picture. In using this illumination I have generally found it best to put the light about eight inches from the microscope, and the reflector will then give an image of the flame upon the object.

The illumination of the whole field, or the throwing of the light more or less on one side, can easily be accomplished by the use of a small condensing lens placed about the distance of its own focus from the lamp, and slight alterations in its position will, so far as I have tried, produce quite as good results as any diaphragm with small apertures at the side.

I feel confident that this method of illumination will prove a valuable addition to the microscope. It is a subject of great importance and interest; but it requires, so far as we know at present, careful and thorough investigation.

NOTE *on* ILLUMINATING OBJECTS *with* HIGH POWERS. By E. G. LOBB, Esq.

(Read January 10th, 1866.)

THERE are several methods of illuminating with high powers. The late Professor Quekett, in his treatise on the microscope, recommends oblique light with the mirror and lamp, removing all appliances under the stage; then after much patience and perseverance *Grammatophora subtilissima* and the Amician test may be resolved.

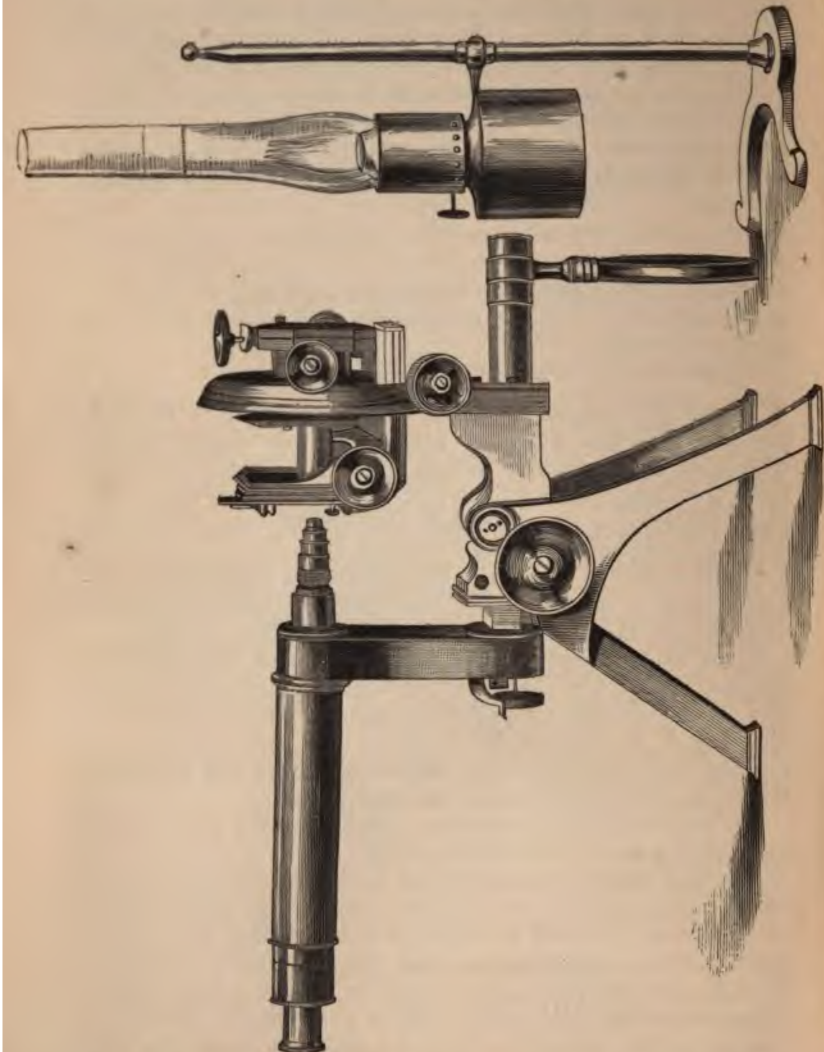
Another plan is to use the flat mirror, the achromatic condenser and a paraffin lamp, daylight not being so easily managed, or even so good for the $\frac{1}{8}$th or higher objectives.

Some use the mirror and a prism, so placed that the light may be thrown on the object at right angles. Others use two prisms and two lamps for the same purpose. Others use the Rev. J. B. Reade's kettle-drum. In fact, multifarious are the methods adopted by different parties, and very successful have been the results obtained.

My own method is as follows, which does for all descriptions of objects, whether lined or not:—

The microscope is placed in the horizontal direction, and a small camphine lamp so adjusted that its reservoir may be close against the end of the rack-tube; having the A eye-piece, the one-inch objective, and the achromatic condenser of 170° aperture, place No. 1 aperture of the wheel of diaphragms in the field, then, looking through the eye-piece, centralize the aperture; this done, put No. 11 aperture in the field, then centralize the lamp flame; everything will now be in the axis of the pupil of the eye.

Should it be wished to examine hairs, scales, or morbid structure, use No. 3, 4, or 5 apertures of the wheel of diaphragms without any stop, the $\frac{1}{8}$th, $\frac{1}{12}$th, $\frac{1}{16}$th, $\frac{1}{25}$th, or $\frac{1}{50}$th object-glasses, and the A, B, or C eye-piece as may be



thought proper; now bring the object into focus, and by merely racking the condenser for the best light, very clear and satisfactory definition will be obtained. Nothing more is required in examining these objects than in selecting the most desirable aperture, and focussing the condenser for that illumination which defines the best; too much and too little light being equally bad.

If it be wished to examine objects such as *Pleurosigma formosum, P. quadratum, P. angulatum,* and their allies, put No. 11 aperture in the field, rack up the condenser until the field is very bright, then put on No. 1 stop, rack up the condenser until the stop disappears, and if the desired effect is not produced try No. 2 stop; the condenser will then require to be racked up still higher, and the dots will come out admirably.

If it be wished to examine *Navicula cuspidatum, N. rhomboides, Pleurosigma fasciola, P. macrum,* or their allies, still use No. 11 aperture, and stop No. 2, which will have to be altered a little in position, when the checks will distinctly appear.

For the Amician test use the slots instead of No. 2 stop; and as regards very difficult lines, such as those of the Acus, the condenser must be so arranged (when focussed up till the field becomes exceeding bright) that a shade be thrown on the object from the left hand, and No. 1 or No. 2 stop used, so as to darken a little the right hand side of the field; the effect will be to bring out these delicate lines. The $\frac{1}{8}$th and $\frac{1}{12}$th object-glasses I have generally found the best for this object with the B eye-piece; in fact, the B eye-piece is mostly to be preferred with high powers.

In the foregoing remarks I have been compelled to allude to my own apparatus; still, no doubt, the same effects may be produced by the use of condensers of different construction, as long as the aperture is considerable.

See Engraving for the arrangement of the microscope and lamp.

MICROSCOPICAL SOCIETY.

Anniversary Meeting.

February 14th, 1866.

J. Glaisher, Esq., F.R.S., President, in the Chair.

The minutes of the preceding meeting were read and confirmed.

Various presents were announced, and the thanks of the meeting returned to their respective donors.

Certificates in favour of J. Bockett, Esq., 10, Willingham Terrace, Kentish Town; J. E. Mayhew, Esq., Hove Place House, Brighton; H. G. Westcar, Esq., Royal Horse Guards, Hyde Park; were read and ordered to be suspended in the usual manner.

J. Lovibond, Esq., was balloted for and duly elected a Member of the Society.

Reports from the Auditors of the Treasurer's accounts and from the Library and Object Committees were read.

Report of the Council.

The Council have to make the following report on the progress of the Society during the past year.

Since the anniversary, held February 6th, 1865, twenty-six persons have been elected members of the Society; 2 members, J. G. Appold, Esq., F.R.S., and Joseph Gratton, Esq., have died; 9 members have resigned, and 3 have been removed during the past year.

The number of members reported at the last anniversary was	348
There have been since elected	26
Making a total of	374
This number has to be reduced by—deceased, 2; resigned, 9; removed, 3	14
Leaving a final total of	360 as

the present number of members of the Society.

Showing an increase of 12 during the year.

The Library has had additions to it from time to time, as shown by the report of the Library Committee; and the collection of objects has been increased, as will be seen by Mr. Lobb's report.

The Journal has been regularly published, and, as usual, circulated among the members.

Receipts.

				£	s.	d.
By Balance from previous year				77	10	7
Admission Fees of 22 New Members				23	2	0
Compositions				42	0	0
Dividends on £753 6s. Consols				22	4	4
Sundries—						
Sale of Transaction	1	1	0			
„ Catalogues	2	0	0			
				3	1	0
Annual Subscriptions—						
For the year 1862	3	3	0			
„ „ 1863	10	10	0			
„ „ 1864	30	9	0			
„ „ 1865	172	4	0			
„ „ 1866	36	15	0			
				253	1	0
				£420	18	11

Payments.

				£	s.	d.
To Salary of Assistant Secretary				21	0	0
„ Curator				5	0	0
Editors of the 'Microscopical Journal'	157	10	0			
Postage and Delivery of ditto	12	6	2			
				169	16	2
Rent				25	0	0
Expenses of Soirée—						
Fittings, Gas, &c.	8	19	8			
Refreshments	18	0	0			
				26	19	8
Book-case				5	13	0
3 Quekett Medals				3	9	0
Reporter				3	3	0
Printing and Stationery—						
Printing	22	18	0			
Books	1	12	6			
				24	10	6
Assistant Secretary, Collection of Subscriptions				15	19	0
Ditto, Petty Expenses				5	8	9
Lamp Oil, &c.				8	3	10
Subscription Ray Society				2	2	0
Balance in hands of the Treasurer				104	14	0
				£420	18	11

We, the undersigned, have examined the Treasurer's accounts, with the documents and vouchers, and found the same to be correct. The amount of Stock in the Consolidated Three per Cents. being £753 6*s.* 0*d.*, and the balance in favour of the Society being £104 14*s.*

HENRY LEE.
W. H. HALL. } *Auditors.*

Report of the Library Committee.

Since the last report the Committee, by the desire of the Council, have procured a new book-case, which with that already in use, will, they consider, afford accommodation for all the books belonging to the Society.

The books already in the printed catalogue have been called in and examined, and with the exception of those mentioned at foot, which have been borrowed and not returned, have been handed over to the custody of the new curator.

The additions, since the last anniversary to the Society's Library have been 6 volumes, and 103 pamphlets, of which 1 volume and 7 pamphlets have been purchased.

List of books not returned by members :—'Burmeister's Organization of Trilobites,' (Ray Soc.) ; 'Grew's Anatomy of Plants;' 'Pritchard's Microscopic Objects ;' 'Quekett's Lectures on Histology,' Vol. I; 'Kölliker's Human Histology.'

F. C. S. Roper.

Report on the Cabinet of Objects during the past year.

At the last Annual Meeting, February 6th, 1865, the Cabinet contained 1315 objects . . .	1315
The following have since been added :—	
Presented by Dr. Carpenter, June 14th, 1865, eight slides of Eozoon Canadense	8
Presented by Mr. W. H. Hall, October 8th, 1865, twenty-five slides, Animal and Vegetable . .	25
Presented by Mr. John T. Tupholme, November 8th, 1865, eighteen slides of Diatomaceæ . . .	18
Presented by Mr. John Hepworth, December 13th, 1865, eleven slides of Injections	11
Presented by Mr. W. M. Bywater, January 10th, 1866, twelve slides of Parasitic Fungi . . .	12
Objects now in the Cabinet	1389

Being an increase of 74 during the year.

Ellis G. Lobb.

The President delivered an address, showing the progress of the Society and of microscopical science in general during the past year.

The PRESIDENT'S ADDRESS *for the year* 1866.

By JAMES GLAISHER, Esq., F.R.S., &c.

GENTLEMEN,—It sometimes happens that one finds himself in a position which requires explanation; such is my own case this evening.

Your rules require an Annual Address from your President, an address which should speak with authority of the advance in Microscopical Science, and indicate as far as possible its future prospects, by one well versed by practical experience and the devotion of much thought and care. Hitherto on these occasions you have listened to such Presidents, the accredited Representatives and Leaders in Microscopical Science, but my usual avocations are not microscopical, and they are so engrossing I have no time to devote to these researches, and therefore my sense of unfitness for this task would have precluded my appearance before you as the exponent of your views.

I am here, however, at your command, and I should be unworthy of your confidence did I not endeavour to comply with your rules by collecting information from all persons and all sources, and giving to our proceedings that completeness which the founders of this Society contemplated.

It is not, however, expected that an annual address should take the form of a scientific paper, but that it should embrace a wider field, and include more varied subjects; tracing the progress of Microscopical Science in the year, and therefore including the results of the labour of many individuals; in attempting this, should I omit anything which I ought to have included, I beg you to excuse me.

The objects of this Society, as laid down in the constitutions, are varied. They are, however, emphatically the advancement of Microscopical Science. In this two things are implied—firstly, that Microscopical Science is a worthy object of pursuit; and secondly, that combined efforts are necessary.

A few moments' consideration of these points may be interesting :—

To say that Microscopical Science is worthy of our pursuit is a proposition to which every one assents. But what do we mean by Microscopical Science? Is it the mere collection of detached facts? Is it to ascertain the purity, or otherwise, of commercial products? Is it to be chiefly valued for its utility and its practical applications? Even in the view of utility alone, the microscope claims a high place, and for an instance we need but refer to our transactions for the past year.

In a case of poisoning by means of corrosive sublimate maliciously substituted for the proper medicine, and in which there was a doubt, which it was of the utmost importance to remove, as to the source of the poison, rendering it uncertain whether the child had met with its death by accident, carelessness, or otherwise, Mr. Deane, by the aid of the microscope, determined in the most unequivocal manner that the poison was derived from a small parcel of the same substance kept in a piece of rag in the house of the child's parents, where it died, thus rendering it quite certain that the death of the child was premeditated, and at the same time removing every trace of suspicion from innocent parties, whose care and common sense had been called in question.

In a social as well as a medico-legal point of view, every one must see from the above recorded illustration how impossible it is to over-estimate the scientific application of the microscope as an element in Medical Jurisprudence.

There is everywhere a pressing demand for what is practical, and often the profoundest speculations of science or adventurous experiments in science are met with contempt when they do not immediately pay back to the experimentalist a return for his labours in marketable value.

The scientific investigator rejoices as warmly as any one in every addition of science to the arts, or to the practical wants of the day; but he emphatically denies that the whole value of science is to be estimated by its present application.

In the narrow sense of utility it may be asked, Of what use to know the forms of some of those beautiful diatomacea drawn by Dr. Greville, or of those beautiful organisms delineated by Dr. Maddox, so minute that many to the naked eye are invisible; but what educated man can be indifferent to them, or who can say to what a more extended knowledge of these atoms may lead?

Take for example the investigation into those remarkable forms *Eozoon Canadense*. In the May number of the 'Intellectual Observer' is a paper on the Structure, Affinities, and Geological Position of this remarkable fossil, by William Carpenter, M.D., F.R.S., &c.

The researches into its structure and character belong partly to the present year, and afford proof of the services which the microscope is able to render to geology and palæontology.

During the Canadian Geological Survey large masses of what appeared to be a fossil organism were discovered in rocks situated near the base of the Laurentian series of North America. Dr. Dawson, of Montreal, referred these remains to an animal of the foraminiferal type; and specimens were sent by Sir W. Logan to Dr. Carpenter, whom we are proud to claim as a former President of this Society, requesting him to subject them to a careful examination.

As far back as 1858 Sir W. Logan had suspected the existence of organic remains in specimens from the Grand Calumet limestone, on the Ottawa river, but a microscopic examination of one of these specimens was not successful. Similar forms being seen by Sir William in blocks from the Grenville bed of the Laurentian limestone, were in their turn tried, and then revealed their true character to Dr. Dawson and Dr. Sterry Hunt.

The masses of which these fossils consist are composed of layers of serpentine alternating with calc spar. It was found by Drs. Dawson and Sterry Hunt that the calcareous layers represented the original shell; and the siliceous layers the flesh, or *sarcode*, of the once living creature. These results were arrived at, through comparison of the appearance presented by the *Eozoon* with the microscopic structure which Dr. Carpenter had previously shown to characterise certain members of the foraminiferal group. The *Eozoon* not only exceeded other known foraminifera in size, to an extent that might have easily led observers astray, but from its apparently very irregular mode of growth, its general external form afforded no help in its identification, and it was only by careful examination of its minute structure that its true character could be ascertained. Dr. Carpenter says:—"The minute structure of Eozoon may be determined by the microscopic examination either of thin transparent sections, or of portions which have been subjected to the action of dilute acids, so as to remove the calcareous shell, leaving only the *internal casts*, or *models*, in silex, of the chambers and other cavities, originally occupied by the substance of one animal."

Dr. Carpenter found the preservation of minute structure so complete that he was able to detect "delicate pseudopodial threads, which were put forth through pores in the shell wall, of less than $\frac{1}{10,000}$th of an inch in diameter."

Dr. Carpenter exhibited some beautiful specimens of the Eozoon at the last *soirée* of this Society, and which he afterwards presented to the Society; and though his results have been controverted in some quarters, they have been fully accepted by naturalists best acquainted with the microscopic structure of the family to which the Eozoon has been assigned.

In a paper read last month at the Meeting of the Geological Society, Dr. Carpenter stated that he had recently detected Eozoon in a specimen of ophicalcite from Cesha Lipa in Bohemia, in a specimen of gneiss from near Moldau, and in a specimen of serpentinous limestone sent to Sir C. Lyell by Dr. Gümbel, of Bavaria, all these being parts of the great formation of "fundamental" gneiss, which is considered by Sir Roderick Murchison as the equivalent of the Laurentian rocks of Canada.

There can be little doubt that a rich field of research is now opened to those who will undertake the examination of rocks of various ages, which present the appearance of analogous structure; as it is, the microscope has been the means of demonstrating the existence of animal life at a very ancient geological date; and in the words of Sir W. Logan "we are carried back to a period so far remote that the appearance of the so-called *Primordial Fauna* may be considered a comparatively modern event."

Such are some of the objects of microscopical scientific research over and above its practical utilities, and are its claims upon our services.

Let me now say a few words upon my second proposition, viz., that combined efforts are necessary to its full development.

Microscopical science advances by observation, by the accumulation of facts, by patient research, by improvements in the object-glass, its mode of illumination, &c. Now, here the co-operation of observers scattered over the world is necessary, and these should include all classes, for so universal are the objects scattered which we wish to study, that a large co-operation is indispensable; so that results may be based upon the comparison and discussion of a wide range of observation. Co-operation and friendly rivalry are also needed with opticians, both in this and in other countries, so that the microscope may be as perfect as possible.

Turning now to our transactions of last year, we find no less than four papers by Dr. R. K. Greville "On New and

Rare Diatoms;" these papers are in continuation of those previously presented to the Society, and are numbered XV, XVI, XVII, and XVIII. These are all accompanied with exquisite drawings, clear descriptions, and are the results of much careful investigation.

Dr. Maddox has communicated a paper "On Photomicrography." It is well known to the members of this Society that for some years attempts have been made to add the application of photography to microscopy, for the delineation of microscopic objects.

Indeed, several papers on this subject have engaged your attention at various meetings.

As far back as April, 1853, in the Journal of this Society, was published a beautiful photographic illustration of microscopic objects. In the January number for 1855 Mr. Wenham wrote on the same subject, and showed how to make the actinic and visual foci coincident, and here and there during succeeding years we find a few scattered individuals endeavouring to rekindle the flame and keep alive this interesting art. Still it was not until Dr. Maddox, feeling fully persuaded that its application has advantages both of scientific and art value, and in the firm belief that it will ultimately materially assist the microscopist, determined to test its capabilities by the delineation of objects the most diverse in structure, colour, and size, and so tested more fully its range and applicability. He described his apparatus and the method he has adopted to overcome many difficulties; and Mr. How, of Foster Lane, exhibited on a screen nearly 100 of Dr. Maddox's results; these showed many minute organisms, with beautiful markings.

It is chiefly to the efforts of Mr. Highley and Mr. How we are indebted for bringing before the public the results of the labours of Dr. Maddox and others in this field of inquiry, and it is gratifying to know that at soirées and other places these illustrations have attracted a good deal of attention; and it is still more gratifying to know, that at exhibitions where their merits have been more carefully tested, they have been considered so well executed as to command the award of medals; one has been awarded to Dr. Maddox from the London Photographic Society, and a second also to Dr. Maddox, from the recent International Exhibition, Dublin; thus showing an appreciation which will furnish me some excuse, were any required, for directing attention to the past, present, and future of this branch of Microscopy. Unfortunately in this branch, so far as I know, there have been but few labourers in this country.

Mr. Thomas Davies has employed photography to render the beautiful specimens of artificial microscopic crystallization which were engraved as illustrations in our Journal, and Dr. W. Bird Herapath, in his valuable papers on the anchors and plates of various synaptæ, and the pedicellariæ of the echinodermata, has likewise had recourse to photomicrography; the photographs being reproduced as engravings and valuable illustrations in the Society's Journal.

In the person of Count Castracane we have the promise of the subject being more fully worked out. He has started with the assistance of a Dubosc's heliostat and prism mounted so as to employ monochromatic light; possibly this may have its actinic advantages, as it occasionally has its optical, for we find both Mr. Wenham and Dr. Maddox calling attention to the use of coloured glasses over the eye-piece. Still, I learn from Dr. Maddox that in his trials with monochromatic light, as derived from the use of Abraham's condensing prism without heliostat, that he did not obtain any advantage, but rather, in some instances, the reverse; the field and object (when the latter is very transparent) being more or less of the same tint, which neutralized the contrast too much; at least he found it did so for the reproduction of transparencies for the lantern.

Mr. Sorby, I believe, also employs photography to illustrate the appearance of fractured surfaces by reflected light.

Probably many others are quietly at work on the subject, with the results of whose labours, sooner or later, perhaps this Society will be favoured.

Abroad it has largely extended its influence, and it remains with ourselves to see whether we shall lose or retain our position. The hindrance to its being fully utilized appears to me greatly to arise from the expense attending the publication of such illustrations as photographs, more especially in scientific literature. Possibly we are on the eve of being able to produce such (which seems highly probable from papers recently read at the meetings of the Photographic Society) by means more nearly allied to the ordinary methods of printing, and then we may expect its future will be as rapid as its past has been tardy.

In a paper on the structure and affinities of the Polycystina Dr. Wallich has furnished us with an elaborate account of this obscure family of the Protozoa, and a classification based, as he believes, on the only constant characters it exhibits, viz., those involved in the mode of development and growth of the siliceous framework within and around which their soft part, or sarcode, is sustained. This is an important step in our knowledge of the Polycystina; for, although long familiar to the microscopist as most beautiful and prized objects of study, they had not previously received anything like a natural and systematic arrangement. But Dr. Wallich's paper claims notice on other grounds, inasmuch as it treats not only of this single family, but of the Rhizopods generally, and recommends for adoption a revised classification of the entire group, based on personal examination of the several families, and supported by a large number of original and highly interesting observations.

Whilst speaking of Polycystina, I wish to direct attention to the drawings of Mrs. P. S. Bury, who has most kindly favoured me with copies of her drawings of Polycystins, which are evidently, as she tells me, the honest representation of the objects as conveyed to her eyes and mind by attentive contemplation of the objects seen in a good binocular microscope.

These drawings illustrate how ladies may assist us in our pursuits, and at the same time, I feel sure, give to themselves great pleasure in dwelling over and recording faithfully some of the variations of forms of growth which are so numerous, sometimes whimsical, and often exceedingly beautiful, as are shown in Mrs. Bury's drawings of those curious organisms.

The subject of the generative productions in invertebrata does not seem to have been much taken up by naturalists. The paper by Mr. A. Sanders is therefore the more valuable. He says, as far as his researches have extended, he has only met with two papers treating especially on the development of Zoosperms; they are in De Quatrefage's series of papers on the Annelida, in the 'Annales des Sciences Naturelles;' there is indeed a paper by Von Siebold in 'Müller's Archiv,' 1835 and 1836, in which the zoosperms of different classes of animals are described, but there is nothing about their development. In this inquiry there is a great deal of physiological interest; but perhaps it would be somewhat too audacious to hope that it would throw any light on the mysterious changes which the physical forces undergo in their passage through organic matter, which we call vitality.

In the Pulmogasteropoda, to which his paper was more particularly devoted, the subject is complicated by another factor, viz., Hermaphroditism; and the older naturalists disputed as to whether the zoosperms and ova were generated in the same or in different glands: the balance of evidence inclined in favour of the former view, and such is the modern received opinion; but it was open to objection, and was objected to in a paper by Dr. Lawson, and until the actual development of zoosperms could be demonstrated in the gland going on at the same time as the ova, it could not be said to be proved. This Mr. Sanders's paper was intended to do, and if the facts he gave are considered sufficient, the question may be considered settled. There is, Mr. Sanders believes, no instance in nature, except in the case of Gasteropoda, in which the two zoosperms and ova are produced in the same gland; in all other hermaphrodite animals there is a separate gland for each.

Mr. Sanders tells me his paper is but an instalment, and he proposes from time to time, as materials offer, to send to the Society notes on the process in different classes of animals.

Mr. Jabez Hogg has contributed a valuable paper on "The Vegetable Parasites of the Human Skin;" the object of which was to show that vegetable parasites do not produce the different varieties of skin disease; but that when certain diseases already exist, the fungi finding a suitable soil, greatly aggravate and often change the type of disease; that these diseases are always associated with neglect of person, dirt, bad air, want of light, and sufficient nourishment; that the spores of fungi are always floating about in the atmosphere, and thus ever ready to be deposited and take root in a favorable soil. Of this Mr. Hogg gave many illustrations, and showed that although yeast, penicillium, aspergillus, and some other fungi, had been separately classed, nevertheless they could be made to pass through the same changes, and produce ferments that could not be recognised one from the other, and therefore difference of form he believed to be entirely due to the soil or nourishment supplied, and dependent on such circumstances as whether the growth of the fungi takes place in a sickly plant, a saccharine solution, or an animal tissue.

Mr. Erasmus Wilson, F.R.S., who has devoted much thought to this subject for a number of years, entertains different views on this subject, and views which commend themselves to the attention and inquiry of microscopical observers. He states that in an unhealthy state of the body and skin the epidermis is produced unhealthily; that one of the forms of unhealthy condition is their persistence of the nutritive granules of the epidermis in the crude and fœtal state, and that in this state they take on the process of proliferation, by means of which the substance of the rete mucosum is converted into a phytiform tissue, composed of cylindrical shafts, simple and branched, and granules, and that it is to the granules that the term sporules has been applied. According to him, therefore, the parasite theory of cutaneous disease has no existence; in fact, the phytiform structure does not come from without, but is developed where it is found, and that, in essential nature, it is a perversion of a normal process, a degradation of vitality of the cell-elements, and a transformation of an animal structure into a lower form of organism, into one which is usually regarded as a vegetable tissue. He further states that this morbid change occurs beneath the epidermis without breach of the latter, and in the substance of the rete mucosum, and that the morbid tissue moves to the surface only by progressive growth. Mr. Erasmus Wilson believes the perforation of the horny layer of the epidermis by a mucedeinous sporule impossible, and regards the cause of the development of the phytiform tissue, and consequently of the disease, as coming from within, dependent only upon the vitality and health of the individual, and independent of personal cleanliness and exterior conditions of every kind.

A more intensely interesting field can scarcely be found for the labours of the micro-physiologist than that chosen by Mr. Hogg.

The most important novelty of the year has been the successful application of the spectroscope to the microscope. In Mr. Sorby's first experiments of this class ('Quarterly Journal of Science,' 1865, p. 198) he used such an arrangement as could be made with a simple triangular prism. This was placed below the achromatic condenser, so that a minute spectrum of any transparent object could be examined, and the particular rays which it transmitted easily seen. Shortly after the publication of Mr. Sorby's paper, Mr. Huggins sent a paper to this Society,* in which he proposed to adapt a spectroscope to the eye-piece of the microscope, so as to enable us to view the spectra of opaque as well as transparent objects. After this meeting, Mr. Browning suggested to Mr. Slack and myself that a direct-vision spectroscope would be the most convenient form for this purpose; and on the 14th June he read a paper in which he showed how a compound direct-vision prism could be applied to the microscope as an eye-piece. The exact form of prism finally adopted was determined after communication with, and experiments by, Mr. Sorby. The slit may be either in the focus of the object-glass, or in that of the eye-piece or of one of its lenses.

One of Mr. Sorby's arrangements was to have the slit in the focus of the object-glass, and the compound prism between them. In using a binocular microscope, this form enables us to see the spectrum with both eyes, and also to use a micrometer to measure the position of any absorption bands. It is

* 'Quart. Journ. Mic. Sci.,' July, 1865, p. 85.

adapted for the study of coloured solutions in test-tubes, but cannot be employed with objects less than $\frac{1}{10}$th of an inch in diameter.

For this reason it is more generally advantageous to employ a form of apparatus with the slit in the focus of the upper lens of the eye-piece, made achromatic; and it is also very much better to have such arrangements that two spectra can be compared side by side, as described in his paper in the January number of the 'Popular Science Review,' 1866, p. 66.

With the Sorby-Browning spectroscope, the spectra of very minute bodies can be seen to great advantage either by transmitted or reflected light; and their being only partially transparent and of considerable thickness does not signify much. Of course, the use of such an instrument is almost entirely restricted to coloured bodies, though in some cases the colour may be very faint; but whenever colour is an important character, it appears that such a method of investigation should not be neglected. The value of the results depends very much on whether the spectra do or do not give well-marked absorption bands; and there are many cases in which the facts are unfortunately very indefinite.

As far as can be judged at present, the chief use of the instrument will be in forming a more definite opinion respecting the nature of solutions, coloured either naturally or by the addition of tests; to the study of blowpipe beads, and of natural and artificial crystals; and, in some cases, to the determination of the nature of the minerals met with in the sections of rocks and meteorites in which chemical analysis cannot be employed.

There are also some branches of natural history and physiology to which it might be usefully applied; but hitherto Mr. Sorby has been more anxious to bring the instrument itself to perfection, and to establish its fundamental principles, than to employ it extensively in deciding any other practical question than the detection of minute blood-stains in cases where ordinary microscopical examination could not yield decided results. As I have previously stated, Mr. Huggins and Mr. Wenham adopted an opposite course to Mr. Sorby: instead of applying the microscope to the spectroscope, which was Mr. Sorby's plan, they applied the *spectroscope* by using it as an eye-piece to the microscope; and, in addition to the examination of solutions or transparent objects, they were enabled for the first time to investigate the spectra afforded by small and strongly-illuminated objects that were opaque.

The spectroscope first employed in this way was that with which Mr. Huggins made his remarkable discoveries in the new science of Celestial Chemistry. Such an apparatus, however, was far from convenient, and Mr. Browning turned his attention to the subject with his accustomed skill, and soon produced the "Sorby-Browning Spectroscope," which we have already described as in the highest degree effective and convenient.

Mr. Sorby succeeded, at an early period of these inquiries, in obtaining characteristic spectra with exceedingly small quantities of blood: but with Mr. Browning's apparatus, and with the use of Messrs. Smith and Beck's $\frac{1}{20}$th, or Messrs. Powell and Lealand's $\frac{1}{25}$th, a distinct spectrum can be easily obtained from the third or the fourth of a single human blood-corpuscle.

The size of such a corpuscle will vary, according to Mr. Gulliver, from $\frac{1}{3200}$th to $\frac{1}{3500}$th: thus, if we take $\frac{1}{12000}$th of a square inch of a human blood-corpuscle, we find that it contains enough of that peculiar substance *cruorine* to give a characteristic result. For such delicate experiments the blood must be quite fresh, and a red-coloured corpuscle selected.

In the 'Proceedings of the Royal Society,' July 19th, 1865, and in the July number of the 'Popular Science Review,' Dr. Beale published a paper on the "Highest Magnifying Powers, and their uses." In this paper Dr. Beale speaks of the difficulty of using the $\frac{1}{50}$th and other high powers complained of by practical men, and points out very clearly that success in their use is dependent upon training. Dr. Beale says, "It is necessary to begin by studying the simplest things in the easiest and simplest manner, and proceed only by degrees to the more complex." This is the only process by which observers can hope for success; and it is this patient labour proceeding step by step, from the lowest to the highest, that constitutes, in fact, the difference between a trained and an untrained observer, not only in Microscopy, but in all minute and accurate investigations. In the ordinary occupations of an observatory the trained eye can see distinctly, and the educated hand measure accurately, that which the uneducated eye cannot see at all. So, doubtless, it is with the use of high powers as applied to the microscope: many beautiful details can be seen by the carefully-trained eye, and traced by the trained hand, of which not a trace is even suspected by observers wanting in this educated eye and equally important educated hand.

In the September number of 'Silliman's Journal,' Professor

Smith, of Kenyon College, Ohio, U. S., described a new condenser he had devised for the opaque illumination of objects under high powers. It has long been felt that it would be immensely to the advantage of microscopic anatomy if such small bodies as the blood-globules could be viewed as opaque objects with high powers. Hitherto there have been great and insurmountable difficulties in the way, but Professor Smith has at length contrived an illumination which promises to effect good service.

In this instrument a pencil of light is admitted above the objective and thrown down through it on the object, by means of a small silver mirror placed on one side, and cutting off a portion of the aperture. Professor Smith sent an instrument of this kind to Mr. Lobb, with a request that he would place it in the hands of Messrs. Powell and Lealand. These gentlemen devised what they considered to be an improvement, and substituted for the small silver mirror, to which Professor Smith had given a preference, a flat glass placed at an angle of 45°, across a tube interposed like an adapter between the objective and the microscopic body. A pencil of light entering by a side aperture striking against this flat glass is partly reflected down through the objective and on to the object, the magnified image of which is viewed through the glass.

If the flat grass is ground so as to have parallel surfaces, no noticeable error is introduced even with the highest powers. About the same time, or a little later, that Messrs. Powell and Lealand were thus at work, Mr. Richard Beck devised a similar arrangement; but he employed a circular disc, such as used for covering microscopic objects, instead of the more solid glass of Messrs. Powell and Lealand.

At the December meeting of the Society Mr. Beck exhibited his new mode of illuminating opaque objects under the highest powers. It consisted of a disc of thin covering glass set at an angle of about 45° in the optic axis of the microscope. This was placed close behind the setting of the object-glass in a special adapter, having a suitable aperture for admitting light from a lamp, the rays from which were reflected downwards. The object-glass thus served for its own achromatic condenser. The definition of the object is not injured by the transmission of rays through the thin glass.

The idea of employing the object-glass as its own condenser was suggested by Mr. Hewitt upwards of five years ago. In consequence of his communication Mr. Wenham was induced to give the plan a trial. A concave speculum was fitted at an angle into the body of the microscope, having a central hole sufficiently large to admit the full pencil from the object-glass, through the back of which the rays from a lamp (passing through a hole in the side of the body) were reflected downwards. The object was strongly illuminated, but there was so much glare from the internal fittings, and from reflection from the back of the object-glass lenses, that the experiment was abandoned, and an unfavorable opinion given of its practicability. It is now demonstrated that the light was too intense, and the most useful or central portion of the rays were wanting. The simple disc of thin glass and its partial reflection meets these objections. If such a disc is used with a little care it is found to be quite as accurate as the other plan, and the natural surface of the glass is more reflective than any artificial one. It has, however, the disadvantage of extreme fragility. By making the object-glass its own condenser, and examining diatoms as opaque objects under high powers, we can now hope to solve the much vexed question as to the true nature of their markings. Mr. Browning has employed the apparatus in a form much more nearly resembling that of the original inventor, only substituting a small glass-reflecting prism for the metallic reflector. Some advantages are gained by the adoption of this arrangement, which, I believe, Mr. Browning will describe in a short paper at our next meeting.

Mr. Hewitt exhibited, at a recent meeting of the Society, a plan in which *one tube* of a binocular instrument was surmounted by a small flat mirror which sent a pencil of light vertically down one tube, and then, by means of the prism employed in the binocular arrangement, down through the other.

The objections to this plan are, first, that the prism cuts off a large portion of the aperture; secondly, that it cannot be used when binocular vision is desired; and, thirdly, that it is not adapted to very high powers, as microscopists are agreed that when a prism is used with great powers it must be placed close to the optical combination, and not at the distance from them in which it occurs in the ordinary binocular arrangements. This plan may, however, be liked for its simplicity by many who do not desire extreme magnification, and who operate with highly reflective objects.

These new modes of illumination bid fair to correct many errors of interpretation resulting from an exclusive use of transparent illumination, and we hope that in the hands of the members of this Society they will reveal many peculiarities of structure as yet unknown.

Since the arrival in this country of the condenser sent by

Professor Smith to Mr. Lobb, American opticians are stated to have improved the details of the instrument, and it will be interesting to see it in what the inventor may consider its most perfect form.

Some time last year Mr. James Brooke and Dr. Beale spoke of the advantage of using a Kelner eye-piece as a condenser for the illumination of certain delicate transparent objects. Since then Mr. Webster introduced a condenser bearing his name. He employed an achromatic combination of considerable curvature, with a bull's eye in front of it, and he also devised a novel form of stops in the diaphragm which he employed. This apparatus yields approximately good results with objects of various depths from one inch upwards, and with those of small apertures it gives, when required, a dark ground illumination. Mr. Highley introduced a variation which seems to be an improvement in the optical part of this apparatus; he employed an achromatic combination, of which the inner lens is a bull's eye of very great curvature. This instrument is well spoken of by those who have tried it, and like that of Mr. Webster's, it is adapted to a considerable range of powers. With very difficult and delicate objects it does not, however, quite satisfy the requirements of observers, and Mr. Highley is now engaged in devising a further modification, which he expects will offer a combination of advantages not yet presented by any single instrument.

In the January number of 'Popular Science Review,' at page 116, mention is made of Collins-Webster's condenser. It consists of a double concave lens cemented to a very deep convex lens, and capable of being fitted beneath the stage of any ordinary microscope. Of this I will only briefly remark that I learn that it performs well, and gives some results that have only hitherto been obtainable by using much more expensive apparatus.

A very ingenious diaphragm has been also introduced by Mr. Collins, by the use of which power is given to the observer to graduate the aperture of illumination with great accuracy, and without losing sight of the object; this is done by the use of a screw, withdrawn or driven by a milled head, causing a lozenge-shaped aperture to gradually open and close till it is reduced to a mere point.

For very many subjects of research this diaphragm is a great improvement on any diaphragm furnished with a number of holes.

Messrs. Powell and Lealand have introduced into their large-angled condenser a new stop, consisting of two slits at right angles to each other. This arrangement is very convenient for the display of both sets of lines in that difficult object, the Amician test. A similar plan, I believe, exists in the Rev. J. B. Reade's hemispherical condenser.

Mr. Richard Beck's "Sorby Illuminator" well deserves mention. It was specially constructed for those examinations of metallic and other mineral bodies, the structure of which has been elucidated by Mr. Sorby.

It consists of a large parabolic reflector attached to the objective. This affords a brilliant illumination of an *oblique* character; and by turning a milled head, a second small flat mirror becomes so placed as to stop all action of the parabolic mirror, and substitute for it an illumination which is nearly *vertical*. The effect is very striking, and often exceedingly instructive. If, for example, we have a transparent mineral under inspection, slanting illumination gives one information to be obtained by a very *penetrating* view, while the vertical one almost destroys penetration, and brings out minute scratches and markings on the surface. This apparatus is best adapted for powers varying from $1\frac{1}{2}$ to $\frac{2}{3}$rds inch.

Messrs. Smith and Beck have introduced, during the past year, a new-pattern cheap microscope, called the "Popular Microscope." The chief arrangements of this apparatus have been devised for the purpose of giving many of the advantages of higher class instruments at a reduced cost, and this object appears to have been gained. The mechanical stage adapted to it is very simple and flat. Two milled heads work concentric spindles, as in Messrs. Powell and Lealand's form. One of these spindles has a friction hold upon a plate which it carries up and down, while the second spindle pulls the first backwards and forwards horizontally, and the movable plate is so attached as to go with it. Thus, rectangular motions are very simply obtained.

Considerable attention has been recently given to various forms of aquatic boxes for maintaining a continuous supply of fresh water to objects under constant observation, which thus sustain their vital growth for a long period. The employment of these is strongly to be recommended, for there is yet much to be discovered concerning the metamorphoses which some of the lower microscopic forms of plant and animal life pass through, and a patient investigation will probably show that many which are now classed as distinct species are merely different phases of the same type, and which alternate in a higher or lower scale of development according to the varied conditions of temperature and nutrition under which they are grown.

In the September number of 'Silliman's Journal,' Professor Smith, of Kenyon College, has furnished us with a better means of watching the growth of a plant under the microscope. He described a very useful invention for the purpose, which he called a *growing slide,* or trough, one of which, constructed by Mr. Suffolk, was shown to the Society, and is doubtless a cheap and useful contrivance.

It consists of two pieces of thinnish glass, cemented together; in one corner of the upper cover a small hole is bored, and through this a fresh supply of water is introduced without in any way disturbing the plant or living object under inspection. This can be constructed for a few pence. Mr. Beck has given us an improvement upon this: a description of this gentleman's may be found in our 'Transactions.'

During the past year no improvement has been made in the construction of microscopic object-glasses. But we would call attention to the application of the single-front lens to the highest powers, in place of the triple combination usually employed by the different makers. A simple anterior lens transmits more light, gives clearer definition, with any desired extent of aperture, and, from its simplicity and comparative freedom from errors of workmanship, is worthy of recommendation. The chromatic and spherical aberrations may be perfectly corrected in this form; and Mr. Wenham informs me that there are now object-glasses existing, of various powers, having only a single-front lens, that will challenge comparison with the best of the usual form.

It is suggested by Mr. Wenham, who has made practical investigations in the optical branch of Microscopy, that further improvements may be anticipated in the performance of object-glasses by discoveries connected with the quality of the glass employed.

It is generally supposed that the dispersive power of flint glasses increases with its density: this, however, is found not to be the case. The best glass for the highest powers that has been made is a Swiss flint having a density of 3·686. A few years back, Messrs. Chance made some beautiful clear and colourless flint glass not liable to tarnish, and which polished well, having a density of 3·867. Mr. Wenham availed himself of the opportunity and procured a quantity, but found, on trial, that the dispersive power was less than in the Swiss flint, at the same time that its refractive power was greater: these combined faults being in the wrong direction, rendered the glass quite inferior for the construction of the higher powers.

It thus became evident that some material had been added which diminished the length of the spectrum and increased the refractive power.

In trying experiments on the manufacture of glass for optical purposes, the drawback has hitherto been the necessity of operating on large quantities with expensive furnace arrangements; for it is useless to attempt to make small samples in the usual forms of glass furnace, on account of the intrusion of a larger proportion of impurities which impair the quality of the glass.

With the aid of the now well-known forms of gas furnace, test-samples not exceeding an ounce in weight may be fused without the encroachment of extraneous matter; and thus, if combinations of all the known materials that can be employed in glass-making were worked into equilateral prisms, and their spectra measured, we should probably arrive at valuable results, and obtain a flint and crown glass of greater and less dispersive power than at present known, and thus be enabled to employ longer radii in the contact or cemented surfaces of microscopic object-glass.

The subject of a Royal Charter of Corporation has specially occupied the attention of the Council during the present Session, and it is the opinion of your Council that this Society should make application for a Royal Charter.

The Society, as now organised, possesses no legal existence. In the infancy of the Society no great inconvenience would arise out of this; but now that we have acquired property to some amount,—that is to say, a large and increasing Library, a large and increasing collection of Microscopes and Microscopic Objects, &c., and a considerable sum of money, at present invested in Government Stock, in the names of Trustees,—it appears to your Council that it would be the duty of the Society, as well as an act of prudence, to present a petition to the Crown, humbly praying that Her Majesty would be graciously pleased to grant a Royal Charter for incorporating into a Society the several persons who have already become Members.

The Society, as a corporate body, would be better able to promote a general spirit of inquiry on Microscopic researches; the Council and Members would be more closely connected together, and more closely connected with all who had preceded them; and the lawful contracts or engagements made by our Council would be binding on their successors. We are possessed of certain property, but it would not be easy to establish legal ownership for what we have acquired. The present Members are in no degree successors by law to past Members who accumulated the said property, and it would be difficult to establish a legal claim to the then proceeds. We cannot appear in a corporate form in a court of equity; we cannot sue or be sued. Our Members can pay or not their subscription, as it seems good to them. We have no power to deal with any Member who may fall into arrears, to recover the money. Should we fall into debt, they are not the debts of the Society, but are the debts of the individual by whose order they were incurred.

Your Council, for these reasons, and for many others, consider it would be for the benefit of all Members, and to all who may hereafter be elected Members, to endeavour to acquire legal power to act and do in all things as fully and effectually, to all intents and purposes whatsoever, as any other body politic and corporate can act and do, and that every other person and other bodies politic and corporate might be able to negotiate legally with this Society.

The necessary fees are considerable; but the Council hope they will not be compelled to charge the expense either to the ordinary revenue account or to the money invested in the Funds. They hope to raise the necessary amount by subscriptions among the Members. Several names of subscribers have already been given in; and in the event of this Annual Meeting approving of the propositions that will be placed before them, no time will be lost in taking the preliminary steps.

In the event of a Royal Charter being granted, the distinctive title of the proposed corporate body would have to be selected, and the initial letters should be those of no other corporate body. The natural title would be "Fellow of the Microscopical Society," with the letters "F.M.S.:" but these letters are already in use. But if we elect to keep our present title, "Fellow of the Microscopic Society of London," the distinguishing letters of the Society would be "F.M.S.L."—a distinction not in use by any other Society.

A good deal of time has been devoted by a Committee, consisting of myself and the Secretaries appointed by your Council, to revise the rules of this Society previous to reprinting them, and your Council have given great attention to this matter. On looking over the rules as they at present stand, it will be found that the Council have no power to call a Special Meeting of the Members, should circumstances arise rendering such a meeting necessary, and this power will be asked of you to-night. It is likely that at an early meeting the results of the deliberation of the Council will be laid before you.

The Quarterly Journal continues to publish our proceedings with the same features by which they have been characterised for several years past; these scarcely meet the wants of the present day; for instance: Papers read last December will not appear till the beginning of April, and I have not the advantage of their perusal in preparing this address; I cannot but feel that as this Society increases in importance, some change in the publications must take place. There must be some more easily accessible channel of publication, so that the proceedings at one meeting may be read and thought over before the next meeting. Of what interest can many papers have four months old, excepting historical, or what influence can they exercise on many investigations which are varying from month to month—the history of the spectroscope last year in its early stages, for instance. Should even a slight addition to the expense of publication be incurred, I think it would be amply compensated by the more general diffusion of the Society's proceedings, and their far greater usefulness. I candidly confess I am not satisfied with the mode of publication at present, and feel certain that if the number of members of this Society increase, and particularly if we should become "Fellows," that the officers of this Society must take such steps that quick publication of its proceedings under their own superintendence, untrammelled by the present arrangements, will follow every meeting of the Society.

It remains only for me to observe that we have skilful observers with increased and increasing optical power, and improved instruments generally; we have members who are careful analysers, as shown by our papers of this year. We have others who can delineate whatever they see. What may justly be expected from such men in advancing their chosen science?

It remains for us to assist and encourage young observers, to assure them that all criticism on their labour will be friendly, that our justice will be impartial. We want the co-operative assistance of numbers. Every eye that can see, every hand that can record or delineate, and every intellect that can arrange, combine, or analyse, may contribute to the results we seek; and these results, it must be borne in mind, are intimately connected with the advance of Geology, of Mineralogy, of Palæontology, of Physiology, indeed, of all the departments of Natural History. Our united efforts for success are necessary, and surely if we are united the result will be success.

Proposed by Mr. Browning, seconded by Mr. Gray, and carried unanimously—"That the thanks of the meeting be given to J. Glaisher, Esq., President, for his address, and that the reports and address now read be received, and that they be printed and circulated among the members without delay."

The following motions, arising out of that part of the President's address which related to the incorporation of the Society, were then put and carried:

Proposed by Mr. Allen, seconded by Mr. Hilton—"That this meeting is of opinion that to be incorporated by Royal Charter would advance the interests and increase the usefulness of this Society."

Proposed by Mr. Lobb, seconded by Mr. Brand—"That the Council be requested to take steps necessary for obtaining a Royal Charter of Incorporation."

Proposed by Mr. Brooke, seconded by Mr. Ince—"That a private subscription be opened for meeting the expense connected with procuring a Charter, and that the Secretaries issue circulars for that purpose."

Proposed by Mr. Tyler, seconded by Mr. Hill—"That in the event of a Charter being granted by the Crown, the Society be incorporated under the style and title of 'The Microscopical Society of London,' and that the Members use the distinctive letters F.M.S.L.

Proposed by the President, seconded by Mr. Roper, and carried unanimously—"That in the clause in p. 15 of the Bye-Laws the following addition be made. After the words 'Annual Meeting,' to insert 'or at a Special General Meeting to be convened for the purpose by the President with the sanction of the Council.'

The Society then proceeded to ballot for Officers and Council for the year ensuing.

Mr. R. Beck and Mr. Hogg were appointed scrutineers of the ballot.

Upon the scrutineers making a report of the result of the ballot the following gentlemen were declared duly elected:

President—James Glaisher, Esq., F.R.S.

Treasurer—C. J. H. Allen, Esq.

Secretaries { George E. Blenkins, Esq.
F. C. S. Roper, Esq.

Four Members of the Council—

W. L. Freestone, Esq.	Dr. Millar,
R. Mestayer, Esq.	S. C. Whitbread, Esq.

In the place of—

Dr. Beale,	R. Hodgson, Esq.
H. Deane, Esq.	J. N. Tomkins, Esq.

Who retire in accordance with the Bye-Laws.

Proposed by Mr. W. H. Hall, seconded by Mr. Browning, and carried unanimously—" That a vote of thanks be tendered by the Members of the Microscopical Society of London to their President, Secretaries, and Council, for their valuable services during the past year.

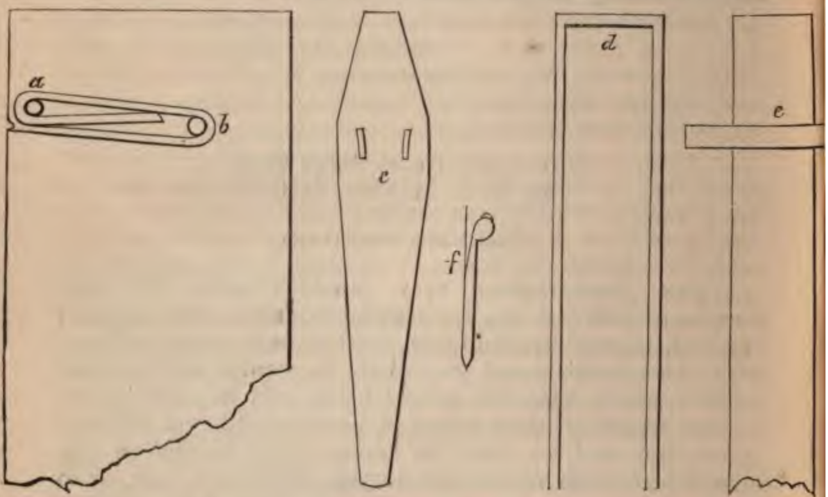
NOTES *on a* BRASS SLIDE CLIP.
By R. L. MADDOX, M.D.

(Read March 14th, 1866.)

WHEN photographing very minute objects with high powers, as the $\frac{1}{8}$ or $\frac{1}{12}$, I generally mounted them between two thin glass covers, and then fixed these to a card stiffened with black varnish, and pierced in the centre with a small circular punch, the little glasses being held in place by two narrow bands of paper gummed at each end and fastened across the card, so that the covers could be slid in any direction to bring objects not in the centre into view, or to shut out others on the same mounting. This plan answered, and was adopted to prevent injury to the object-glass in case of any slip with the focussing rod. Having occasion to re-examine some of the objects, and also wanting some simple method for holding the covers on the usual slide, or a pierced slide of glass, metal, wood, ebonite (as the one sent) or card, I devised the accompanying, which answers well, costs comparatively nothing, and can be made by any one in a few minutes. It also answers to form a live trap and growing slide if required. It must only be regarded as a "country expedient," when more perfect plans, such as my friend R. Beck's, are not at hand.

The mode of making is the following. Procure a few feet of brass wire, the number, I think, is 18, or about the size figured; cut several seven-inch lengths; also obtain some thin sheet brass (called, I believe, laten brass), about the thickness of an ordinary address card; cut off some strips five inches by half an inch, place these singly on a flat piece of iron, or the ordinary flat iron, and run the head of a hammer heavily along them several times to furnish some degree of spring; divide these in the middle into two-and-a-half inch lengths, then with a stout pair of old scissors or small shears cut them into the shape of fig. *c*, and punch with a small turnscrew two cuts, as shown in figure at the shoulder; run a fine file along the edges to take off the burr.

These ready, take a piece of hard wood any suitable length,



one and a half inch wide and half an inch thick; file a small notch on one of the narrow sides, and about the tenth of an inch above it; drill through the wood a hole the size of an ordinary bradawl, as in the fig. *a*, *b*, and another on a line from the notch distant three quarters of an inch; cut two stout wires one and half inch in length to pass into these holes; one is seen in section in fig. *e*. Set the wood in the vice, notch from you, and bend one of the slips of brass through the two cuts with a piece of the wire bent at double right angles, as in fig. *d*, and place it, wire fitting, into the notch of wood; now with the pliers turn both ends of the brass wire under the wire *b* at each side, then over the wire *a* each side one and half turn, bring the ends backwards in a straight line, and cut off the portion held by the pliers about a quarter inch or so; withdraw the wires *a, b*, remove the clips, and finish by turning up the narrow end at half an inch over one of the stout wires, and double it on itself, to form a fulcrum from the spring (see side view *f*.) The wire part may require a little pressing together to set nicely on the slide. One suffices for holding a cover to the slide, two when placed one above and one below a pierced side for a live trap. If the nicks are conveniently chosen the slide, when reversed, will be in the same plane from the object-glass.

As a growing slide, or for keeping Confervæ or Algæ a short time, use a full-sized square cover, and with it attached by one of the clips, the end of which should be platinized, place the slide on a weighted bung, which has a hole bored or burnt through its diameter about midway, and a small hole from above to below through the centre of the cork; with a saw cut two slightly slanting saw cuts through the cork into the large cross hole, less than a quarter of an inch apart; set two pieces of glass about one inch by half an inch into these cuts, so that they nearly touch at the top, then place the slide and object between them and float the bung on a basin of water, seeing that the liquid can enter at the side holes as well as from the smaller one below. The water rises by capillary attraction, and keeps up a supply to the cover.

Trusting the above may be found useful to others, may it form an apology for trespassing on your notice?

On the STRUCTURE *of the* EGG *in* SCATOPHAGA.

By TUFFEN WEST, F.L.S., &c.

(Read March 14th, 1866.)

THE leg of the yellowish-brown fly, *Scatophaga stercoraria*, is a favourite object with microscopists, on account of the large size of the pulvilli, the transparency of the cushions, and the distinctness and exquisite regularity of arrangement of the tenent hairs.

The egg of the same fly has, I believe, not been *minutely* described, though the remarkable structure presently to be named, has been briefly alluded to by Mr. Westwood in the following terms*:

* Introduction to Modern Classification of Insects,' vol. ii, p. 572.

"The species of Scatophaga revel upon excrement, in which also they deposit their eggs, which are of an oval form, but have two broad divergent appendages at the upper end; the object of which appears to be to prevent them from sinking in the matter in which they are deposited."

The eggs (figs. 1, 2, Pl. VII) are about a line in length, of a long elliptic form, somewhat arched backwards, the ventral surface being much the most convex. The top may be described as cut off obliquely from before backwards; covering the opening thus formed is a lid or small door, of a somewhat triangular shape, which is articulated behind. A little beyond the centre of this lid, on its under side, arises at tongue-shaped process, by which the aperture is completely covered. From the upper fourth of the egg shell, where the cover is joined to it, arise with a gentle curve, and pass out obliquely on each side, two arms or processes, about two thirds the length of the entire shell. The obliquity with which these pass off, as well as the amount of their curvature forward, vary in different examples, but in what may be considered typical specimens the angle formed with the axis of the shell is about 45°.

There can, I think, be no doubt as to the purpose served by these remarkable appendages, and that it is as suggested by the author above quoted.

Investing the larva, and left behind after its exit, is a membrane, represented at *m*, in fig. 3.

The egg-shell, which is of a horny texture, is covered with hexagonal reticulations, the interspaces minutely punctate with elevations (fig. 4). The processes are mere cuticular derivations, solid throughout, and finely elevato-punctate (fig. 5). That portion of the lid which covers the actual opening is of a rich, deep red-brown colour, and of a somewhat different structure from that named above, being mapped with lozenge-shaped or 5-sided areæ; in the centre of each area is a rounded transparent spot, the space around very finely punctate (fig. 6).

The eggs are deposited on the same material by different flies, and at different periods, so that larvæ may be met with growing rapidly at the same time that others occur in the most rudimentary condition. Fig. 7 represents two broad toothed processes, from a larva gently pressed out of one of the cases; the anterior pair of spiracles was distinctly seen in this individual; but little else of structure could be traced in the granular mass of which it was composed. Larvæ already hatched, and three lines in length, were obtained at the same time.

DESCRIPTION *of the* SKIN *cast by an* EPHEMERON, *in its* "PSEUD-IMAGO" CONDITION. By TUFFEN WEST, F.L.S., &c.

(Read March 14th, 1866.)

THE following observations appearing to have some bearing on the disputed question as to the exact nature of the penultimate change in the Ephemeridæ, are brought before the notice of the Microscopical Society with the hope that they will prove to be a small contribution towards our knowledge of a subject confessedly requiring further elucidation.

In wandering near water in the country on a summer's evening, some of the members of our Society may have found themselves speedily covered by small whitish looking flies, with two or three long tails a piece, which after alighting on some portion of the dress, remain quiet for a brief period, and then fly off, leaving behind them an alter ego, in shape of a perfect cast of their integuments. These casts may sometimes be found on railings, branches of trees, &c., in the vicinity of water.

On Frensham Common are two considerable pieces of water, known in these parts by the names of the "Great" and the "Little Pond," which are favoured resorts of numerous aquatic insects, and from the latter of which on a fine summer's evening, clouds of a small species of May-fly arise, and settling on the hat and upper portions of the dress, soon cover him with their exuviæ.* So rapidly does the operation take place, that it was not till the sight had become educated by attempts on several occasions to observe the whole, that I became able to witness the entire process, whilst the (to the naked eye) complete disappearance of the pellicle covering the wings left a mystery on the mode of their reaching me which I was long unable to solve. The distance from the water at which the clouds that so thickly covered one occurred was considerable; I counted 230 paces from the water's edge to the boughs of a Scotch fir, which was fairly whitened with them, the tree being the nearest of a clump growing on a neighbouring hill.

From their extreme delicacy the bringing home uninjured of these cast-skins for microscopic examination is a very difficult matter; but an individual of a larger species having

* In Westwood's 'Introduction to the Modern Classification of Insects,' vol. ii, at p. 27, is a graphic description of the process, and in a foot-note on p. 28 a discussion of the nature of the metamorphosis.

settled and undergone its final ecdysis on the muslin curtain of one of the windows in the house in which I at present reside, tidings were quickly brought to me, and I succeeded in obtaining the specimen in beautifully perfect condition, which forms the subject of the following notes. I regret much that the fly, which was also obtained in first-rate order, and which lived with me nearly twenty-four hours, was afterwards accidentally destroyed, so that I am unable to give the species.

The entire cast measures eight lines in length, nearly five of which belong to the tails (Pl. VI, fig. 8). The three divisions of the thorax are well indicated; the integument of the legs and of the antennæ (*a, a,* fig. 9) are very perfect; the reticulate corneal covering of both the sessile and the columnar pairs of compound eyes is left, the areolation being most distinct on the latter.

Behind the slit on back of the thorax through which the creature's body was extricated, is a mass composed of the pellicle from which the wings were withdrawn (*a. p.*, fig. 8); and (if I mistake not) the investments of the puparial gills.

The most noticeable feature, however, is the presence of the two main tracheary tubes (*tr, tr,* fig. 9), which appear to arise at either side from the anterior part of the pro-thorax. Doubtless by dissection the spiracles whence they arise would be found, and the true nature of the mass at the hinder part of the thorax could be ascertained by floating in water, but I am unwilling to sacrifice so perfect a specimen for the sake of these details, which may perhaps be obtained from other examples in the coming season.

The larvæ of *Lepidoptera,* in changing their skin, cast also the lining membrane of the great tracheal trunks; it seems fair to infer, therefore, from the specimen now under consideration, that in the so-called pseud-imago condition of the Ephemeridæ, we have merely the pellicle forming the inner investment of the pupa, carried out by the fully-formed insect in its first flight, and shortly got rid of.

As a small contribution to the history of "minute markings," which will some day, and that probably before long, have to be considered in its extended bearings, it may be mentioned that the tegument of the May flies is thickly covered with a minute elevated punctation.

On the TRUE READING *of* MEASUREMENTS *with the* COBWEB MICROMETER. By Capt. J. MITCHELL.

(Communicated by F. C. S. ROPER, F.L.S.—Read March 14th, 1866.)

IT is now some two years since I forwarded to the Editors of the Journal some remarks on the true zero position of the filaments in the cobweb micrometer. The paper does not appear to have reached the Editors. The mail steamer having been wrecked, it was probably either destroyed or rendered illegible by the salt water.

I have been so much engaged since that I had no time to return to the subject. In doing so now I have thought it would be preferable to request you to do me the favour to bring the subject before the Society. I hope your rules do not exclude communications from a non-member, at least from one residing abroad.

The late Professor Quekett, in his 'Treatise on the Microscope,' 2nd ed., p. 221, says, "the cobwebs should exactly coincide when the graduated head of the micrometer is at zero," and the same directions are repeated at p. 223. It appears from this that he did not take into consideration the thickness of the filaments, supposing, perhaps, that they were too fine to affect the measurements, which, however, is not the case.

I assume that, in ascertaining the value of the divisions of a screw micrometer, we should endeavour to make the axes of the cobweb filaments coincide with the centre of the grooves ruled on the stage-micrometer, and that in measuring the distance between the striæ of diatoms the same method would be pursued. In both these cases the true distance is that between the axes of the filaments; and as these are supposed to coincide, when the micrometer head reads zero, the measurement will be correct. But the measurement of the interval between lines is neither the sole nor the chief use of a micrometer; on the contrary, the greater number of objects require to be placed *between the filaments*, and when this is the case the quantity shown by the micrometer head will be the diameter of the object plus twice the semi-diameter of the filaments, or, which is the same thing, the diameter of one filament.

Now, with the same micrometer this excess is a constant quantity with all powers alike. With my micrometer a negative eye-piece, one by Powell and Lealand, with four filaments, amounts to two divisions of the micrometer head.

It is evident, therefore, if the value of the divisions had been obtained with the micrometer adjusted to zero when the axes of the filaments coincided, the reading would be too great by two divisions for every object placed *between* the filaments. But though the *quantity* is constant, the *error is not,* for it becomes greater as the object is smaller, *i. e.* as it occupies fewer divisions of the micrometer head. For instance, with my $\frac{1}{12}$th objective one division of the micrometer is equal to $\frac{1}{523,333}$rd of an inch, measuring *from the axes of the filaments.* If I place *between the filaments* an object that is measured by one hundred divisions, the true measure is evidently but ninety-eight, and the result is too great by one fiftieth; but if the object be measured by ten divisions, the correct measure is but eight, and the error amounts to one fifth! Thus, the error is always in inverse proportion to the magnitude of the object, the *smallest* readings giving the *largest* errors. In the case last supposed an object that measured $\frac{1}{65,404}$th of an inch would appear to measure $\frac{1}{52,333}$rd of an inch, *i. e.* if, as I presume is generally the case, the thickness of the filaments be not allowed for.

The means of obtaining exact measurements is readily applied; thus, if the filaments coincide when the micrometer head is at zero, a deduction equal to the thickness of one filament must be made whenever the object is placed *between them,* or after the value of the divisions has been obtained with the filaments coinciding at zero the micrometer head may be shifted until it is at zero, when the filaments are parallel. The reading will then be correct for all objects placed between the filaments, but an addition equal to the diameter of one filament must be made to the measurement of all intervals between lines, striæ, &c.

The thickness of the filaments is easily obtained by placing the movable filament in contact with the fixed one, first on one side, then on the other; half the number of the divisions passed over by the micrometer head is the distance which it must be set back to place the filaments in contact when the reading is zero.

No stage micrometer that I have seen is ruled sufficiently fine for the higher powers. With a one-twelfth the grooves are inconveniently wide. A large number of measurements will probably give a mean not very far from the truth; but it would be more satisfactory to have such lines as the filaments would just cover, as is the case with the lower powers. The $\frac{1}{2000}$th of an inch would also be a more convenient division for the higher powers than the $\frac{1}{1000}$th, which occupies too much of the field.

It has been said, not only that the measurements afforded by the cobweb micrometer are unnecessarily delicate, but, which is a contradiction, that they are also not so exact as they appear to be, and that Jackson's glass micrometer is sufficiently accurate for all purposes. To this I beg to reply, first, that measurements, to be of any scientific value, should be made with the most perfect instrument which science and manufacturing skill have placed at our disposal. Secondly, that any one who will take the trouble to obtain the mean of a number of carefully made measurements of the best stage micrometer he can procure can always get a reading, certainly and easily, within one division of his micrometer; I can always do it within half that quantity, when I desire to be very exact; in this method nothing is obtained by estimation, it is a simple mechanical operation. Thirdly, in Jackson's glass micrometer the divisions are fixed, and no object is measured exactly that does not exactly reach from one division to the other. Such cases form the exceptions, and in the majority of cases there is something left to be estimated, which means simply guessed at. There should be nothing left to guess that can be measured, as it undoubtedly can with the cobweb micrometer. I have heard of such guessing of the diameter of blood-corpuscles when a man's life was in the balance.

TRANSACTIONS OF THE MICROSCOPICAL SOCIETY OF LONDON.

A New Adjustable Diaphragm. By Sidney B. Kincaid, Esq., F.R.A.S.

(Communicated by F. H. Wenham, Esq.)
(Read March 14th, 1866.)

The desirability of possessing a means of adjusting the illumination of transparent objects under the compound microscope within closer limits than those allowed by the ordinary wheel of diaphragms placed beneath the stage, has been patent to microscopists almost ever since the study of the more minute forms of nature under high magnifying power has claimed to rank as a science. But although practical opticians have proposed various aperture-limiting shutters for attaining that object, no contrivance, as far as I am aware, has hitherto been described which fulfils the condition of affording an easily adjustable aperture, which constantly preserves its centricity, and approximates more nearly to a circular figure than a square or diamond.

When I turned my attention to the subject a short time since it appeared to me that the adaptation of the Iris diaphragm (which was designed some years ago to be applied to the astronomical telescope for the purpose of observing variable stars) beneath the stage of the microscope would at once furnish the wished-for desideratum; and the experiment has proved so satisfactory that, in the hope that it may be of service to others engaged in microscopic pursuits, I would beg leave to lay a description of it before the Microscopical Society.

The arrangement, of which a sectional view is shown in Fig. 1, consists of a brass tube, A, screwing beneath the stage of the microscope at B, and within which a second tube, C, of less length, works friction tight; this latter is sprung and furnished at one end with a milled edge, D, projecting beyond the outer tube, and affording the means of rotating the inner one. To the opposite extremities of these is attac[hed] by brass rings, E, fixed with small screws, a tube of vulcanized india-rubber, F, equal in length to A, but rather less in diameter than the interior of C. By turning the milled edge while A remains fixed, the rubber is made to extend inwards, and when half a rotation is accomplished, it completely closes the aperture, which remains constantly central, and nearly circular, being, indeed, a polygon of a great

Fig. 1.

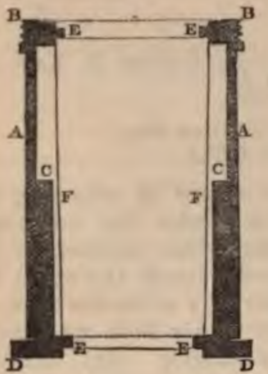
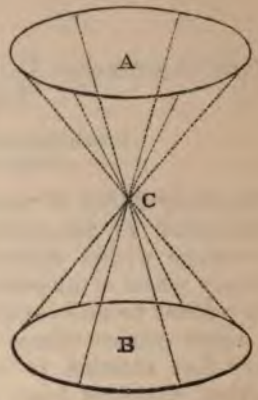


Fig. 2.



number of sides. The principle of the contrivance will, perhaps, be more readily understood by a reference to Fig. 2; for if two rings, A and B, be supposed similarly divided in any number of points, and those points connected by parallel lines forming a skeleton cylinder, it will be seen at once that if one of the rings be turned half way round, every line will pass through the centre, C, of such cylinder, the general figure resembling an hour-glass. The india-rubber tube must evidently be considered as composed of an infinite number of such threads.

In Fig. 2 is given a sketch of the appearance presented by the rubber when the opening is nearly closed, only six folds, however, being taken for the purpose of illustration.

In conclusion, I would remark the necessity of making the tube C sufficiently long in proportion to its diameter, to allow of the rubber quite closing the aperture. The cement commonly used by opticians in the construction of electrical apparatus seems well suited for fixing the rubber to brass, and a solution of caoutchouc in mineral naphtha may be used to join the surfaces of rubber.

Descriptions *of* New *and* Rare Diatoms. Series XX.

By R. K. Greville, LL.D., F.R.S.E., &c.

(Communicated by F. C. S. Roper, F.L.S., &c.)
(Read March 14th, 1866.)

Plagiogramma.

Plagiogramma orientale, n. sp., Grev.—Minute; valve panduriform, with central costæ and shortly produced apices; puncta very minute, impervious decussating lines. Length, ·0012″. (Pl. VIII, fig. 1.)

Hab. Zanzibar; Professor Hamilton. L. Smith.

Almost as minute as *P. atomus*, and resembles it in form, only not so deeply constricted. The chief difference, however, lies in the absence of costæ at the ends.

Gephyria.

Gephyria constricta, n. sp., Grev.—Valve with obtuse, crenate ends, and deeply constricted in the middle; costæ 5—6 in ·001″. Length, ·0055″ to ·0072″. (Fig. 2.)

Hab. Monterey deposit; L. Hardman, Esq.

A noble species, of which, through the kindness of Mr. Hardman, I have seen a number of examples. The constriction is so remarkable that, while the widest part of the frustule is nearly ·0020″, it is often only ·0007″ across the middle. The relative proportion, however, of the two parts varies to some extent. Between the costæ the valve has a minutely punctate appearance; but on a careful examination this seems to arise from a subjacent very minute cellulation. In Mr. Hardman's cabinet is the front view of a lower valve of a gigantic Gephyria, nearly ·0120″ in length; in which the base of the valve is punctato-striate.

Melosira.

Melosira costata, n. sp., Grev.—Pale; joints cylindrical, uninterrupted, longitudinally costate. Breadth of filament, ·0003″ to ·0007″. (Figs. 3—6.)

Melosira?—Small form with longitudinal markings, Norman, in 'Annals of Nat. Hist.,' vol. xx. 2nd Series, p. 159. (1857.)*

* 'Notes on Diatomaceæ from the Stomach of Ascideæ.' By George Norman, Esq.

Hab. North Sea, off the coast of Yorkshire, in the stomachs of Ascidians; George Norman, Esq. Hongkong; J. Linton Palmer, Esq.

The diatom above indicated by my friend Mr. Norman I find, on examination, to be identical wilh the specimens kindly communicated to me by Mr. Palmer from Hongkong, where it appears to be abundant. The remarkable longitudinal costæ, seven or eight of which are sometimes visible at once, constitute an admirable character. Under a high power the costæ are seen to be dilated at their apices, and attached to those of the adjoining frustule.

CRESSWELLIA.

Cresswellia rudis, n. sp., Grev.—Valves convex, depressed at the apex, minutely cellulate, with a circle of numerous, short, obtuse spines towards the margin, and a row of similar smaller ones round the depressed apex. Diameter, ·0035″ to ·0040″. (Fig. 7.)

Hab. Monterey deposit; L. Hardman, Esq.; R. K. G.

Distinguished chiefly by the numerous, short, clumsy spines, which are nearly of the same thickness from their base to their apex, which is often encumbered with fragments apparently torn from the spines of the valve to which they have been attached. The outer circle is situated at some distance from the margin; then come a few very small, scattered spines, which are probably sometimes wholly absent; lastly, the inner circle crowning the flattened apex. The substance is somewhat thick, and the cellules nine in ·001″. Neither Mr. Hardman nor myself have been so fortunate as to find entire frustules; but this is of little consequence, as the valves in this genus are simply repetitions of each other.

COSCINODISCUS.

Coscinodiscus Lewisianus, n. sp., Grev.—Disc oval or oblong; granules conspicuous, forming an irregular central cluster, from which a few nearly straight, wide lines radiate to each end, and some very short ones to each side; margin striated, with an interior narrow band of minute puncta. Length, ·0024″ to ·0045″. (Figs. 8—10.)

Hab. Rappahannock deposit, United States; E. W. Dallas, Esq.; R. K. G.

I have not been able to find any description of this well-marked and beautiful species. The form renders it at once conspicuous, for it does not appear to be ever circular or even to approach towards it, but ranges between a true oval and elliptic-oblong. There is no umbilicus, but a loose irregular cluster of large, round granules, radiating in either slightly curved or straight lines to each end, diminishing gradually in size; the lines are so wide apart that four to seven fill up the space, and leave but little room for the few very short lines which radiate to the sides. Just within the striated margin is a very narrow belt of minute puncta.

CRASPEDODISCUS.

Craspedodiscus umbonatus, n. sp.—Disc hexagonally cellulate, the border nearly equal to half the radius, the centre rather sharply umbonate. Diameter, ·0035″. (Fig. 15.)

Hab. Barbadoes deposit, Cambridge estate; in slides communicated by C. Johnson, Esq.

Distinguished at once by its umbonate centre. Cellules near the margin of the border 8 in ·001″.

COSMIODISCUS, *n. gen.*

Frustules simple discoid; disc radiato-punctate or cellulate, with linear, blank radiating spaces extending from the margin inwards (no processes nor internal septa).

Whether the three diatoms I have here brought together are really generically allied I will not, in the present state of our knowledge regarding them, take upon myself to say. As, however, they agree in the most prominent character, a provisional union will be, at least, convenient. The genus is constructed specially for the disc first described, which for many years has perplexed me when called upon to examine the Monterey deposit. All these discs appear to be allied to *Aulacodiscus*, in having blank lines or channels radiating through more or less of their surface towards the margin; but being destitute of lateral processes they must be arranged among the *Coscinodisceæ*.

Cosmiodiscus elegans, n. sp., Grev.—Disc with a broad, smooth margin, and numerous very narrow radiating blank lines; intervening compartments filled with very minute puncta passing into striæ next the margin. Diameter, ·0035″. (Fig. 13.)

Hab. Monterey deposit; L. Hardman, Esq.; R. K. G.

Disc with an irregular, blank umbilicus; granules minute, somewhat scattered and irregularly arranged for some distance round the umbilicus, gradually becoming crowded and more minute, and ultimately passing into fine close striæ as they reach the circumference. Radiating lines numerous (24 in the example figured), commencing indefinitely, generally at about a third of the radius from the centre, so narrow as frequently to resemble dark striæ, but, on careful examination, are perceived to be exceedingly narrow blank spaces; margin or border pale, smooth, and somewhat broad.

Cosmiodiscus Barbadensis, n. sp., Grev.—Disc convex, with numerous linear blank lines, extending about one third of the radius from the margin; the portion of the disc so occupied forming a sort of broad, less convex border. Diameter ·0034″. (Fig. 12.)

Hab. Barbadoes deposit, Cambridge estate; in slides communicated by C. Johnson, Esq.; exceedingly rare.

Disc convex for about two thirds of the radius from the centre, then becoming somewhat flattened; umbilicus a small, circular, blank space; granules equal, minute, distinct radiating in straight lines to the boundary of the convex centre, then becoming larger, and diminishing gradually in size to the margin. In the flattened circumference are situated about fourteen blank, linear, radiating spaces, not produced by divergence in the lines of granules, but commencing and terminating abruptly.

Cosmiodiscus Normanianus, n. sp., Grev.—Radiating blank lines numerous, extending about half way from the margin to the centre, the intervening compartments filled with radiating lines of minute puncta; centre with scattered and much larger puncta. Diameter ·0024″. (Fig. 11.)

Hab. Barbadoes deposit; cabinet of George Norman, Esq.; exceedingly rare.

The central portion occupying as much as half the radius, containing large, remotely scattered puncta, and presenting a sudden contrast to the minute puncta between the blank, radiating lines, give a remarkable aspect to this disc, and may possibly lead to its separation when we come to be better acquainted with it.

EUPODISCUS.

Eupodiscus Hardmanianus, n. sp., Grev.—Large; disc with four circular marginal processes, hexagonally cellulate, with a broad, raised, remotely striate margin, and circle of teeth. Diameter ·0055″. (Fig. 14.)

Hab. Shell-cleanings from South America; L. Hardman, Esq.

A splendid and well-defined species, with four circular, not very prominent processes, placed just within the broad margin, which is furnished with a circle of numerous obtuse teeth. Within this margin or border is a narrow, irregular, somewhat dark line, apparently indicating a sudden depression of the surface between it and the marginal border. Hexagonal cellules 6 in ·001″.

BIDDULPHIA.

Biddulphia Chinensis, n. sp., Grev.—Large; frustules quadrangular; valves with the angles terminating in short, slender, obtuse, curved processes, and with a long stout spine springing from the swollen base of each process. (Pl. IX, fig. 16.)

Hab. Harbour of Hongkong; J. Linton Palmer, Esq.

A very fine diatom, with the colour, structure, and fragility of *Biddulphia Mobiliensis* (*B. Baileyi*, Sm.). At first sight the general resemblance is so striking that the observer might be excused for at once pronouncing it to be a large state of that species; and, considering the notoriously variable character of the valve in some *Biddulphiæ*, it would require very decided differences to separate it. I am, indeed, bound to confess that I have been deceived for a time by variations from normal forms in this genus, and, for example, that I am now convinced that my *B. Roperiana* is nothing more than one of the endless varieties of *B. aurita*. Nevertheless, in the case now under consideration, I venture to assume that really good diagnostic characters exist. Of *B. Mobiliensis* Mr. Ralfs remarks (Pritch. 'Infusor.,' p. 851, 1861): "There is no central projection of the valves, but two slight elevations, furnished with one or more bristles, and dividing the margin into three nearly equal portions. The elevations appear to be situated between the processes, but are really placed on opposite sides." This description is well illustrated in Smith's 'Synopsis,' vol. ii, pl. lxii, fig. 322 (front view); and in Roper's excellent article "On the Genus *Biddulphia* and its Affinities," in 'Trans. Mic. Soc.,' vol. vii, Pl. I, figs. 8, 9 (side views of valve). Now, in *B. Chinensis* this relative position of the bristles or spines with the processes is completely changed. The former do not divide the margin into three nearly equal portions, nor, indeed, divide it at all, nor are they situated on the margin. They arise from the swollen base of the processes themselves, on the inner side; so that, instead of being margined, they may be said to be actually on the median line (an imaginary one drawn between the processes). If these remarkable differences are not considered of value, I do not see how any character derived from the position of spines in any of the other species can be depended on. No approach towards an intermediate condition has been observed. It may also be remarked that the processes seem to be influenced by the position of the spines in *B. Chinensis*, for they are covered outwards, and are not straight, as figured by Smith and Roper in *B. Mobiliensis*.

Biddulphia ? podagrosa, n. sp., Grev.—Frustules quadrangular; valves with the angles prolonged into very thick processes, which are swollen and punctate near the base, then contracted, and again dilated into broadly capitate truncate, punctate apices; median space, with a hemispherical or subcapitate elevation. Length of perfect frustule ·0035″. (Fig. 17.)

Hab. Barbadoes deposit, Cambridge estate; in slides communicated by C. Johnson, Esq.

One of the extraordinary forms of the *Biddulphia* family only to be met with in the Barbadoes deposit. It is obviously allied to my *Hemiaulus ? capitatus* ('Trans. Mic. Soc.,' vol. xiii, pl. 6, fig. 24), which would have been more appropriately registered as a doubtful *Biddulphia*. The present diatom has a most whimsical appearance. The horn-like processes seem as if they had become proliferous; as if a second series had grown out of the first. The summits are large, inflated, almost cyathiform. The central projection is punctate like the processes, and in one specimen is so prolonged as to be almost capitate. The whole surface, with the exception of the punctate portions, is smooth and somewhat glassy. The processes are ·0020″ in length.

TRICERATIUM.

Triceratium lautum, n. sp., Grev.—Large; valve with straight sides, rounded angles, and large pseudo-nodules (processes); margin with a somewhat pectinate row of large cellules; granules rather remote, radiating from a central cluster, and increasing in size towards the margin. Distance between the angles ·0050″. (Fig. 20.)

Hab. Barbadoes deposit, Cambridge estate; C. Johnson, Esq.

This species bears a great general resemblance to *T. prominens*, but differs in the marginal cellules, in the angles being arched off and filled up with much larger processes, and in the absence of any central inflation.

Triceratium repletum, n. sp., Grev.—Small; valve with nearly straight or slightly convex sides and obtuse angles, and large ovate, minutely punctate pseudo-nodules (processes); surface entirely filled with small roundish granules, which become gradually smaller towards the margin, which is striate. Distance between the angles ·0030″. (Fig. 18.)

Hab. Barbadoes deposit, Cambridge estate; in slides communicated by C. Johnson, Esq.

Conspicuous for the very large processes which fill up the almost rounded angles, and extend over more than a third of the space between the angles and centre. Cellules near the centre, about 10 in ·001″.

Triceratium quinquelobatum, n. sp., Grev.—Valve with five obtuse lobes, the sides concave; cellules small, radiating from the centre, hexagonal, becoming less towards the margin. Distance between the angles ·0024″. (Fig. 21.)

Hab. Moron deposit, Province of Seville; Rev. T. G. Stokes.

This differs from the hexagonally-lobed *T. reticulatum*, not only in having only five angles (which might not prove of sufficient importance), but in the much smaller and more regularly hexagonal cellulation, which at the angles passes into very crowded, minute puncta. The lobes are also much less rounded.

Triceratium picturatum, n. sp., Grev.—Valve with slightly concave sides and obtuse angles containing a few minute puncta in the extreme apices; margin giving off a number of very short veinlets, and in the middle of each side a roundish impression reaching nearly to the centre. Distance between the angles ·0032″. (Fig. 19.)

Hab. Barbadoes deposit, Cambridge estate; in slides communicated by C. Johnson, Esq.; extremely rare.

A species somewhat akin to *T. denticulatum*, but differing essentially in the three middle impressions. The general surface has remote, scattered puncta, with smaller and more numerous ones between the marginal veinlets and on the impressions.

SYRINGIDIUM.

Syringidium dæmon, n. sp., Grev.—Frustules smooth, central portion quadrangular; one of the valves contracted into an elongated conical process, the other globose, with two truncate, spine-bearing horns and an intermediate spine. (Figs. 22—28.)

Hab. Harbour of Hongkong; J. Linton Palmer, Esq.

In general aspect, this whimsical-looking diatom comes nearest to *S. Americanum,* but is more minute, has a smooth surface, and the capitate valve is furnished with a spine or bristle between the processes. The frustule is subject to considerable variations, which may probably be accounted for by its progress toward the period of self-division. In its early stage the diatom is filamentous, specimens in my possession showing three frustules *in situ* (Fig. 22); and it will be perceived that the capitate ends of the frustules are opposed to each other within the tube, the horns meeting, and the terminal spines overlapping each other, as in the genus *Hemiaulus.* It appears that the frustules become fully developed within the tubes before they escape, for although, in the figure just referred to, the conical process is not yet visible, it is mature, or nearly so, in Fig. 24. When perfect, the frustule may be described as comprised of two valves, rather sharply quadrangular (as viewed in the microscope); the one suddenly contracted and passing into a long conical process terminating in a minute spine; the other contracted into a short, thick neck, supporting a spherical head furnished with two short, conical, truncate horns, each tipped with a spine at its inner angle, while a slender, short spine is also situated in the intermediate space. The relative proportion of the two valves varies greatly, as will be seen by consulting the figures; but this seems to be of no momemt in a diagnostic point of view. A very remarkable deviation from the typical structure of the genus occurs in *S. simplex,* Bail.* A very minute species, in which the valves are described as "nearly symmetrical," and "both gradually tapering into pyramidal cones."

It is to Mr. Palmer that we are indebted for specimens in so perfect a state as to indicate distinctly their affinity with *Hemiaulus.* Nevertheless, we cannot but agree with Mr. Ralfs in his observation, that, "although it is not difficult to point out differences between the *Chætocereæ* and other groups, yet, on account of the variety in their forms, we confess our inability, in the present state of our knowledge, to give a concise definition which shall include its own members and exclude all others."†

NAVICULA.

Navicula spectalissima, n. sp., Grev.—Elongated, deeply

* "Notes on new species of microscopical organisms, chiefly from the Para River, South America." By Loring W. Bailey. 'Boston Journal of Natural History,' vol. vii, p. 343, fig. 65.

† Pritchard, 'History of Infusoria,' 4th edition, p. 860.

constricted, with ovate-cuneate lobes, minutely punctate; margin composed of a single series of large, linear-oblong cellules, which, as well as the puncta, disappear opposite the central nodule. Length ·0050″. (Fig. 29.

Hab. Zanzibar; Professor Hamilton. L. Smith.

One of the most exquisite diatoms which have ever come under my observation, and for which I am indebted to the kindness of my excellent correspondent, Professor H. L. Smith, Gambier, Ohio, who is prosecuting original and important investigations into the structure and development of the diatom frustule. The present new species belongs to the extensive group of *Naviculæ*, in which the valves are more or less constricted at the middle, constituting the exploded genus *Diploneis* of Ehrenberg. Its nearest ally appears to be *N. marginata*, of Lewis,* in which there is also a minute inner structure, and a single row of large marginal cellules. In *N. spectalissima*, however, this contrast of structure is carried much farther, for the puncta next the median line are more minute, and the marginal cellules form a band nearly as broad as the punctate portion itself. These cellules are 7 in ·001″, and at the widest part of the valve are ·0004″ in length, and so regular as to give the margin a pectinate and crenate character. They gradually diminish in length, and disappear near the apex, and opposite the central nodule.

STAURONEIS.

Stauroneis rotundata, n. sp., Grev.—Small; valve linear, or very slightly dilated in the middle, rounded at the ends; stauros broad, linear, reaching to the margin; striæ parallel, exceedingly fine, not quite reaching to the median line. Length ·0033″. (Figs. 30, 31.)

St. rotundata; Grev. MS.; Dr. L. Lindsay. 'Journ. Linn. Soc.,' vol. ix, p. 134 (name only).

Hab. Otago, in New Zealand, in fresh water; Dr. Lauder Lindsay.

This seems a well-marked species, with its parallel sides (sometimes slightly dilated at the middle) and very rounded ends, where the margin is broader than at the sides.

Stauroneis scaphulæformis, n. sp., Grev.—Small; valve linear; lanceolate somewhat contracted and produced at the sub-acute ends, which are arched over by the thickened

* 'Notes on new and rarer species of Diatomaceæ of the United States' seaboard.' By F. W. Lewis, M.D., 1861, p. 6, pl. ii, fig. 1.

margin; stauros broad, dilated, reaching to the margin. Length ·0036″. (Fig. 32.)

St. scaphulæformis, Grev. MS.; Dr. L. Lindsay. 'Journ. Linn. Soc.,' vol. ix, p. 134 (name only).

Hab. Otago, New Zealand, in fresh water; Dr. Lauder Lindsay.

Very similar in general appearance to the diatom figured by my friend Dr. Lewis,* as a variety of *St. Legumen*, of Ehrenberg; but it differs in having a very broad, dilated stauros, instead of a very narrow, simple one; and in the contraction of the valve below the apices.

On the so-called PACCHIONIAN BODIES.

By H. CHARLTON BASTIAN, M.A., M.B. Lond., F.L.S.

(Communicated by W. H. INCE, F.L.S.)
(Read March 14th, 1866.)

CERTAIN granulations or minute polypoid excrescences in connection with the membranes of the human brain, now familiar to so many anatomists and pathologists, were first described in 1705 by Antonius Pacchionius,† and regarded by him as rounded glands, secreting a clear pellucid fluid, from which lymphatics proceeded to the pia mater. Succeeding anatomists, for a time sharing in this opinion, spoke of them as 'Pacchionian glands,' and by this name they were known till a comparatively recent period, when a growing doubt as to their nature gradually resolved itself into a pretty firm conviction that they had no real claims to be included in the category of glandular structures. Now almost all anatomists prefer to speak of them as 'Pacchionian bodies.'

Although these growths have received a very fair share of attention since the date of their first discovery, still many of the statements made concerning them are quite conflicting, and the accounts to be found in English text-books more especially are meagre and inexact as to their real nature and mode of origin. Seeing that they are found in several situa-

* "On extreme and exceptional variations of Diatomaceæ in some White Mountain localities," &c. By F. W. Lewis, M.D. 'Proceedings of the Academy of Natural Sciences of Philadelphia,' Jan., 1865, pl. 2, fig. 14.

† Dissert. Epistolaris de Gland. conglobatis duræ meningis Humanæ, indeque ortis Lymphaticis ad Piam meningem productis. Reprinted also at p. 103 of his 'Dissert. Physico-Anatom. de dura meninga Humanâ.' 1721.

tions in connection with the skull and membranes of the brain—occasionally in great numbers as well as much enlarged—it is a matter of some interest to know in what situations they may be found, how they come to occupy these positions, what is their precise histological structure, whether they are normal or abnormal growths, and, if the latter, what is their pathological significance.

In text-books they are principally referred to as existing on the surface of the dura mater, on one or both sides of the middle line and subjacent longitudinal sinus, and causing more or less marked depressions in the corresponding region of the skull. It is also generally stated, however, that their presence is uncertain, that they are most frequently met with in persons dying at an advanced age, and that they are occasionally seen in the longitudinal sinus as well as on the arachnoid along the edges of the great longitudinal fissure separating the cerebral hemispheres; whilst, if anything at all is said concerning their seat of origin, this is represented to be in the pia mater beneath the arachnoid. Such a view as to their origin was held by Cruvelhier,* Andral,† and the late Dr. Todd,‡ and seems to have been adopted by other English anatomists, notwithstanding the observations of Luschka,§ who in 1852 clearly pointed out that they invariably arose from, and were direct continuations of the arachnoid membrane.

But even other situations have been indicated in which these growths may be met with; thus Dr. Todd wrote:—"Bodies somewhat similar are also found occasionally on the choroid plexuses of the lateral ventricles. Very frequently we meet with granulations of a like kind in the fringe-like processes of pia mater which descend from the velum interpositum to surround the pineal gland, and also upon the little processes of that membrane which go under the name of choroid plexuses of the fourth ventricle." Kölliker also states‖ that they are found in connection with the choroid plexuses of the ventricles. I have myself always failed to detect them in these situations, and on several occasions having cut off little opaque bodies from these vascular fringes, looking to the naked eye somewhat like Pacchionian bodies, have invariably found them to be, after inspection with the micro-

* 'Anatom Descript.,' t. iv, p. 537.

† 'Clinique Médical.' Translated by Dr. Spillan, 1836, p. 43.

‡ 'Cyclop. of Anat. and Physiol,' vol. iii, art. *Nervous System*, p. 645.

§ 'Über das Wesen der Paccionishen Drusen.' Müller's 'Archiv,' 1852, p. 101.

‖ 'Manual of Human Micros. Anat.,' 1860, p. 243.

scope, altered portions of the plexus only, rendered more opaque by the deposition in their interior of calcareous matter, in the form of 'brain sand.' Cruvelhier, moreover, altogether denies the similarity of the opaque granulations occasionally found on the choroid plexuses to Pacchionian bodies.

Agreeing with Rokitansky* and Luschka as to the fact of these bodies being invariably growths from the arachnoid, though differing from the latter observer as to the fact of their ever springing from its parietal layer, I will first speak of them as they may be observed on the visceral portion of this membrane.

When the dura mater is reflected we frequently see in more or less abundance a number of small, opaque, almost milk-white looking granulations, varying much in size, but seldom exceeding that of a rice-grain, situated on each side on the arachnoid along the median contiguous edges of the cerebral hemispheres. They exist most abundantly over the middle and commencement of the posterior third of the hemispheres, where the largest veins enter the longitudinal sinus, and are found principally at the angle and over the upper surface of the brain immediately contiguous to it, but are not met with on the vertical surface entering into the great median fissure. Occasionally, however, a little patch of these bodies may be seen over the upper surface of the hemisphere at a distance of an inch or more from the median line, and distinctly separated from those in this situation. The portion of arachnoid from which the Pacchionian bodies arise is invariably opalescent or opaque, and more or less thickened, and they are generally most numerous on the membrane over and covering the large veins as they leave the pia mater to enter the longitudinal sinus. They vary extremely in form, as may be seen by reference to Pl. X, fig. 1, which represents some of the shapes most frequently met with. Some are simple, others compound in various degrees, with ternary or even quaternary buds from the primary growth. Some are sessile and attached by a broad base to the arachnoid, whilst others are fixed only by comparatively long and attenuated pedicles, or may present all intermediate conditions between these two extremes. Luschka figures a compound growth resembling a small bunch of grapes, and so far as I have seen, this distinct pediculation, whether simple or compound, is most frequent in the early stages of these growths before they become very apparent to the naked eye.

Pacchionius also described bodies of a similar kind existing in large numbers in the longitudinal sinus, now well known

* 'Patholog. Anat.' (Syd. Soc.), vol. iii, p. 329.

as a very common locality in which these growths may be seen, when the sinus is slit open. The bodies projecting in this situation push before them the lining membrane of the sinus, instead of perforating it, and this was the covering probably alluded to by Pacchionius when he spoke of the assumed glands in the sinus as, "propriâ et tenuissimâ membrana, veluti in saculo conclusæ." Concerning them in this situation also Dr. Todd wrote :—"It has been supposed that these bodies are natural structures, destined to perform a mechanical office somewhat on the principle of a ball valve, but they are frequently absent altogether, and when present they have no constant relation to the venosus orifices." According to Cruvelhier,* Haller has found growths of this kind at the anterior extremity of the straight sinus, whilst he himself once met with "une petite masse pédiculée" of a similar nature in the horizontal portion of the lateral sinus. I have occasionally found them pretty plentiful in this latter situation.

In most cases where the Pacchionian bodies exist in any quantity it is found somewhat difficult to reflect the dura mater, on account of the adhesions between it and the arachnoid on each side of the median fissure, without tearing away portions of the latter with the upper membrane. Where this occurs, when the under surface of this reflected dura mater is examined, there is no difficulty in detecting the torn portions of arachnoid adherent to it, and if the edge of one of such portions be held with a forceps, and carefully pulled, it will be readily seen as the two membranes separate, that the adhesion is entirely due to an interlocking, by means of the Pacchionian bodies, which (still springing from the cerebral arachnoid) have pressed against the inner layer of the dura mater, destroyed its epithelial lining, and insinuated themselves into its substance by separating the interlacing fibrous bundles of which it is composed. Instead of its ordinary smooth appearance, also, the under surface of the dura mater in these parts will be found to have an open reticulated or cribriform aspect, owing to the separation of its fibres by the growths just dislodged from between them. After lodging themselves in the substance of the dura mater, these growths still increase in size, and are developed into the little pear-shaped bodies, which can then only be pulled backwards through its meshes by exerting a considerable amount of traction. Some few of these bodies which have thus lodged themselves take on a further increase of growth, and soon exceed in dimensions any of those to be found unattached on the surface of the arachnoid. When the skull

* Loc. cit., t. iv, p. 537.

cap is removed in such cases we see slight bulgings on the surface of the dura mater on either side of the middle line; at later stages these prominences would be more manifest, and at last the outer layer of the dura mater having become thinned and then eroded, portions of the growths protrude, differing, however, in appearance from that which they present when smaller and seen on the surface of the arachnoid.* They have now a less opaque and more pellucid aspect, and instead of being white in colour are seen to have a faintly reddish or even yellowish tinge. Sometimes several of these bodies, small in size and situated together in a little patch, may be seen on the surface at a slight distance from the middle line, the outer layer of the dura mater being absent over the area occupied by them. It seems a more probable supposition to imagine that this has been caused to disappear by pressure and erosion, than to account for its absence by a congenital defect, as some have suggested, seeing that this hypothesis is inadequate to explain why it should be that in preference growths should spring up on an independent subjacent membrane, precisely opposite those very parts where there is a deficient development in the one above it. Certain of the little tumours generally situated pretty close to the middle line, and mostly solitary in position, attain a morec onsiderable size still. They produce, as they increase in bulk, at first a mere depression in the corresponding region of the inner table of the skull, and at last an actual erosion of this, and even of the outer table, if their growth still continues. I have several times seen the outer table of the skull reduced to a plate of extreme tenuity, though never actually perforated. Dr. Ogle,† however, has lately described and figured cranial bones which have been perforated by these bodies, and mentions also that Mr. Turner, of Edinburgh, has once seen an actual perforation of the right parietal bone, in which the aperture in the outer table was large enough to give passage to an ordinary pea, whilst, as is frequently the case, the inner table was worn away over a

* This difference in appearance led me at one time to imagine that they might be structures of a different nature. In fact, knowing nothing very definite about them, I looked upon the little growths found on the dura mater as Pacchionian bodies, and in earlier autopsies was in the habit of looking upon the opaque granulations of the arachnoid as something quite distinct. This, however, I soon found to be erroneous. I now suspect that the opaque white appearance of the bodies seen on the surface of the arachnoid is partly a post-mortem effect due to the absorption of serum, since those found on the surface of the dura mater assume the same appearance after a short immersion in water.

† 'Brit. and For. Rev.,' Oct. 1865, pp. 502—4, figs. 21—23.

much greater area. In cases in which there has been lodgement only, but no perforation, by the Pacchionian bodies, the aperture through the inner table is often sharp and clearly defined.

Such being the appearances and positions occupied by these bodies, and arising in all cases as they do from the arachnoid membrane, it comes to be a matter almost of accident whether they are found on the surface of this membrane, on the external surface of the dura mater, or projecting into the longitudinal sinus. Those springing up on a portion of the surface of the arachnoid not in very intimate contact with the dura mater, have room and are enabled to grow without contracting adhesions; whilst those commencing on a portion closely in contact with the upper membrane (over the top of a convolution, for instance, instead of over a sulcus) penetrate between its fibres in the manner before stated, and if the portion of dura mater against which they impinge chances to be the wall of the sinus, they project into it instead of appearing on the outer surface of the dura. These latter in their growth push aside the reticulated fibrous bundles of the dura mater till they come in contact with the firm elastic membrane constituting the inner wall of the sinus. This they are unable to perforate, and instead, it slowly gives way before them, so that at last they come to project into the sinus in much the same way as an organ does into a serous sac. I have fully satisfied myself as to the nature of this covering over those bodies projecting into the sinuses, not only by recognising its microscopical similarity of structure to that which can be dissected off from other parts of the sinus, but also from the fact that I have frequently succeeded, by exerting considerable traction with a forceps upon a portion of adherent arachnoid outside the sinus, in pulling some of these bodies out, and leaving the little membranous caps with which they were surrounded—constituting the "propria et tenuissima membranâ," in which Pacchionius described them as being enclosed. The bodies projecting into the horizontal portions of the lateral sinuses, which are much less frequently met with than those in the longitudinal, would appear to rise from the arachnoid covering the posterior border of the cerebellum, and not from that on the lower surface of the posterior extremities of the cerebral hemispheres, since I have found them situated only along the lower angle of the base of the sinus.*

* Since this was written I have twice detected small Pacchionian bodies on the arachnoid over the posterior border of the cerebellum, as above sugg

The description here given of the Pacchionian bodies differs to a certain extent from that advanced by Luschka, whose views also seem to have been received by Wedl* and Förster,† since, according to him, all the most important of these growths, pathologically speaking, namely, those which insinuate themselves into the dura mater, appear on its external surface, or project into the longitudinal sinus, take origin from the *parietal* arachnoid. But quite independently of the fact, that the only representative of this membrane now believed to exist by Kölliker and other leading histologists is a layer of epithelium,‡ I have fully satisfied myself, after the most careful examination, that so far as can be ascertained, all these growths which imbed themselves in the dura mater or project into the sinuses, as well as those which remain free, seem to spring from the cerebral arachnoid.§ This is an arrangement easily demonstrated when, as is so often the case, portions of arachnoid corresponding to growths imbedded in the dura mater are found adherent to the under surface of this membrane, having been torn off during its reflection, since, on pulling the two membranes asunder, as before stated, many of the growths still firmly attached to this fragment of the visceral arachnoid, emerge uninjured from between the fibres of the dura mater, whilst the more slender pedicles of others are ruptured. The same thing, of course, occurs in the original turning back of the dura mater—certain of the pedicles give way, instead of the ararchnoid in all cases tearing, in order to permit of the separation of the adherent membranes. In such cases, where rupture has taken place, whether the Pacchionian body be situated in one of the sinuses or on the surface of the dura mater, if we pass the point of a fine needle through the membrane as nearly as possible in the direction of its pedicle, we shall always find it emerge on its under surface at a point where the fibres of the dura mater have the characteristic open cribriform arrangement, and in most cases be able to discover the broken extremity of the fleshy-looking little pedicle.

Continuous as these bodies are with the arachnoid, so are their histological elements precisely the same. I have not been more successful than other observers in recognising

* 'Rudiments of Path. Histol.' (Syd. Soc.), 1855, p. 350.

† 'Lehrbuch der Patholog. Anatom.'

‡ See concluding note.

§ Virchow and many of the other German anatomists have now almost ceased to use the word arachnoid at all, believing that no distinct membrane exists to which this name can be applied. They regard the so-called 'parietal arachnoid' simply as the epithelial lining of the dura mater, and the 'visceral' layer as only the condensed superficial layer of the pia mater.

either vessels or nerves in them. Some of the statements at present in vogue concerning the histology of the Pacchionian bodies are very lax: thus, by Todd and Bowman* they are stated to be "whitish granules composed of an albuminous material found amongst the vessels of the pia mater," which in their increase push the arachnoid before them; whilst in another place† each of these bodies is said by Dr. Todd "to consist of a mass of minute granules enclosed in a membranous sac."

Luschka is, I believe, the only writer who mentions the existence of epithelium upon the surface of these bodies; he describes it, however, as scanty, and met with only in isolated patches. It is often not easily recognised without the aid of reagents, but when small growths of this kind, or portions of larger ones, are mounted in equal parts of water and acetic acid for microscopical examination, the structures swell and become more transparent, whilst a pretty uniform covering of roundish or elliptical cells can generally be discovered on the surface, lying close together, though not in contact (fig. 2). The use of the same reagent renders visible bodies precisely similar on the surface of the arachnoid itself, though they are somewhat difficult of detection when portions of it are immersed in water alone previous to examination. The examination of other serous membranes, such as the peritoneum, pleura, and pericardium, showed bodies of a similar nature on their surface, and it was after careful scrutiny of them that I convinced myself that these apparently distinct, elliptical, nucleated cells were in reality only the nucleolated nuclei of a pavement epithelium, just such as has been described by Henle, and similar to what I have represented in fig. 3. The containing cell on the arachnoid and its outgrowths must be extremely delicate and fragile, since, though scrapings with a knife from their surface yield crowds of nuclei, separate as well as aggregated, yet I have never succeeded in detecting the same tesselated arrangement of their containing cells as I have seen elsewhere, though I have occasionally seen isolated nuclei contained in a delicate and almost invisible cell (fig. 4), and all analogy would lead us to believe that the nature of the epithelium was the same on the arachnoid as on other serous membranes, more especially when bodies precisely similar to what are undoubtedly the nuclei of these are found on the former. The epithelium is generally best seen on the younger growths, or else on those older ones which have

* 'Physiolog. Anat. of Man,' vol. i, p. 255.
† 'Cycl. of Anat. and Physiol.,' *loc. cit.*

inserted themselves into depressions in the cranial bones. In bodies picked out from this last situation (where, perhaps, they are more protected from friction, as well as supplied with more nutriment from the cranial diplöe) I have found a large quantity of epithelium, evidently in multiple layers, accumulated on their surface. A tendency to this is sometimes seen also on the arachnoid itself, since cells may be recognised in different places lying over one another as though a double or even treble layer existed. In addition to this epithelial covering, the Pacchionian bodies are composed of fibrous tissue, which may be seen in all stages of development, either in the same or different growths. Everything I have observed during the examination of this tissue in these bodies tends to confirm the opinions of Henle and Virchow* —who are so far agreed as to the fact that the undulating fibres composing the bulk of its substance are derived from the direct fibrillation of a homogeneous, hyaline, and gelatinous-looking material—and lends no support to those of Schwann or even Reichert. In great part this homogeneous material seems to grow in the Pacchionian bodies in the form of a branched network, reticulating in all directions so as to produce a pretty compact sponge-like structure. A portion of these interlacing, structureless bundles, which was scraped from the surface of one of these bodies, together with epithelium,† is represented in fig. 5. In many parts of the interior of the growths an areolated arrangement of bundles may also be seen, apparently at a later stage of development, since their texture seems firmer, their outline more sharply defined, and in many of them, by a proper adjustment of light, faint linear markings can be recognised, which may be the first traces of fibrillation (fig. 6). A thin, transverse section of one of the more opaque bodies on the surface of the arachnoid reveals the full maturity of the tissue (fig. 7), and instead of a network of a homogeneous or faintly fibrillated aspect, we get one composed of ordinary areolar or fibrous tissue, the bundles of which present the same reticulated arrangement. Occasionally I have seen a spiral fibre of elastic tissue of the kind mentioned by Luschka twisted around a still homogeneous bundle (fig. 5*a*), and in portions of the surface fibrous tissue of these bodies which

* 'Cell. Pathology.' Translation by Chance (1859), pp. 41—45.

† The minute buds so frequently found projecting from the surface of a still growing Pacchionian body, and which are the origin of the various secondary and tertiary outgrowths, are small projections of a tissue of this kind, which gradually undergo differentiation and development as they increase in size.

frequently does not show the manifest reticulated arrangement of the fibrous bundles, elongating cells or nuclei may be seen of the ordinary kind (fig. 8). The elastic tissue in the Pacchionian bodies is represented by fine fibres, and is not very abundant, though I have not had time further to make out its mode of development and arrangement.

As is the case with the arachnoid membrane itself, these Pacchionian outgrowths, especially in old people, very frequently contain deposits of brain sand. Sometimes it exists in the form of the usual bright, highly refractive, and irregularly rounded nodules of various sizes, situated in the midst of the fibrous tissue, with no special envelope of any kind; whilst in others a deposition of the calcareous matter seems to occur in small separate granules, and a concentric arrangement of cellular tissue, in the form of lamellæ, appears to take place around them (fig. 9), which in some cases is very distinct. Occasionally a large calcareous nodule is seen, apparently simple and of the kind first mentioned, but which, on alteration of the focus, seems to be made up of concentric lamellæ, or at all events it presents a series of concentric markings. This appearance may perhaps be due to the subsequent calcareous infiltration of a concentrically arranged fibrous envelope developed around a primary saline deposit. All the forms seem to be intimately connected with one another, and according to Kölliker,* brain sand generally, "after the extraction of the salts, completely retains the form of the concretion, and appears as a concentrically stratified pale mass." Kölliker also speaks of *corpora amylacea* as sometimes existing in the Pacchionian bodies; these I have never met with, unless some of the earthy nodules may be bodies of this kind which have undergone calcification.

Now we come to the question, are the Pacchionian bodies to be considered as normal structures, or as the results of pathological change? The investigations of the brothers Wenzel,† and even more, the later ones of Luschka, supply us with important data for the solution of this question. As yet these growths have been found only in the human subject, notwithstanding the diligent search made for them by the above-named observers in many of the lower animals. With regard to the ages at which they are found in man the brothers Wenzel came to the following conclusions:—"In children, from birth to the third year, these bodies, if they ever occur, must be very few. From the seventh to the

* Loc. cit., p. 243.

† De penitori hom. et brut. cerebri structurâ. Tubingæ, 1812.

twentieth year they sometimes are numerous. From the latter period to the fortieth year the number is considerable, and the nearer we approach the fortieth year the greater does it become. Lastly, from the fortieth to the one hundredth year these bodies are found in great numbers." Luschka, however, says he has never failed to find a certain number of these bodies on the arachnoid, at the borders of the great longitudinal fissure, at any period of life. Even in the new-born infants he has detected very minute outgrowths, which he considers as the rudiments of future Pacchionian bodies, though in them, as well as in other children dying during the first few years of life, their existence is easily overlooked, and they can only be detected by the most careful examination, since they are then minute pellucid structures of the same colour as the unaltered arachnoid. In individuals between sixteen and twenty years of age they are easily detected on account of their increased size and whiteness; and though at later periods of life they generally become more numerous and much larger, still there is a very great difference in this respect in different individuals, and in some persons dying even at middle age or beyond none of these bodies can be detected by the naked eye, though they may be seen by floating portions of the arachnoid in water, and then examining it with a lens. Luschka looks upon these growths as normal structures,* having a definite aim, which may be considered to be in a mature condition in individuals between the ages of twelve and twenty years, and to become pathological only by reason of their hypertrophy at later periods of life; and he accordingly names them 'arachnoidal villi.' But the old name seems to me a more desirable one, since it involves no implication as to their nature; and the possibility of any function performed by these bodies seems so doubtful that it appears more desirable to look upon them, with Rokitansky, merely as hypertrophic vegetations, or polypoid excrescences from the arachnoid, notwithstanding the fact that the rudiments of them are to be met with even at the earliest periods of life. Bearing upon this question, too, it is interesting to consider how far a pathological condition (assuming it to be such) so constant as the existence of these bodies in middle and advanced life, may, in the course of generations, through the influence of hereditary transmission, have at last tended to their rudimentary production, independently of the special causes at first potential in giving rise

* Andral and Dr. Todd regarded them as decided pathological products, whilst Cruvelhier, though in doubt as to their nature, was disposed to look *upon them* as of too frequent occurrence to be considered morbid growths.

to them in the original progenitors of the race. Or are we to suppose that the conditions instrumental in bringing about their increase of size in after life have already been in operation, during the intra-uterine period, to a sufficient extent to produce the early rudiments of these structures, ascertained by Luschka to exist in the new-born infant? At all events, it does not appear that these bodies can be looked upon as isolated structures of an exceptional nature, in the face of what we know as to the existence of similar hypertrophic excrescences from other serous as well as synovial membranes. According to Wedl,* "papillary new formations," with a covering of epithelium, have been found by Heschl on the pleura, and especially on that portion over the lower border of the inferior lobes of both lungs; whilst it is a well-known fact that in many cases the "white patches" of the visceral pericardium have a shaggy appearance when floated in water, from the presence of minute outgrowths, which would, in all probability, present, on microscopic examination, a fibrous structure, similar to that known to be presented by the opaque patch itself. On the other hand, the bodies developed from the synovial membranes of the larger joints, in cases of chronic inflammation, so well known to pathologists—often stalked and compound in form, but occasionally simple, smooth, ovate, compressed, and compared to melon seeds by Mayo—also present a fibrous structure, and may fairly be considered as having a close pathological relationship to the Pacchionian bodies.† Two causes seem influential in bringing about a fibroid thickening and opacity of serous membranes: undue amount of friction, on the one hand, which, as Dr. Jenner and other pathologists maintain, seems to be by far the most frequent cause of the 'white patches' of the pericardium; and hyperæmia on the other, whether from chronic inflammation or oft-repeated congestions, to which this condition of the arachnoid and synovial membranes seems most attributable. Repeated congestions alone are looked upon by Rokitansky and others as capable of producing opacity and thickening of the arachnoid, independently of any inflammatory process. Some amount of it is generally met with after the middle periods of life; and the same may be said as to the increase in number and size of the Pacchionian bodies;

* Loc. cit., p. 357.

† In a more recent work ('Die Halbgelenke,' 1858, p. 46) than his communication before referred to, Luschka has shown that the central part of each intervertebral disc is a synovial sac, the membrane of which is developed into processes almost precisely resembling the Pacchionian bodies. (*Note added June 19th.*)

and at any period of life their number and size seem to be in direct proportion to the frequency with which the brain and its membranes have been subjected to congestions; thus, even in youths or young adults, considerable enlargement of them is generally met with in those subject to frequent epileptic attacks, and less notably so in habitual drunkards. Startling exceptions occasionally exist, however, to this rule; for instance, I lately examined the brain of a man fifty-six years of age, who was known to have led an intemperate life, and who had in addition been insane, and perfectly incoherent in his conversation, for more than twelve months, and yet there was only the faintest opalescence of a small portion of the arachnoid, and no Pacchionian bodies to be seen with the naked eye. Such cases are, however, very exceptional; so that, leaving age out of the question, we may still look upon cerebral congestion and excitement as the causes most instrumental in bringing about the production or increased growth of these structures. This was also the opinion of Dr. Todd, who said: "In persons addicted to the excessive use of spirituous liquors, in those of irritable temperament, and who were frequently a prey to violent and exciting passions, they are almost uniformly highly developed."

Are these enlarged Pacchionian bodies of much pathological significance? It has been thought that they may give rise to dangerous symptoms by their pressure upon the brain, and by the impediment they may offer to the circulation of the blood through the great veins entering the longitudinal sinus as well as through the sinus itself. I know of no cases on record bearing out this assumption, and am disposed to think their effects are not often very serious in the first place, because, owing to the slowness of their growth, impediment to the flow of blood through any particular vein, if it should take place, would, without difficulty, right itself by an increased flow through the contiguous channels; and in the next, from the fact that no growths large enough to produce any appreciable pressure upon the brain are ever found between the membranes attached to the arachnoid only. Those so situated, being non-vascular themselves, receive plasma for their further increase only by absorption through the non-vascular arachnoid itself, and with which, oftentimes, they are only connected by means of a narrow pedicle, so that the conditions are by no means favorable to their attaining any notable size. Those, on the other hand, which have become imbedded between the fibres of the dura mater are enabled to absorb more nutritive pabulum directly from this more vascular membrane, with which to build up their structure, and they undergo a corresponding increase in size. Still their growth is slow, and the pressure exerted upon the cerebrum can only be insignificant, seeing also that the direction is *outwards* towards more vascular parts, causing them to press upon the inner table of the skull, and finally produce more or less deep erosions in the vault of the cranium. Here, indeed, is a source of danger, owing to the weakening of the bony case in which the brain is lodged, rendering it less able to resist the effects of blows or external violence of any kind. But the projection of these growths into the sinuses, and their increase in this situation, seem to be the course most likely to be attended with deleterious results, since, as foreign bodies, they may lead to a blocking up of the sinus, either from the deposition of fibrinous coagula upon them in certain states of the system, or from an actual increase in their own number and size. This latter effect would doubtless be of no very unfrequent occurrence were it not for the conservative influence of the tough, elastic lining membrane of the sinus, which, in all probability, impedes the growth of these bodies, partly by its strength and pressure, and partly because it does not give a sufficiently ready passage to the flowing pabulum afforded by the serum of the blood, in which these structures are immersed, and which, could it be assimilated more easily by the Pacchionian bodies, might cause them to grow so as almost invariably to block up the sinus, and hence lead to the most serious results.*

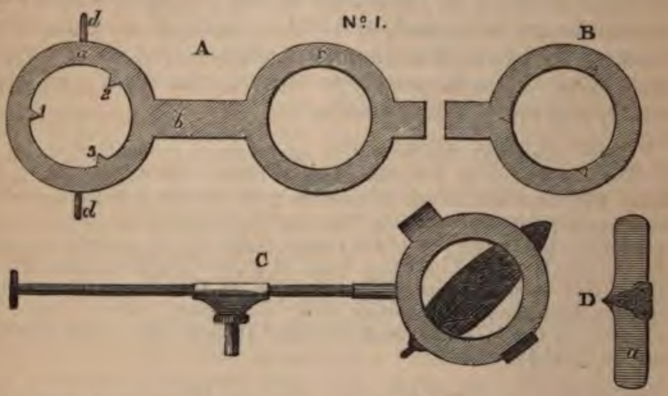
* Since this paper was written I have seen a communication on the Pacchionian bodies by Ludwig Meyer ('Virch. Archiv.,' vol. xix, p. 171 and p. 288), in which he not only insists upon the fact that these growths are invariably developments from the visceral arachnoid, but also has anticipated me in the recognition of the completeness of their epithelial covering. Dr. Cleland, however, I have also found, in spite of Meyer's statements, reaffirms that some of these bodies do arise, in the manner described by Luschka, from the internal surface of the dura mater (parietal arachnoid), in a paper in the 'Glasgow Med. Journal,' 1863, p. 148. (*Note appended June* 19, 1866.)

On a form of Leaf-holder *for the* Microscope, *and a* Revolving Slide-holder *with* Selenite Stage. By James Smith, F.L.S.

(Read May 9th, 1866.)

On a Leaf-holder for the Microscope.

The instrument to which I would this evening venture to draw the attention of the Society, and which I have called a leaf-holder, as indicating the class of objects for which it was designed and is best adapted, is intended to supply a want I have often felt in the examination of leaves, feathers, wings of moths, and other similar large flat objects which frequently require to be placed in a particular position, both as regards the microscope and the source of illumination. I have also found, in observing aphides or minute fungi upon the surfaces of leaves, very great difficulty in getting the object into a good position for examination, the ordinary stage forceps being in some cases almost useless for the purpose.



In the above set of drawings, A, shows the double ring forming the clip, made of a thin elastic yellow metal; B, the foundation ring, upon which the others work; C, the complete instrument with leaf inserted; and D, the small holder for such minute objects as could not be well held by the rings alone.

The ring B, which forms the foundation upon which the others rotate, may be made of somewhat stouter metal, the piece projecting at the side forming the socket to attach it to *the stem,* as shown in C. In A, the double ring forming the holder, the lower one (*a*) has three small projections on its inner margin, which being doubled over the inner edge of ring B (as indicated by the dotted points) form at once the means of attachment and rotation. The second or upper ring (*c*) is brought into its proper place, over, and lightly touching the first by bending the middle piece (*b*), which makes a sort of spring hinge, keeping the rings together, and retaining by its pressure the object in its place between them; D, the secondary holder for very small objects, consists of a flat piece of metal of sufficient length to be conveniently held by the rings forming the clip; in the centre of this flat piece a small watch spring joint (*b*) is fixed, the object being secured between this point and the projecting portion in the centre of the piece itself.

When a leaf or other such large object is to be examined it is placed between the rings, which by their tendency to come together hold it with sufficient firmness, and at the same time without injuring the specimen; and it can then be rotated upon its own centre by pushing the projecting portion forming the spring hinge, or the two small pieces (*d d*). The other rotation is of course effected by turning the milled head at the end of the stem; bringing the leaf examination at any desired angle with respect to the object-glass, while a half turn brings the underside into view without the necessity of disturbing the object itself; this facility of examination, which is given by the ring-like form of the instrument, will be found of some little value.

With respect to the size of the rings forming the clip, I may say that although in my own instrument they are about one inch in diameter, yet I think they might with advantage be made somewhat smaller; but as this is very much a matter of convenience, no precise size need be given.

On a Revolving Slide-holder for the Microscope, combined with Selenite Stage.

The accompanying diagrams show a very simple addition to the accessory apparatus of the microscope, which I would term a revolving slide-holder, and which will, I think, be found of use with some of the simple forms of microscopes. It consists (as will be seen in the drawings) of an upper plate, *a*, about 3 in. by 1, with two clips for holding the slide, a secondary one upon which the top plate revolves, an intermediate space (B *a*), and a lower plate somewhat larger and heavier forming the stage plate; further description seems scarcely needed. With many objects it is absolutely necessary to have them in a certain position with respect to the light to

Revolving Slide-holder and Selenite Stage.

see them at all, and with many more a slight change in position renders them far more distinct, and I am led to think that in such cases this slide-holder will be found both convenient and useful from the ease with which a slide placed upon it can be completely rotated; it might also be found useful in some cases of examining transparent objects by oblique light, and the hole in the lower plate might be made oblong, so as not to interfere with the oblique rays from the mirror.

A second and more general use to which this slide-holder might be applied is that of a selenite-holder for use with the polarizing prisms. In the 'Microscopical Journal' for July, 1860, pp. 203-4, I described a simple form of selenite stage having for its object a means of removing and replacing again the various selenites without disturbing the slide under examination or requiring to alter the focus of the microscope. In the revolving stage plate I now bring under the notice of the Society, it will I think be seen that by means of the intervening space between the lower and secondary plates, as shown in *a*, drawing B, the selenite plates can be slipped in and out without disturbing the object; and in the case of this holder there is the additional advantage obtained of having the object itself revolvable, while the polarizing prisms and the selenites remain in a fixed position with regard to each other —an arrangement which brings out some remarkable effects. It will also be apparent that when this secondary stage is used with a microscope that has a revolving stage plate of its own, the selenite plate and object under examination may be made to rotate in the same or in an opposite direction to one another; while the polarizing prisms remain fixed.

On a Binocular Microscope for High Powers.
By F. H. Wenham.

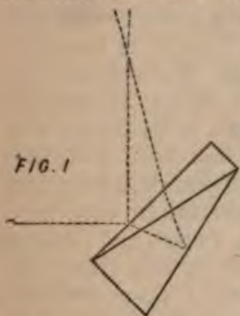
(Read May 9th, 1866.)

The common binocular microscope performs satisfactorily up to the $\frac{1}{4}$, but for powers above this a special arrangement is needed for the prism, which must be set close behind the posterior lens of the $\frac{1}{8}$th, $\frac{1}{12}$th, and upwards, in order to obtain an entire field of view in each eye. This it is found to accomplish perfectly when in that position; but still for very delicate test objects requiring the utmost extent of aperture for their definition, it will not resolve them as clearly as with the single body, from the fact that the aperture is divided and half only effective in each eye. It has therefore long been thought desirable to obtain the whole aperture in each tube. This has recently been effected by Messrs. Powell and Lealand by means of an inclined disc of glass with parallel sides; the partial reflection from the under surface is again reflected into the second eye by means of a rectangular prism. Assuming this surface to be placed at an angle of 45°, the amount of reflected light will be only 53·66 out of 1000 of the incident rays, or nearly $\frac{1}{19}$th part. To collect half the light the reflector would have to be set at $82\frac{1}{2}$°, but this would cause the glass plate to extend to such a length as to render the adaptation nearly impracticable, but even with the above-named enormous difference in the relative quantity of light, the arrangement as turned out by the hands of these clever mechanicians has surprised us with the fact that a good effect may be obtained by such means, and having thus started the principle it remains to be seen what improvements can be made with the view to increasing the quantity of reflected light, and if possible obtaining a more equal result in each eye.

By slightly modifying the existing arrangement of Messrs. Powell and Lealand, light otherwise lost may be utilised. In order to prevent the image from the second surface of the reflecting disc from appearing at the eye, and overlapping and confusing the first, Messrs. Powell and Lealand make it of considerable thickness. The secondary image is thus so far separated as to be thrown beyond the reach of the rectangular prism, and practically this light is totally lost. As the disc is made thinner, so do the images approximate and the distance between them diminish. Therefore if the glass is made as thin as practicable, and a very slight angle given to the two sides, these may be so arranged that both images are ultimately combined at the eye-piece. There would be no difficulty in working the glass to a mean thickness of $\frac{1}{50}$th of an inch. In this form the angle between the sides would be so exceedingly small that the chromatic effect considered as a prism would be inappreciable in the direct eye-tube.

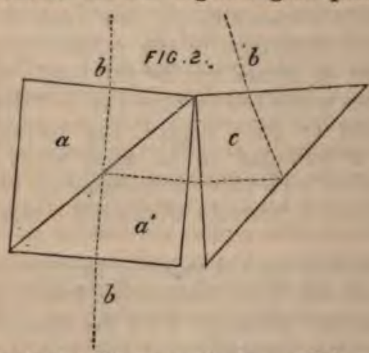
Another idea was to dispense with the rectangular prism and employ a wedge-shaped piece of glass, with the back silvered as shown by fig. 1, making use of the front and back surfaces for the two reflections and separation of the images. The wedge should be achromatic, and composed of angles of flint and crown as shown. But this could only be employed singly in such microscopes as have the object-glass set at right angles with the body. This plan might be of use for viewing sun-spots in a telescope where a diagonal eye-piece is seldom objectionable. In a microscope the increase of light obtained by removing the reflecting prism would not probably be very appreciable.

FIG. 1



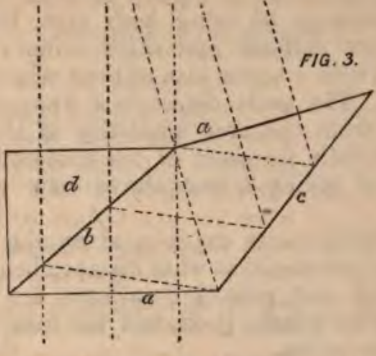
If two reflecting and transmitting surfaces be placed in close contact, both images will be combined at the same point. On this princple the following arrangement was tried: *a a*, fig. 2, are two similar right-angled prisms, with their

FIG. 2.



diagonals in contact: these are to be sufficiently tilted out of the plane of the microscope to throw the first reflecting surface out of the range of total reflection, and allow direct rays to be transmitted. The rays, *b b*, reflected from both the diagonal planes, after leaving the side of the prism *a*, were thrown into the second body of the microscope by means of another right-angled prism, *c*, while the transmitted rays passed through straight into the direct tube. The performance of this arrangement was very satisfactory, an equal amount of light being apparently obtained in each eye.

The next plan is to be preferred, shown in the diagram four times the full size. *a a*, fig. 3, in outline, resembles the now well-known form of "Wenham prism," but in order to transmit light the first reflecting angle, *b*, must be within the



range of total reflection. This for crown glass is when the ray makes with the surface an angle of 48° 11′, and allowing due margin for difference of density, the incident angle should not be less than 50° with the plane, consequently the angle, *b*, should be inclined 40°. The back angle, *c*, must be arranged in accordance with the inclination given to the bodies of the microscope, but as a rule *the difference between the angles of the front and back surfaces is half the angle of deviation of the ray from the perpendicular.*

In the microscope for which this prism was made, the bodies are set relatively at 15°; the back of the prism is, therefore, shown in the diagram 47½°. This also falling within the range of total reflection must have its surface silvered. On the first inclined surface of the main prism is adjusted the prism *d*, with two polished surfaces making an angle of 40°. With each other this brings the top of the supplementary prism parallel with the base. The rays from the object-glass are transmitted without any displacement into the direct tube. A portion of the same rays are reflected from both contiguous surfaces, and thence from the silvered back into the slanting body. The two prisms are fitted into a small drawer of the usual size which slides into the opening of the ordinary binocular microscope. The two prisms need not be pressed into contact—if so, Newton rings are formed; they may be set a visible distance asunder, but great care is needed in adjusting the small prism so as to get both reflections combined, otherwise a blurred image will be seen in the slanting body.

As to the performance of this arrangement the introduction of the prisms do not perceptibly interfere with the definition in the direct tube—delicate markings may be seen quite as well with the prism in place as out, and with proper workmanship the result is equally good in the other; and having the privilege of using both eyes, the observer is enabled to view diatoms and other minute objects more agreeably, and with a better idea of their structure, than with single vision. The great defect is a want of stereoscopic effect arising from the near similarity of the images. In this respect it falls far short of the common prism in the qualification of giving a perspective view with the lower powers.

In most arrangements constructed on the principle here described it is immaterial at what distance behind the object-glass the prism and reflecting surfaces are situated; the definition will be equally good, and the field entire, if fixed close to the eye-pieces.

The rectangular prisms arranged with their diagonals in contact may be otherwise made serviceable for the microscope. With some plan of modifying the light it may be used for a camera lucida and also for an illuminator in place of the glass disc employed where the object-glass acts as its own condenser for opaque objects.

On this principle of illumination the right system appears to be to obtain a very intense parallel ray of light, of as small a diameter as possible, thrown through a portion only of the object-glass.

With these prisms it is possible to obtain totally reflected light for the illumination, at the same time that the image of the object is transmitted. The light for the illumination must in this case be sent through the object-glass somewhat obliquely, and to reduce the diameter of the ray down to the small size required a stop of tinfoil may be atached to the lateral surface of the prism.

Constitution *and* Laws *of the* Microscopical Society *of* London.

(Revised May 9th, 1866.)

Presidents of the Society.

Richard Owen, F.R.S., &c.	1840
John Lindley, Ph.D., F.R.S., &c.	1842
Thomas Bell, F.R.S., &c.	1844
James Scott Bowerbank, LL.D., F.R.S., &c.	1846
George Busk, F.R.S., &c.	1848
Arthur Farre, M.D., F.R.S., &c.	1850
George Jackson, F.R.C.S.	1852
William Benjamin Carpenter, M.D., F.R.S., &c.	1854
George Shadbolt	1856
Edwin Lankester, M.D., LL.D., F.R.S., &c.	1858
John Quekett, F.R.S., &c.	1860
Robert James Farrants, F.R.C.S.	1861
Charles Brooke, M.A., F.R.S., &c.	1863
James Glaisher, F.R.S., &c.	1865

Objects of the Society.

The Microscopical Society of London is constituted for the promotion and diffusion of improvements in the optical and mechanical construction, and in the mode of application, of the Microscope:—

For the communication and discussion of observations and discoveries tending to such improvements, or relating to subjects of Microscopical observation:—

For the exhibition of new or interesting Microscopical objects and preparations, and for the formation of an arranged collection of such objects:—

For affording the opportunity and means of submitting difficult and obscure Microscopical phenomena to the test of instruments of different powers and constructions:—

For the establishment of a Library of standard Micrographical Works.

Constitution and Government of the Society.

The Microscopical Society of London shall consist of Ordinary and Honorary Members, and of Associates.

The Ordinary Members shall elect, out of their own body, a President, four Vice-Presidents, Treasurer, Secretaries, and Council, in accordance with the following Laws; to whom, subject only to the restrictions imposed by the Laws, all business relating to the Society shall be entrusted.

I.—*Of the Members.*

1.—The Society shall consist of Ordinary and Honorary Members, and of Associates; the number of the Honorary Members shall be limited to twenty.

2.—Every candidate for admission as an Ordinary Member of the Society must be proposed by three or more members, who must sign a certificate in recommendation of him, which must set forth the names, description, place of residence, and qualifications of the candidate, and state that he is desirous of becoming a member; and the proposer, whose name stands first upon the certificate, must have personal knowledge of the candidate. The certificate shall be read aloud by one of the Secretaries at the first Ordinary or Annual General Meeting of the Members next ensuing, and shall then be suspended in a conspicuous place appropriated for that purpose in one of the rooms of the Society. The method of voting for the election of Members shall be by ballot.

3.—The ballot shall take place at the Ordinary or Annual Meeting at which the certificate shall have been read the second time, and immediately after such reading. No such ballot shall be valid unless twelve or more members ballot; and when two thirds or more of the members balloting shall be in favour of the candidate, such candidate shall be declared to be duly elected.

4.—The Secretaries shall address, or cause to be addressed, to every person elected a member, a letter to inform him thereof, on the day following his election, together with a copy of the Laws of the Society, a List of Members, and a card announcing the days on which the Society will hold its meetings during the season.

5.—Each Ordinary Member on his admission shall pay an entrance fee of one guinea, and an annual subscription of one guinea for the current year, which subscription shall be considered as due on the 1st of January in every subsequent year. Members who shall be elected, however, in the months of October, November, or December, shall not be called upon for a subscription for the current year.

6.—Any member may on his election compound for his future annual contributions by a payment of ten guineas, in addition to his entrance fee of one guinea; or he may at any time afterwards (all sums then due being first paid) compound for his annual contributions by the like payment of ten guineas. Every such composition shall be invested in Government Securities, in the names of Trustees.

7.—No person elected a member shall be entitled to exercise any privilege as such, nor shall his name be printed in any list of the Society, until he shall have paid his admission fee and first annual subscription or composition; and unless these be paid within two months from the day of his election, or within such further time as the Council may grant, the election of such member shall be void.

8.—Associates shall be elected in the same manner as Ordinary Members, but the admission fee and annual subscription shall be remitted.

9.—The Ordinary Members shall have the right to be present and to vote at all Ordinary or Annual Meetings, and to propose candidates for admission to the Society. They shall also be entitled to the use of the instruments, books, and mounted microscopic objects in the Society's collection, under such restrictions as the Council shall deem necessary. They shall have the privilege of personally admitting one visitor to the Ordinary and Annual Meetings of the Society, whose name shall be entered in a book kept for that purpose, together with the name of the member admitting such visitor.

10.—No member shall have the privilege of voting on any occasion, or be entitled to receive the publications of the Society, if his subscription be twelve months in arrear.

11.—Honorary Members and Associates shall possess all the privileges of Ordinary Members, excepting those of proposing candidates, of voting, of introducing visitors, and receiving the Publications of the Society.

12.—The payment of the admission fee shall be considered as distinctly implying the acquiescence of every member elected into the Society, in all the Laws, regulations, and by-laws thereof.

13.—Any member who may be absent from the United Kingdom during the space of one year, shall, upon previously giving to one of the Secretaries notice in writing of his intention, be exempt from the payment of his annual contribution during such absence.

II.—*Honorary Members.*

14.—Every person eminent in Microscopical Science shall be eligible as an Honorary Member.

15.—Every such person proposed for admission as an Honorary Member must be recommended by three or more Members, all of whom must certify in writing that he is a person eminent in Microscopical Science, and that they have a personal knowledge of him, or are acquainted with his works.

16.—The mode of proposing and balloting for Honorary Members shall be the same as that prescribed for Ordinary Members; but no person shall be balloted for as an Honorary Member unless the Council shall have previously approved of him.

III.—*Withdrawal and Removal of Members.*

17.—No member shall be considered to have withdrawn from the Society until he shall have paid his arrears and given a written notice of his intention to resign to one of the Secretaries.

18.—Whenever it shall be proposed to remove any member from the Society, the same shall be done by a resolution of Council, which shall be read at three sucessive Ordinary Meetings, and be suspended in the intervals in the Society's room of Meeting; and at the last of the said meetings the proposition shall be balloted for, and if two-thirds of the members balloting shall vote for such member's removal, he shall be removed from the Society accordingly.

19.—The names of all members who shall be in arrear of their annual subscription for more than two years shall be publicly suspended in the Society's ordinary room of meeting, with the amount of subscriptions due from each; and unless the same shall be paid within three months after such suspension, their names shall be liable to be removed from the list of the members.

IV.—*Annual Meeting and Election of Officers.*

20.—An Annual Meeting of the Society shall be held in the place of the Ordinary Meeting for February, for the election of officers for the year ensuing, and for receiving the report of the Council on the state of the Society, or to enact, alter, or repeal Laws.

21.—Notice of the Annual Meeting shall be given from the Chair, at the preceding Ordinary Meeting of the Society in January, and also upon the cards of the Ordinary Meetings.

22.—The Council, at the Ordinary Meeting in December, shall declare the names of the four members whom they recommend to retire, and propose to the Society the names of four other members to supply their places in the Council: they shall also declare the names of the other Officers whom they recommend for election.

23.—At the Annual Meeting the officers and four members of Council, to replace those who retire, shall be elected. The mode of election shall be by ballot.

24.—In the event of any member of the Society being desirous of proposing other names than those recommended by the Council, a written list of the same shall be delivered to one of the Secretaries, on or before the Ordinary Meeting in January, and the same shall be read from the Chair, and publicly suspended in the Society's rooms, with the list recommended by the Council; and no member shall be eligible for election into the Council unless he has been proposed in the manner and form above specified.

25.—The President or other member in the Chair shall appoint two Scrutineers from among the members present, to superintend the ballot during its progress, and to report the result to the meeting.

26.—If in the interval between the two Annual Meetings the office of President, Vice-President, Treasurer, or Secretary, may become vacant, either by death, resignation, or otherwise, the Council shall have power to appoint one of their own members to fill such office until the next Annual Meeting.

V.—*Ordinary Meetings of the Society.*

27.—The rooms shall be open to members at the hour of 7 o'clock, for microscopical investigation. The Chair shall be taken at 8 o'clock precisely.

28.—The ordinary course of business shall be as follows:—

1st. The names of the visitors, and of the members by whom they are introduced, shall be announced from the Chair.

2nd. The minutes of the proceedings of the previous meeting shall be read, and submitted for confirmation.

3rd. The lists of candidates for election and for suspension shall be read, and the ballot for the election of members shall take place.

4th. Scientific communications shall be read and discussed.

29.—The Chair shall be vacated at 9 o'clock, or as soon after as may be convenient; and the Society shall resolve itself into a Conversazione.

30.—At the Ordinary Meetings nothing relating to the Laws, or to the enactment of new Laws, shall be introduced or discussed.

VI.—*The Auditors.*

31.—Two Auditors shall be appointed by the Society at the Ordinary Meeting in January.

32.—They shall audit the Treasurer's accounts, and produce their report to the Annual Meeting of the Society, to be held in February. They shall have the power of calling for all necessary accounts and vouchers.

33.—No member of the Council shall be eligible as an Auditor.

VII.—*Council.*

34.—The business of the Society shall be conducted by the President, four Vice-Presidents, Treasurer, and two Secretaries, who, with twelve other members, together with the past Presidents elected previous to the year 1866, shall constitute the Council; and at all meetings of the Council *five* shall be a quorum.

35.—Four of the twelve members of the Council shall retire annually, and four new members shall be elected in their places.

36.—The Council shall hold their Ordinary Meetings on the day of the Ordinary Meetings of the Society.

37.—Extraordinary Meetings may be held at the discretion of the President, who shall direct the Secretaries to issue especial summonses for the occasion.

38.—The ordinary mode of decision on questions before the Council shall be by show of hands, unless a ballot shall be demanded.

39.—Any member who shall be personally interested in the question before the Council, shall retire during the consideration and discussion of the same.

40.—The Council shall present, and cause to be read to the Annual Meeting, a report on the general concerns of the Society for the preceding year; and such report, or the substance thereof, shall be printed under the direction of the Council, for distribution among the members.

VIII.—*The President and Vice-Presidents.*

41.—The President shall be in virtue of his office Chairman of the Council, and shall take the Chair at all Ordinary, Annual, or Extraordinary Meetings of the Society; he shall regulate the order of proceedings, and shall, *ex officio,* be a member of all Committees appointed by the Council.

42.—In the absence of the President, one of the Vice-Presidents, or in their absence the Treasurer or one of the members of Council, shall take the Chair and conduct the business of the Meeting; and in the case of the absence of all those officers, the Meeting may elect any other member present to take the Chair.

43.—No member shall be eligible as President or Vice-President of the Society for more than two years in succession; and two of the Vice-Presidents shall retire annually.

IX.—*The Treasurer.*

44.—It shall be the duty of the Treasurer to receive all sums of money due to the Society, and to pay therefrom only such amounts as may be ordered by the Council.

45.—He shall keep an account of such receipts and payments, and shall produce the same at all Meetings of the Council.

46.—The Treasurer shall pay all moneys received by him into the hands of the Society's banker, retaining a sum not exceeding £30 for the payment of current expenses.

X.—*The Secretaries.*

47.—It shall be the duty of the Secretaries to attend all Meetings of the Society and Council.

48.—They shall take, or cause to be taken by the Assistant Secretary, minutes of the proceedings, and produce and read them at the ensuing Meeting; read the scientific papers presented to the Council, if requested by the authors; and conduct the correspondence of the Society.

49.—The Council shall be empowered to appoint an Assistant Secretary, and to assign to him such portion of the duties of Secretary as it may think desirable, at such remuneration as the Council may deem proper.

XI.—*Scientific Papers.*

50.—All scientific papers shall be submitted to, and approved by, the Council, previously to their being read at the Ordinary Meetings of the Society.

51.—They shall be read in the order in which they have been received, unless the Council shall otherwise direct; and the discussion of the subject of each paper shall immediately follow the reading thereof; but it shall be left to the discretion of the Chairman to take the discussion on two or more papers, on similar subjects, together.

52.—The papers and illustrative drawings to be considered the property of the Society, unless the authors shall stipulate to the contrary.

53.—Authors shall be at liberty to read their own papers.

XII.—*Publications.*

54.—The Transactions of the Society shall be published at such intervals, and on such conditions, as the Council shall think fit.

55.—They shall consist of a selection from the papers which shall have been read at the Ordinary Meetings of the Society; such selection to be made by the Council.

56.—The authors of such papers as may be published by the Society shall be entitled to twelve copies, free of expense.

XIII.—*Library.*

57.—The books in the possession of the Society shall be allowed to circulate among the members, under such regulations as the Council may deem necessary, but they shall be returned to the library on or before the next Ordinary Meeting following that on which they may have been taken out.

XIV.—*Microscopes and collection of Objects.*

58.—The microscopes and microscopic objects in the possession of the Society may be employed by the members during the period of the Ordinary Meetings, but shall not be taken out of the Society's rooms without the permission of the Council.

XV.—*Trustees.*

59.—The Council shall appoint three members of the Society to act as Trustees of the property of the Society, of whom the Treasurer shall be one; and may appoint others in their place, on any vacancy occurring by resignation or otherwise.

60.—The Council shall decide on the mode of investing the property of the Society, which investment shall be in the names of the Trustees for the time being.

XVI.—*Of altering the Laws.*

61.—No permanent alteration in the Laws of the Society shall be made, except at the Annual Meeting, or at a special General Meeting to be convened for the purpose by the President, with the sanction of the Council; and notice of any proposed change must be given on or before the preceding Ordinary Meeting.

On the SURFACE-FAUNA *of* MID-OCEAN. By MAJOR SAMUEL R. I. OWEN, F.L.S., F.A.S.L., Member of the Microscopical Society, and Associate of King's College, London.

(Read June 13th, 1866.)

No. 3.—*The Towing-net.**

THE time is now coming when we shall be distributed far and wide for the summer's vacation, and many will have the opportunity of using the towing-net, by being near the sea or upon its waters. I wish to say a few words on the subject of its use, and what may be expected from its assistance.

Towing-nets for short distances, and only in calm, fine

* Nos. 1 and 2, on the Surface-fauna of Mid-ocean, "*Recent Polycystina*" and "*Foraminifera,*" were read before the Linnean Society, and will be found in their publications.

weather, is not all that is required. Nets should be made that will tow from even a steam-vessel, and thus be made to sweep the ocean-surface for several degrees at a time. By this course a satisfactory account may be given of our own and the neighbouring seas; and to such as take long sea voyages they will open out a vast field of interesting research.

I will begin by describing a simple form of net, such as may be rigged out at a few hours' notice. A grummet should be made for the mouth, to which three cords may be attached to connect it with the towing-line; that line should be a good stout piece of stuff, and capable of bearing a great strain. To the grummet should be attached, first, a bag, the upper part of which may be made of a thin canvas, the lower part of strong jean, ending in a piece of close calico or linen; the bottom must be left open, and tied round with a tape when used: this will be found convenient for taking out the contents; and by leaving it open and towing it so for a short time, it can be thoroughly washed. Over the whole an outer covering of the strongest sail-cloth should be put, the upper part, in like manner, attached to the grummet, the lower part left open, and a portion for a foot or eighteen inches of the seam left to be coarsely laced up with a piece of cord, the same being done for the bottom itself. If necessary, a third covering may be put between these of any strong but rather porous material; but this, in its turn, should be left open at the bottom, and only tied when required for use. Its length should be so adjusted, when tied, that the inner lining of calico may rest against it, and be relieved from the strain. The outer sail-cloth should, in like manner, be laced up to receive and support the whole.

For a net to be used when the vessel is under steam, or in heavy weather, the grummet may be three inches diameter in the clear. Any young nautical friend will explain how a grummet is made; and the whole of the apparatus may be sown down from a foot below the mouth to near the bottom with two seams, making it into three tubes. This will be found to answer in every respect all that can be required of a net, even in the roughest weather. A piece of strong fine net may be arranged at the mouth; this will prevent larger things from going to the bottom; they can be at once taken out on getting the net on board. For the removal of the finer contents, it will be necessary to unloose the outer cover, untie and turn up the second, then the calico bag, containing what is wanted, can be untied, turned inside out, and carefully washed into a bowl of salt water, where the material may be passed through a sieve of coarse muslin. The larger will thus be separated from the finer portions; by decanting each part so obtained the heavier will be separated from the lighter; thus, four divisions well adapted for examination will be in separate vessels. Each haul being thus treated, a register may be kept in bottles and on glasses of every portion of the ocean passed over.

Weak spirit, or a solution of bay salt and arsenic, will preserve things in a wet state; others may be allowed to dry on the glass slides.

Larger nets may be made on a similar principle for quiet sailing and finer weather. Nets with large openings, a yard wide, may be used in calms, and from boats. A bent cane and a straight deal lath make a very good mouth. The material nearest the opening should be of fine net; below this muslin should be used, and at the bottom the fine close calico bag, made open, and tied when used. A bag of coarse net should be attached to the mouth, penetrating it a yard or so, to intercept the larger things that may get into it.

To use these nets conveniently, a spar or bamboo should be rigged out on the quarter or side of the vessel, having a guy or two to support and steady it; a pulley or small block should be fastened at the outer end, through which the towing-line may pass and come in board some distance forward of the place from which the spar is projecting; this will relieve the spar, in a great measure, from the strain.

It would be found difficult to haul in such a net when the vessel is going ten knots an hour, but this difficulty is entirely removed by having a second thinner line attached to the side of the mouth of the net; by hauling on this the strain of the water is at once taken off and the net brought in board with the greatest ease, and, moreover, should the tow-line break the net is saved by the second line from being lost.

It will be found that the length of the towing-line must be regulated in some degree by the size of the net and the rate of sailing; if too short, the net will only touch and dance upon its surface without taking up the water; if too long, it may be carried under water, and so increase the strain as to endanger the line or spar. The length should be sufficient to allow the mouth to keep dipping in and taking up water when the vessel is going at great speed; but when a slower rate is to be adjusted for, then the mouth should keep at the surface, the grummet being generally nearly under water, but the waves of the sea will interfere with any great nicety in this respect. The line should be strong enough for any sudden jerk that might occur.

I need not here go deeply into the various interesting objects that may be met with by the use of such an arrangement. The Polycystina, with their interesting allies the Acanthometra; the Thalassicolla, &c. &c., about which so little is really at present known, might be found. I am persuaded that the genera Pulvinulina and Globigerina, of the family Colymbitæ of the Foraminifera, will be found on the surface of the ocean near home. Dr. Wallich found them in great numbers in the sediment forming the bed of the Atlantic. From 70 to 98 per cent. of this deposit in the deep seas is often composed of these Rhizopods. These two genera, together with the Orbulina of Dr. Carpenter, but which I have now proved to be a sub-genus of Globigerina, have been found to be surface-forms on every part of the ocean that I have sailed over. Different classes of creatures will be found on the surface during the night to those found in the day time; from sunset till daylight the Polycystina, Foraminifera, Acanthometra, Entomostraca, small Pteropods, and shelled Molusca, must be looked for; during the day the Crustaceans, Thalassicolla, Creseis, &c., will repay our endeavours.

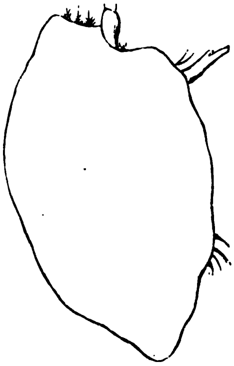
I hope enough has been said to induce some to try the experiment on a scale that will bring great results.

When at sea I had not the chance of entering upon a field of observation that promises to be very fruitful and interesting. I had no spectrascope with me to examine into the nature of the light given off by the various phosphorescent forms that are at times met with in such profusion on the sea-surface. I would now make an appeal in their behalf. We shall look forward with interest to receive papers on this subject when we meet again at the close of the year. I hope that some of our correspondents abroad will take it up, and send us the spectra of the fire-fly, lantern-fly, and a host of other luminous creatures. At home the glowworm and phosphorescent sea-surface forms might all be attended to. Those who visit the Mediterranean and more southern parts of the ocean this summer might add the spectrascope to their scientific instruments for this purpose. I take much interest in this subject, but, as I am not likely to have an early opportunity of prosecuting the investigation, I have brought it forward for the benefit of others who may be more fortunate.

These spectra must be compared with those we shall get from such sources of phosphorescent illumination as phosphorus, heated fluor spar, and many others that I might name.

I have the pleasure to present to the Society a slide containing the most brilliant phosphorescent Entomostraca that I have met with. (See figs. 1, 2, 3.) When these were taken the sea was alive with them. When swallowed by or entangled with other creatures they in their turn appear to be also luminous. They also give luminosity to the water itself as it flows over them. When they are at rest they gradually cease to give out light; but as soon as they are disturbed or in motion, or the vessel containing them is shaken, they again become bright, even after many hours' confinement. Each of these specimens I picked out while phosphorescent, that there might be no mistake about the giver of light.

Fig. 1.



The nearest of the Entomostraca that I have been able to compare with these is the species Gibbosa, genus Cypridina, of the order Astrucoda, named and figured by Dana. He reports having found his specimens in the Pacific, in lat. 15° 20′ south,

Fig. 2.

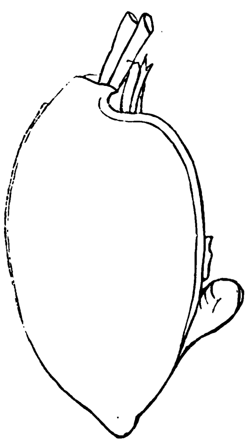


Fig. 3.

and long. 148° west. He notes them as "very brilliant." My specimens from which these drawings are taken were caught in the month of November, in the Bay of Bengal, in lat. 3° north, and long [illegible] t. T[illegible] reason why such things [illegible] therefore, be the same species.* It will be satisfactory to have more specimens of this from the Pacific, as we all know how an error might creep in, in labelling each specimen, when the collector passed over so many oceans during the same voyage.

I have seen the ship's decks running with liquid fire when the net containing this species has been taken on board. I must again express my regret that I had no spectrascope with me on my last voyage. I am therefore unable to lay before you the drawings of the spectra of the luminous Entomostraca that are on the table. I shall conclude by hoping that some of my zealous fellow-workers will take up the subject, and at an early day make up for my want of opportunity. It will end in more than a few interesting experiments. I look for results that may not only add to our chemical knowledge, but to such as may afford us some hints on matters that are at least the nearest akin to the nature of organic life.

* The difference in the form of the beak has since made me think it may be found entitled to be considered a distinct species.—S. R. I. O.

ERRATUM IN CAPTAIN MITCHELL'S PAPER ON THE SCREW MICROMETER.

Page 71, line 3 from bottom.

For—"With my micrometer a negative eye-piece (one by Powell and Lealand), with four filaments, amounts to the divisions of the micrometer head."

Read—"In my micrometer a negative eye-piece (one by Powell and Lealand), the thickness of one filament is equal to two divisions of the micrometer head."

TRANSACTIONS OF THE MICROSCOPICAL SOCIETY OF LONDON.

DESCRIPTIONS *of* NEW *and* RARE DIATOMS. SERIES XX.

By R. K. GREVILLE, LL.D., F.R.S.E., &c.

(Communicated by F. C. S. ROPER, F.L.S. &c.)
(Read May 9th, 1866.)

(Plates XI and XII.)

PLAGIOGRAMMA.

Plagiogramma elongatum, n. sp., Grev.—Frustules elongated, with two central costæ; valve linear, narrower towards the rounded apices, generally very slightly contracted in the middle; striæ composed of rows of large, distinct, subquadrate granules. Length ·0074″. (Pl. XI, figs. 1, 2.)

Hab. In cleanings of shells from South America; Laurence Hardman, Esq.

In the character of the markings this noble species is allied to *P. tessellatum*, but it is twice the size, and the valve is of a different form, linear instead of elliptical, rounded at the ends, near which it becomes narrower and more strictly linear. It is the finest species of the genus hitherto discovered.

Plagiogramma? angulatum, n. sp., Grev.—Frustule in front view linear, with parallel sides, central and terminal costæ; the space between the terminal costæ and the apex oblique; striæ forming a very narrow band. (Fig. 3.)

Hab. Barbadoes deposit, Cambridge estate; in slides communicated by C. Johnson, Esq.; extremely rare.

All the specimens I have met with present the front view; and as the ends are distinguished from those of all the other species in being, as it were, sharply bevelled off on each side, some slight doubt may exist as to its generic position. The striæ are 16 in ·001″, and form a narrow marginal band. There is a remarkable angularity and squareness in the whole aspect of this diatom. Length about ·0040″.

GEPHYRIA.

Gephyria gigantea, n. sp., Grev.—Valves much elongated, broadly cuneate and obtuse at the ends; costæ about 3½ in ·001″ (Figs. 7, 8.)

Hab. Monterey deposit, California; Laurence Hardman, Esq.

A truly magnificent species. A lower valve now before me measures ·0120″ in length! A smaller example is ·0100″, in which the breadth is ·0017″ in the middle. Towards the ends the valve dilates a little, and then becomes broadly cuneate or elliptic-cuneate. Compared with this species, all those previously described are as dwarfs. In the largest of them (*G. incurvata*) the costæ of the valve are about 7 in ·001″, in the one now described they are only 3½ in ·001″.

OMPHALOPELTA.

Omphalopelta Moronensis, n. sp., Grev.—Small; disc with six compartments, filled with decussating striæ variously arranged, causing a play of colour; three of them pale, with a deltoid impression, the others darker, with a sort of triradiating nucleus and a marginal spinous process. Diameter ·0030″. (Fig. 14.)

Hab. Moron deposit, Province of Seville; Laurence Hardman, Esq.; extremely rare.

An exquisite little diatom, the markings of which cannot be satisfactorily reproduced by the artist, as they depend for effect upon the slightest change of focus. I have endeavoured to delineate what may be regarded as the most *peculiar* aspect. The play of colour is somewhat similar to that seen in *O. versicolor*, only not so brilliant. This effect seems to arise, not alone from the outer pellicle, the striæ of which are uniformly decussate, but partly from the undulation of the surface, and possibly from the subjacent structure. The marginal processes do not occur in all the compartments in accordance with the generic character, but only in the alternate darker ones. At the same time the diatom is too closely allied to *O. versicolor* to admit of its being removed. The presence or absence of spines, in many cases, at least, does not appear to be of much importance.

AULACODISCUS.

Aulacodiscus sparsus, n. sp., Grev.—Small; disc with 4 linear-oblong, submarginal processes; granules minute, coloured, so remote as not to be conspicuously radiate; umbilicus a subcircular blank space; furrows becoming gradually wider as they approach the processes; margin with a row of puncta. Diameter ·0030″. (Fig. 6.)

Hab. Barbadoes deposit, Cambridge estate; in slides communicated by C. Johnson, Esq.; extremely rare.

The only species with which the present very beautiful diatom can be compared is *A. Kilkellyanus*, which it resembles in the disc, having a general appearance of being sparsely filled with granules, while it is not much inferior in size. But in that species the lines of granules are conspicuously radiate, the sparse appearance depending upon the distance between the lines, the granules themselves being arranged in a pretty close series. The number also of processes in the same species is constantly three. In our new species the sparse character arises from the distance between the individual granules in the lines, which is so great that the radiation of the lines does not strike the eye at once, while the granules get disposed into half-concentric wavy lines, which have a beautiful effect. The number of processes is four.

CESTODISCUS.

Cestodiscus pulchellus, n. sp., Grev.—Disc circular, very convex, with minute, remote, radiating puncta, becoming irregularly crowded, and slightly less in size towards the margin; processes numerous; margin, as well as the space between it and the granules, striated. Diameter ·0030″. (Fig. 5.)

Hab. Nankaurie deposit, Nicobar Islands; in a slide kindly communicated by George Norman Esq.; very rare.

Distinguished by the remote punctation, which considerably neutralizes the effect of the radiating character. In the centre the granules are somewhat loosely disposed. Towards the margin the radiating granules pass abruptly into a band of others, crowded and irregularly arranged, from the outer edge of which band the processes arise, sixteen or more in number. Margin strongly defined and conspicuously striate.

Cestodiscus Stokesianus, n. sp., Grev.—Disc circular, with lines of very minute puncta, closely radiating from the very centre, and terminating towards the margin in a belt of still smaller irregularly crowded puncta; processes small, 6; margin striated. Diameter ·0030″. (Fig. 4.)

Hab. Moron deposit, Province of Seville; Rev. T. G. Stokes.

This species differs from *C. pulchellus*, with which it agrees in form and size, in the crowded character of the radiating lines which fill the disc, and in the very much smaller number of processes. The latter are somewhat inconspicuous. The puncta which form the band between the radiating lines and the striated margin are smaller than the others, and irregularly crowded. I am obliged to my indefatigable friend Mr. Stokes for having brought this addition to the genus under my notice.

RUTILARIA (char. amended).

Frustules very compressed, cohering into a short filament; valves slightly elevated at the angles, with a central glistening nodule prolonged into two short, linear, obtuse processes; the margin pectinate-ciliate.

The fortunate discovery of perfect frustules *in situ* enables me to determine the true position of this very interesting and curious genus, three species of which were published in the 'Quart. Journ. of Mic. Sci.,' Vol. III, New Series. At that time nothing more was known of them than what was afforded by a side view of the valve, which, however, was sufficient of itself to separate them from all known diatoms. The genus is unquestionably allied, as my friend Mr. T. G. Rylands suggests, to the *Biddulphieæ*. The angles of the valves are not prolonged into horns, but are only slightly elevated, and consequently the valves of opposite frustules, as seen in the front view, are brought so near together that the marginal ciliæ of each nearly cross the intervening space. The best view of the structure, showing its affinity with the *Biddulphieæ*, is to be obtained from the valve when so placed as to present both the front and lateral surfaces. (Fig. 10.) The genus, in fact, passes into *Biddulphia* through *B. fimbriata*, and especially through *B. spinosa*. Mr. Rylands, who with his usual kindness and acuteness examined, at my request, *R. elliptica* very critically, satisfied himself that of the two central processes one was straight and the other curved, as in the flexure of the forefinger; and that the processes of the opposing valves were interlocked, the straight process of the one passing mutually through the curved process of the other. Such an arrangement exhibits a remarkable analogy with that which exists in *Syndetocystis*, a MS. genus, to be described by Mr. Ralfs in his forthcoming supplement to the *Diatomaceæ* of Pritchard's 'History of Infusoria.' It was discovered in the Barbadoes deposit, and also belongs to the *Biddulphia* family. In that most wonderful genus the valves are nearly circular, fringed with ciliæ, and furnished with two intra-marginal rounded processes, and in the centre with another solitary process, erect, cylindrical, and elongated, and terminated by a laterally projecting ring. Looking at frustules *in situ*, in the front view, it is perceived that the stalk of the process of one valve passes through the ring of the process of the opposing valve, and, as this is the mutual position, the two frustules move freely as on pistons, and can be pulled asunder until the respective rings are brought into contact, but, of course, no further. Nothing but force can separate them. In the cabinet of my friend Mr. George Norman is a chain of four frustules so united.

Rutilaria elliptica, Grev.—Valve narrow-elliptical, raised at the angles into two short conical elevations. (Figs. 9, 10.)

Rutilaria elliptica, Grev.—'Journ. of Mic. Sci.,' Vol. III, New Series, p. 229, Pl. IX, fig. 3 (valve).

The figures which I am now able to offer will, it is hoped, render the structure quite intelligible. The front view exhibits four valves *in situ*, with the intermediate zone. The figure of the valve I formerly published was simply a side view. I now give the valve as seen under the most favorable circumstances for illustrating its relation to *Biddulphia*, viz., a partially front view.

Rutilaria superba, n. sp., Grev.—Large; valve elongated, oblong in the middle, gradually contracting towards each end into a narrow neck, which again dilates, and then suddenly terminates in a broadly elliptical, subacute apex. Length ·0065″. (Figs. 11, 12.)

Hab. Barbadoes deposit, Cambridge estate; in slides communicated by C. Johnson, Esq.

A fine species, with frustules almost as long as *R. epsilon*, but with a totally different diagnosis. The species to which it comes nearest is *R. ventricosa*; but it differs (so far as we know at present) in its far more elongated form and in the dilated ends of the valve. I have seen many specimens of *R. ventricosa*, none of which exhibit the last-named character; on the contrary, the prolonged extremities of the valve are sometimes more slender and attenuated than they appear in my figure ('Mic. Journ.,' Vol. III, N. S.. Pl. IX fig. 2). Nevertheless, these two diatoms may be ultimately found to be extreme forms of one and the same species. Fig. 11 exhibits a front view of two frustules *in situ*.

COCCONEIS.

Cocconeis armata, n. sp., Grev.—Small; disc broadly oval, with rather large, subremote, decussating granules, and distant marginal tubercles; median line straight, with a parallel row of very minute close puncta on each side. Length ·0021″. (Fig. 13.)

Hab. Barbadoes deposit, Cambridge estate; in slides communicated by C. Johnson, Esq.; extremely rare.

A brilliant and well-marked little diatom. The median line very slender. The granules arranged in intersecting curves, 8 in ·001″. Marginal tubercles, about 8 on each side.

NAVICULA.

Navicula strangulata, n. sp., Grev.—Valve elongated, deeply constricted at the middle, and composed of two ovato-cuneate subacute lobes, very minutely punctato-striate, with a narrow border of larger, more remote striæ (or cellules). Length ·0042″. (Fig. 24.)

Hab. In marine dredgings, Nassau, West Indies.

Among the multitude of described *Naviculæ* I can find no trace of this or the following well-marked species. The present diatom is evidently allied to *N. marginata* of Lewis, not only in form, bnt in the contrast between the minutely punctate striæ of the general surface and the row of larger cellules which constitute the margin. In the diatom before us these cellules are relatively much smaller than in *N. marginata*, but they are, nevertheless, evident. The general striæ are almost parallel, becoming slightly oblique only towards the ends. These striæ, taken near the median line, are 20 in ·001″, while those at the margin (cellules) are 10 in ·001″.

Navicula Jamaicensis, n. sp., Grev.—Elongated, with a deep constriction, dividing the valve into two oblong-elliptical lobes, somewhat produced and obtuse at the ends; structure minutely punctate, the puncta (cellules) arranged quincuncially, with a row of still smaller puncta along the margin. Length ·0040″. (Fig. 23.)

Hab. Jamaica; obtained by washing seaweeds.

This diatom has no immediate affinity with the preceding. There is no edging of larger cellules, but, on the contrary, a row of smaller puncta. The general structure, too, is unlike what is usually seen in the genus, the punctæ, which increase in size towards the margin, being not primarily so arranged as to produce the effect of striæ, but in quincunx fashion. Near the margin they are 15 in ·001″.

Navicula Egyptiaca, n. sp., Grev.—Elongated, narrow, convex, with elliptical subacute ends, and very gradually and slightly constricted at the middle; a linear lanceolate band of short broad costæ midway between the margin and median line, interrupted opposite the nodule, and a partial view of a second band of costæ at the margin. Length ·0050″ to ·0065″. (Figs. 16, 17.)

Hab. Stomachs of Holothuriæ; in slides kindly communicated by W. J. Baker, Esq., and George Norman, Esq.

My friend Mr. Ralfs has justly remarked in his observations on the genera *Navicula* and *Pinnularia*, that, "were the costæ always plainly developed as in *Pinnularia nobilis* and its allies, no difficulty could occur in determining the genera; but in many of the more minute species it is often very difficult to distinguish between striæ and costæ;" and he adds very truly, "that it is impossible to say to which genus a large number of Ehrenberg's species should be referred. He resolves the difficulty by merging for the present, at least, *Pinnularia* in *Navicula*. The very elegant diatom now under consideration would be, according to the late Professor Smith, an unquestionable *Pinnularia*, and it is too well marked to be mistaken for any other species. Costæ about 10 in ·001″. This Holothurian material is rich in many species, and there can be no doubt that collections from the stomachs of the *Holothuriadæ* generally, especially in the warmer parts of the world, would amply reward the diatom hunter.

Navicula permagna (Bail.), Ralfs.—Large, lanceolate or turgid-lanceolate, with somewhat obtuse apices; striæ fine, close, an intramarginal line, and a second shadowy line between the margin and the median line, and generally a rather broad, longitudinal, median blank space. Length ·0060″ to ·0108″. (Figs. 18—21.)

Navicula permagna, Ralfs, in Pritch. 'Infus.' (1861), p. 907. —Lewis, 'Notes on Diatom. of U. S. Seaboard,' p. 12, pl. ii, fig. 11 (var.).

Pinnularia permagna, Bail., 'Mic. Obs.,' p. 40, pl. ii, figs. 28, 38.

Hab. Abundant in the Hudson River at West P occurs of a smaller size in Lake Monroe, at Enterprise, Florida; Bailey. In most of our large Atlantic rivers and brackish marshes; at Cape May, saltmarsh near Cold Springs, abundant; Dr. Lewis. Mouth of the River Berbice, West Indies, at half tide; Dr. Abercrombie.

Having had occasion some years ago to notice that this species exhibited a remarkable range of variation, I have endeavoured to ascertain to what extent it may be traced. In taking the original figures of the late Professor Bailey as our starting-point, we find the longitudinal median space so large that the striæ are regarded as forming a mere marginal band, constituting, in fact, the salient feature in the specific character of Bailey, and subsequently of Ralfs. In the smaller of the two figures given by the former the median space is equal to half the entire breadth of the valve. The next American authority is my friend Dr. Lewis, of Philadelphia, who publishes a figure of a singular variety, which, he says, is more common on the Delaware River and its tributaries than that represented by Bailey, and which, he thinks, may be the *Navicula Esox* of Kützing. (Fig. 21.)

In this variety the breadth of the median blank space is diminished nearly one half. In my two larger figures (18, 19), drawn from Berbice specimens, the breadth of the same part is again considerably reduced; and in the small figure (20), from the same locality, the blank space has become a mere line. Thus, although the extremes present an extraordinary difference, we have the discrepancy reconciled by intermediate conditions. In a dry state the valve of the Berbice examples exhibits very gorgeous colouring, the general hue being fine blue, while a broad, bright, crimson streak extends down each side midway between the median line and the margin, passing into orange-yellow towards the ends. It is to be regretted that there should be no reference to this in the American notices of the species. Another character which is prominent in the Berbice specimens is not mentioned by Bailey or Lewis. I refer to the shadowy lines, one of which passes down the whole length of the valve on each side between the margin and the median line; the other, close to the margin itself, is indistinctly given in Dr. Lewis's figure. The former seems to be uncertain as to its position, being much nearer the median in my figure 20 than in figures 18 and 19. These lines appear to be caused by superficial ridges, the intermediate spaces being generally concave; and if so, the character is an important one. With regard to the striation in some large valves, I have counted 16 in ·001″. In some small varietes 25, or even more, in

·001″. They are generally less close opposite the nodule, being 15 in one specimen, while in other parts of the same valve they are 20 in ·001″. The fact is, however, that no dependence can be placed on characters of this description. Besides the examples already referred to, I have some from Long Island agreeing with the intermediate form of the species, and a slide containing a large series from a salt marsh at Cold Springs, Cape May, U.S., all the specimens being small and intermediate. In a drawing copied by my friend Mr. Roper from a specimen obtained by Professor Bailey from drift ice on the Hudson River the leading characters are very prominent, especially the longitudinal ridge-like line; and the median space is nearly as broad as in Professor Bailey's figures.

Navicula Zanzibarica, n. sp., Grev.—Large; valve elliptical, with the apices obtuse, somewhat produced; striæ minutely moniliform, divided by a blank line into two series, the one linear, very narrow, parallel with and next the median line, the other containing a sort of irregular spot opposite the nodule. Length ·0074″. (Fig. 22.)

Hab. Zanzibar; in slides kindly communicated by Professor H. L. Smith, of Kenyon College, Gambier, Ohio.

A noble diatom, and, beyond dispute, an excellent species. The striæ are obviously moniliform, slightly oblique, interrupted by a narrow blank line, not contracted opposite the nodule, gradually attenuated towards the ends, and disappearing before reaching the apex. On each side the median line, and parallel with it, is a narrow line or band of striæ; and these two bands, along with the median line itself, as they approach the ends become somewhat elevated and produced, and terminate in what may be regarded as a broad keel. Opposite the nodule, and midway between the margin and median line, is a curious spot composed of an irregular cluster of punctæ, puckered, as it were, in the middle, while the surrounding striæ are for a small space thrown into confusion. The first specimen which I found conveyed the impression that this singular appearance was the result of some accidental malformation; but all the valves which have been subsequently discovered present the same character. The striæ are 17 in ·001″.

Navicula rimosa, n. sp., Grev.—Elliptic or elliptic-oblong, with a band of fine striæ less than a third of the semi-diameter in width, a second very narrow band close to the median line, and a third narrow one between the two and not extending to the ends; the intermediate spaces obscurely punctate (cellulate). Length ·0035″ to ·0060″. (Fig. 25.)

Hab. Red Sea; cabinet of Laurence Hardman, Esq.

The intermediate linear band of striæ serves to distinguish this species at a glance. It has at first sight the appearance of a cleft in the valve, for the striæ, being very fine, are not at once perceived. It extends generally to about two thirds of the length of the valve. Sometimes it follows the curve of the valve, but in others (as in the figure) it is straight or very nearly so.

Navicula excavata, n. sp., Grev.—Elliptic, with an external band of fine striæ, less than half the semi-diameter of the valve in breadth, and a very narrow series next the median line; intermediate space obscurely cellulate, with a large sudden indentation opposite the nodule. Length about ·0030″. (Fig. 15.)

Hab. Red Sea; cabinet of Laurence Hardman, Esq.

A species having much of the contour of *N. Hennedyi*, but differing from it in the much finer striæ (about 35 in ·001″) and in the large remarkable notch or excavation in the intermediate space opposite the nodule into which the marginal striæ extend.

West imp.

DESCRIPTION OF PLATE I,

Illustrating Dr. P. M. Duncan's paper on the Histology of the Reproductive Organs of the Irid, *Tigridia conchiflora;* with a description of the Phenomena of its Impregnation.

Fig.

1.—Transverse section of one ovarian cell, showing two ovules, one ready for impregnation (1½-inch object-glass). *a.* External coat. *b.* Projection of the nucleus. *c.* "The papillary structures," a portion of the placenta which is usually perforated by pollen-tubes, and with which the open micropyle is in contact when undisturbed by manipulation. *d.* Position of the body of the nucleus, the embryo-sac being in its interior. e. Position of the micropyle when separated from the papillary structure near the placenta. (This portion of the placenta is continuous with the so-called conducting tissue of the style; the name placenta ought properly to be restricted to the tissue through which the vessels pass from the axis to the ovule). The ovarian wall is closely applied to the ovules in nature, but is readily separated by violence; as growth proceeds after impregnation the wall becomes distant.

2.—*a.* Nucleus stripped of its external coat (¼). *d.* Body; the unshaded central oval spot shows the square cells, and denotes the position of the internal pellucid embryo-sac. *d x.* Cells magnified (⅛). *b.* Neck of the nucleus composed of elongated cells. *c.* Circular opening of the micropyle whose canal can be traced as a dark line extending upwards to the central light spot. *c, x.* Micropyle (mag. ⅛ object-glass). *e.* Part of immature embryo-sac, the position of its cells being shown by their nuclei (⅛).

3.—*b.* Micropyle and "the papillary structure" slightly separated (¼). *c.* Overlapping circular cells of embro-sac (⅛). *d.* Some square cells from the upper part of embryo-sac (⅛). The ovule has reached its full devlopment before impregnation.

4.—*a.* Cells of external coat of ovule. *b.* Cells of the projection of the nucleus. *c.* Micropyle in an ovule not fully developed.

5.—*a.* Pollen-tube (cellular) from the stigma. *b.* From the style. *c.* Drawn out from the "papillary structure" close to the micropyle; very turgid. *d, e.* Hair and cells of the conducting (nourishing tissue) tissue of the style (all ¼ inch).

PLATE I (*continued*).

6.—*a*. Pollen-tube pulled out of the micropyle; one end remains in the "papillary structure," and the other is bulbous, has lost its granules, and the contiguous cells of the embryo-sac have come away with it ($\frac{1}{4}$). *b*. Bulbous end of pollen-tube ($\frac{1}{8}$). *x*. Embryo-sac-cells. *y*. End of pollen-tube. *c*. End of pollen-tube, not yet become bulbous, impinging on, and slightly pressing in, the cellular coat of sac ($\frac{1}{4}$). *d*. Embryo-sac removed from nucleus. *d*, *x*. The position of the indentation by the pollen-tube ($\frac{1}{4}$).

7.—*a*. Pollen-tube drawn out of the side of the ovarian cell-wall, and remaining in the micropyle-canal. *b*. Tube drawn out of papillary structure, it being tight in the micropyle canal, twenty-four to thirty hours after application of pollen to stigma ($\frac{1}{8}$).

•8.—*a*. Terminal cells of pollen-tube; the empty cell has been drawn out of the ovule; it is not bulbous. *b*, *c*, *d*. Forms taken by terminal cell ($\frac{1}{8}$).

9.—*a*. Cells of anterior end of impregnated embryo-sac ($\frac{1}{4}$). *b*. Same ($\frac{1}{8}$). *c* and *d*. Outline of embryo-sac after impregnation. *x*. The position of contact with the pollen-tube ($\frac{1}{4}$). *e*. First trace of granular embryo in embryosac.

DESCRIPTION OF PLATE II,

Illustrating Dr. Macalister's paper on *Ascaris* (*Atractis*) *dactyluris*.

Fig.

1.—Male.
- *a*. Tuberculated mouth.
- *b*. Stomach.
- *c*. Cœcal glandular apparatus.
- *d*. Testicular tube.
- *e*. Vesiculæ seminales.
- *f*. Intestine.
- *g*. Vas deferens.
- *h*. Spicula, large and small.
- *i*. Glandular apparatus around the dilated lower end of the intestine.

2.—Female.
- *a*. Mouth, with exserted proboscis.
- *b*. Commencement of ovarian tube.
- *c*. Lateral line.
- *d*. Cardiac constriction of stomach and tooth-like processes?
- *e*. Pyloric valvular constriction.
- *f*. Intestinal dilatation.
- *g*. Secreting cœca, perhaps renal.
- *h*. Cornu of cœcum.
- *i*. Ducts of cœca around rectum.
- *j*. Anus.
- *k*. Ovarian tube, containing perfect ova.
- *l*. Opening of ovarian tube.
- *m*. Cœcal glandular apparatus.

3.—Head of the alate variety of *A. dactyluris*.

4.—Tail of female.
- *a*. Glandular cœca, renal?
- *b*. Ducts.
- *c*. Tubercles on the curved cauda.

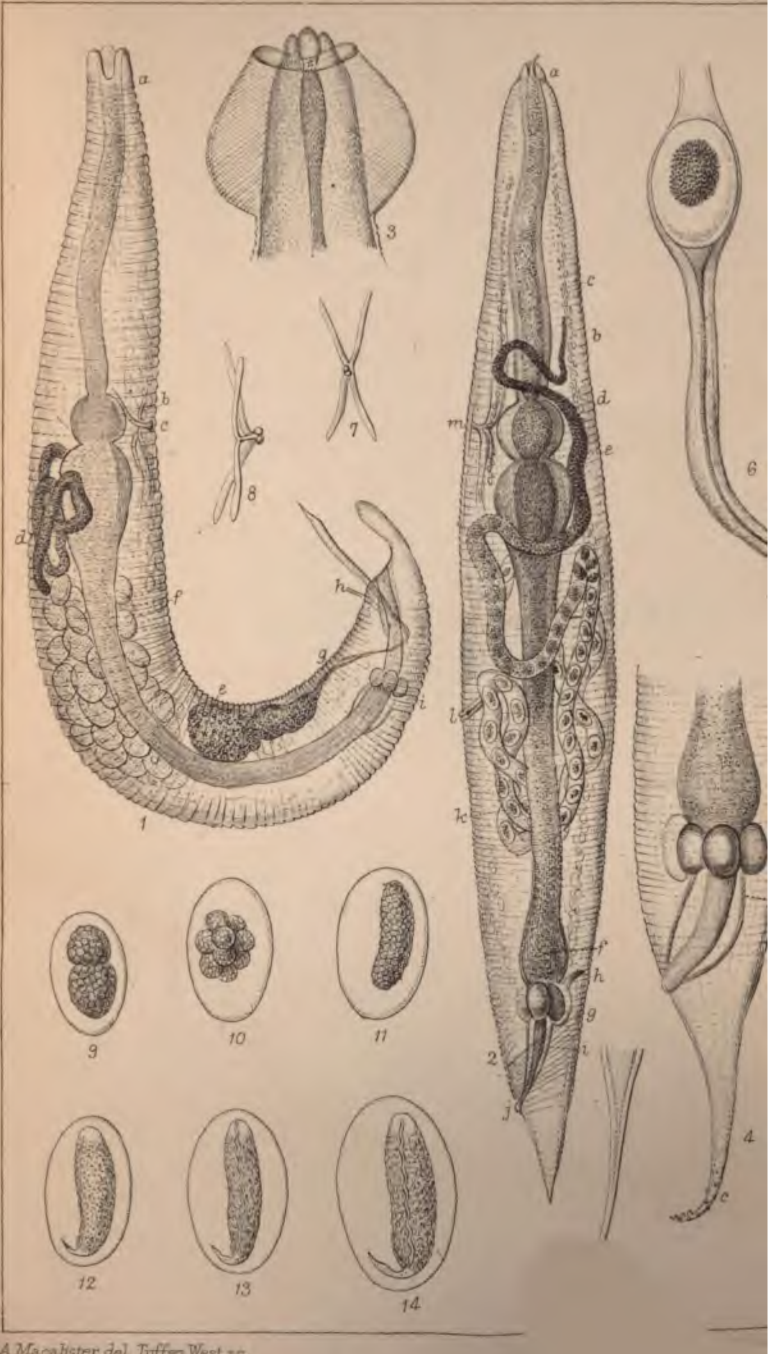
5.—Fine prolonged tail, found in immature females.

6.—Termination of oviduct, and ovarian orifice.

7, 8.—Secreting cœca of males and females.

9, 10, 11.—Ova with yolk in process of segmentation.

12, 13, 14.—Ova further advanced, showing the development of the intestinal canal.



A Macalister del. Tuffen West sc.

Mic. Journ. Vol. VI. N.S. Pl. III

DESCRIPTION OF PLATE III,

Illustrating the Translation of 'Observations on the Development of Resting Spores of Œdogonium.'

Fig.

1.—A resting Œdogonium-spore before germination.

2 and 3.—Germinating spores, which are releasing the contents divided into four masses and surrounded by a delicate hyaline covering.

4 and 5.—The four masses surrounded by their covering.

6 and 7.—Abnormal formations, the spore-contents forming three or two masses.

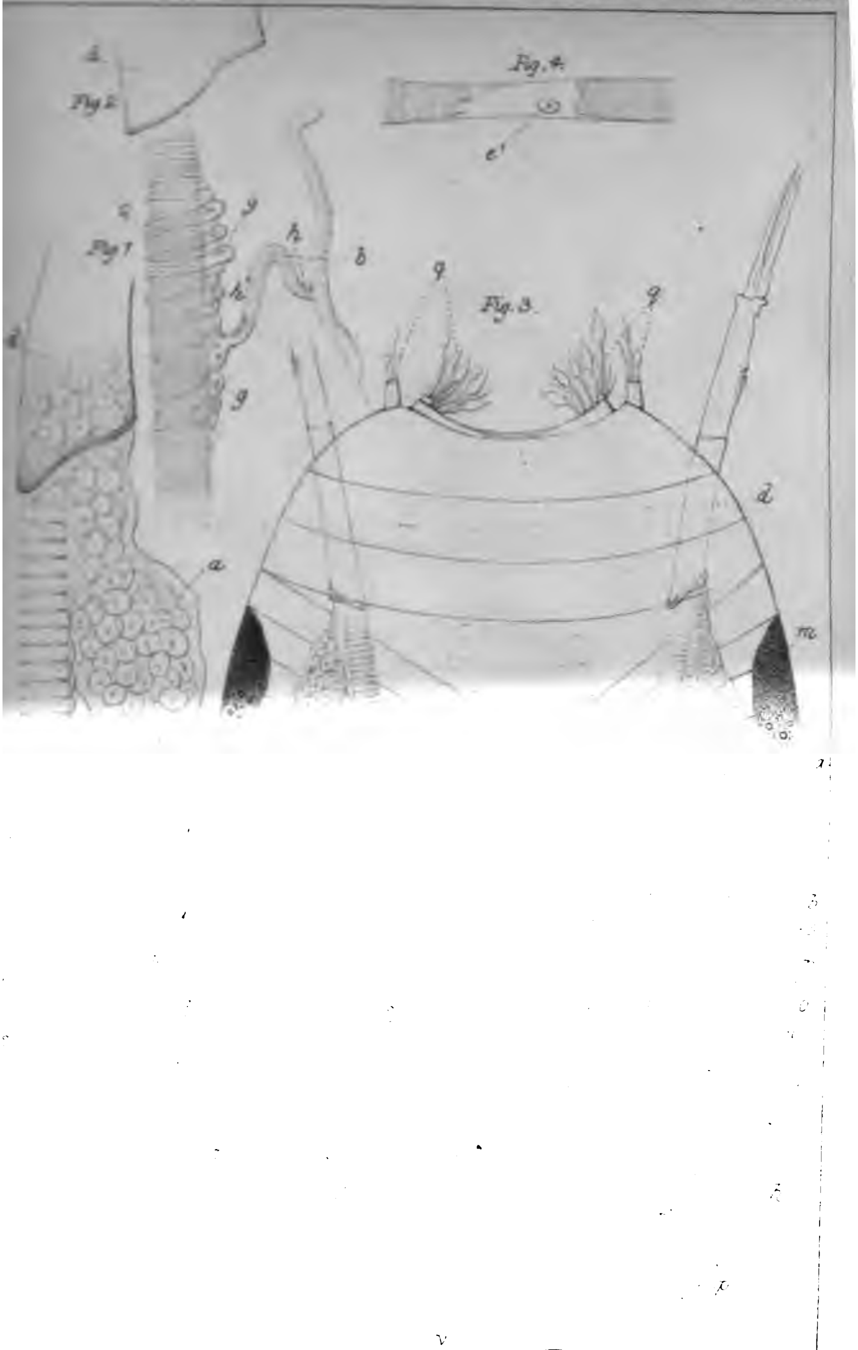
8 and 9.—The two spore-membranes after the contents of the spores have emerged; *a* the outer, *b* the inner membrane.

10 and 12.—The membranes of the four cells formed in germination after the zoospores have left them.

11.—A zoospore emerging from its mother-cell.

13.—A free zoospore.

14 to 19.—Young Œdogonium plants.



Tuffen West sc. West imp.

DESCRIPTION OF PLATE IV,

Illustrating Dr. Moxon's paper on the Peripheral Termination of a Motor Nerve.

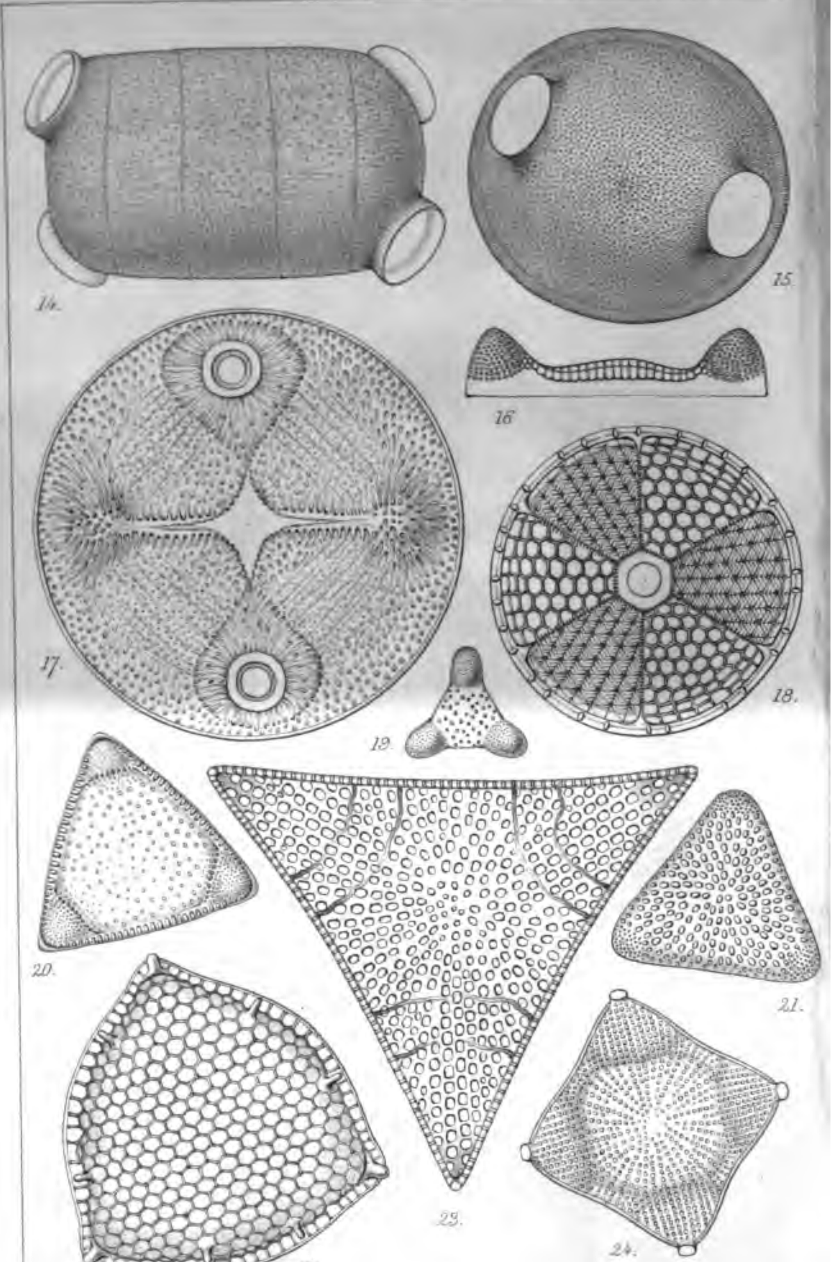
Fig.

1.—Root of antenna, with its nerve, ganglion, and muscle, seen with ⅛th inch object-glass. *a*, ganglion; *b*, motor antennal nerve coming, at *h*, from, *d'*, the sensory antennal nerve; *c*, motor antennal muscle; *d*, root of antenna; *e e*, the nuclei of its sarcolemma; *g g*, apparent nuclei in the space between the edge of the sarcous substance and the sarcolemma; *h h'*, nuclei on motor antennæ nerve.

2.—The same muscle in a state of contraction. Letters as in Fig. 1.

3.—Partial outline drawing of the head of the larva of Culex. Specimen seen from above with ⅓th inch object-glass. Letters as Figs. 1 and 2. *m*, eye; *n*, antennal lobe of encephalon; *o*, optic nerve; *p*, end of dorsal vessel; *q*, part of armature of mouth; s, constrictors of, *r*, pharynx; *v*, œsophagus.

4.—One of the muscles of the trunk, seen with ⅓th inch object-glass. Its sarcous tissue torn; the sarcolemma remaining perfect. *e*, a nucleus upon the sarcolemma.



R.K. Greville del. – on stone by F. Huth. W.H. McFarlane, Lith. Edin.

DESCRIPTION OF PLATES I & II,

Illustrating Dr. Greville's paper on New Diatoms. Series XVIII.

Fig.

1.—*Plagiogramma decussatum*, front view.
2.— „ „ side view.
3.— „ *Barbadense*.
4.—*Mastogonia Actinoptychus*.
5.—*Xanthiopyxis? umbonatus*.
6.—*Coscinodiscus elegans*.
7.— „ *pulchellus*.
8.— „ *robustus*.
9, 10.— „ *oblongus*.
11.—*Brightwellia Johnsoni*.
12.—*Actinoptychus minutus*.
13.—*Eupodiscus minutus*.
14.—*Biddulphia Johnsoniana*, front view.
15.— „ „ valve.
16.— „ *mammosa*, front view of valve.
17.—*Auliscus Hardmanianus*.
18.—*Heliopelta nitida*.
19.—*Triceratium mammosum*.
20.— „ *dulce*.
21.— „ *inelegans*.
22.— „ *Robertsianum*.
23.— „ *Stokesianum*.
24.—*Amphitetras elegans*.

All the figures are × 400 diameters.

DESCRIPTION OF PLATES III & IV,

Illustrating Mr. Jabez Hogg's paper on Vegetable Parasites.

PLATE III.

Fig.

1, *a.*—Second day, specimen from No. 1. Favus-ferment in barley-wort, set aside in a darkened room. Yeast-cells, chiefly ovoid in form, with spores and a few epithelium-scales.

1, *b.*—Fifth day, specimen from No. 1. The yeast-cells more circular in form and larger in size. Spores and torulæ, with bacterium-like bodies in an active state.

1, *c.*—Tenth day, specimen from No. 1. Yeast-cells slightly degenerating, becoming more ovoid; torulæ and bacteria.

2, *a.*—Fifth day, specimen from No. 2, freely exposed to light. Small growth of yeast-cells, with spores and tufts of mycelia, penicillium, and a few large epithelium-scales; bacterium-like bodies not drawn.

2, *b.*—Tenth day, specimen from No. 2. Yeast-cells degenerating and disappearing; spores of mould, mycelia, and bacteria increasing.

3. —Healthy yeast-cells fresh from a porter brewery, drawn rather smaller than they measured.

4. —Portion of a scab taken from a boy suffering from eczema of eyelids and impetigo of scalp, showing spores, moniliform chains, torulæ mycelium, and epithelium-scales.

PLATE IV.

1.—Fresh yeast transferred to a saccharine solution, and showing on the second day a tendency to degenerate.

2.—Degenerated or exhausted yeast taken from the bottom of a porter-vat; cells nearly all void, and torulæ abundant.

3.—Favus-fungus grown in a pure saccharine solution.

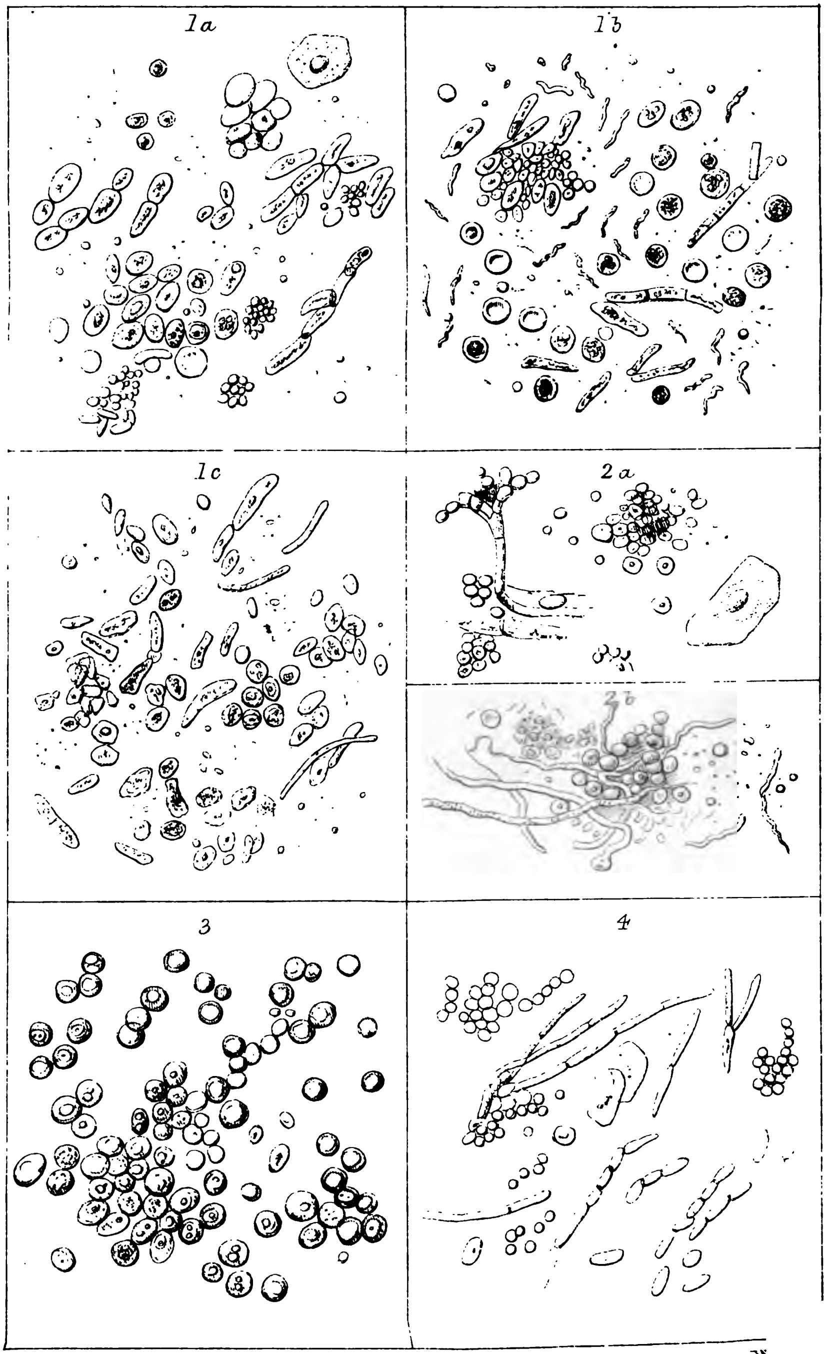
4.—*Aërozoa.* Spores with mycelium, &c., taken in the atmosphere during the cholera visitation of 1858.

5.—Penicillium-spores. Mould growing in saccharine solution.

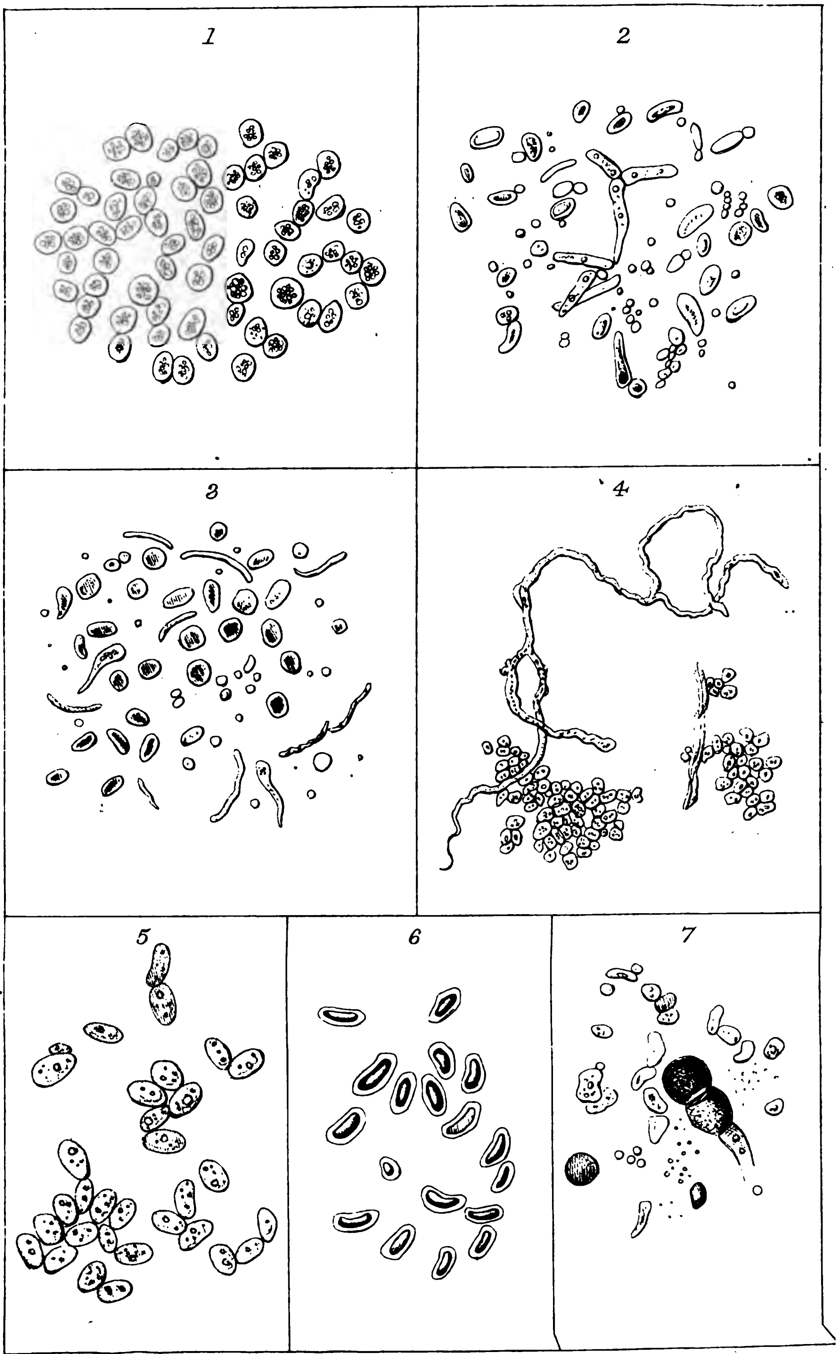
6.—Aspergillus-spores growing in saccharine solution.

7.—Puccinia-spores growing in saccharine solution.

Magnified 400 diameters.

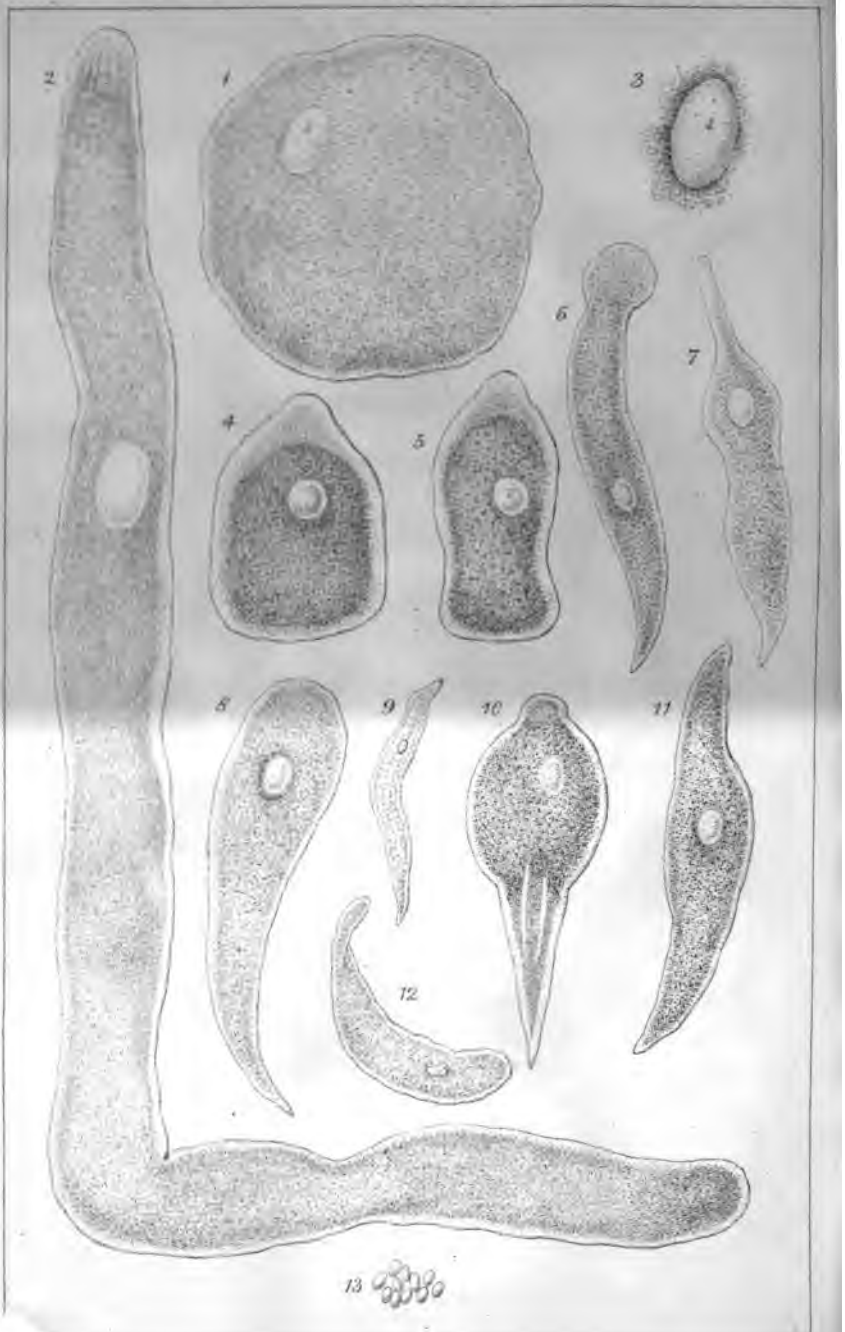


Jabez Hogg del. Tuffen West sc.



Jabez Hogg del. Tuffen West sc.

W. West. r.



Lankester del. Tuffen West sc.   W. West imp.

DESCRIPTION OF PLATE V,

Illustrating E. Ray Lankester's paper on the Gregarinida.

Fig.

1.—An unusually large ***Monocystis Lumbricorum*** of the circular form, from the posterior extremity of the visceral cavity of *L. terrestris*, $\frac{1}{25}$th inch in diameter.

2.—An unusually large *M. Lumbricorum* of the elongated or linear form, from the seminal vesicle of a specimen of *L. terrestris*, in which all the genitalia were occupied by such forms, $\frac{1}{5}$th of an inch in length.

3.—Nucleus or vesicle of the individual drawn in fig. 1.

4, 5.—*Monocystis pellucida*, Kölliker, adult specimens, which are not *pellucid*, showing the extensive development and apparent fibrillation of the sarcodic envelope.

6, 7.—Forms of Monocystis (*M. Nemertis*, Köll.?) met with abundantly in *Ommatoplea* and *Convoluta* and once in *Aphrodita hystrix*.

8.—*Monocystis Cirrhatuli*, n. sp., a large form abundant in the perivisceral cavity of *C. borealis*.

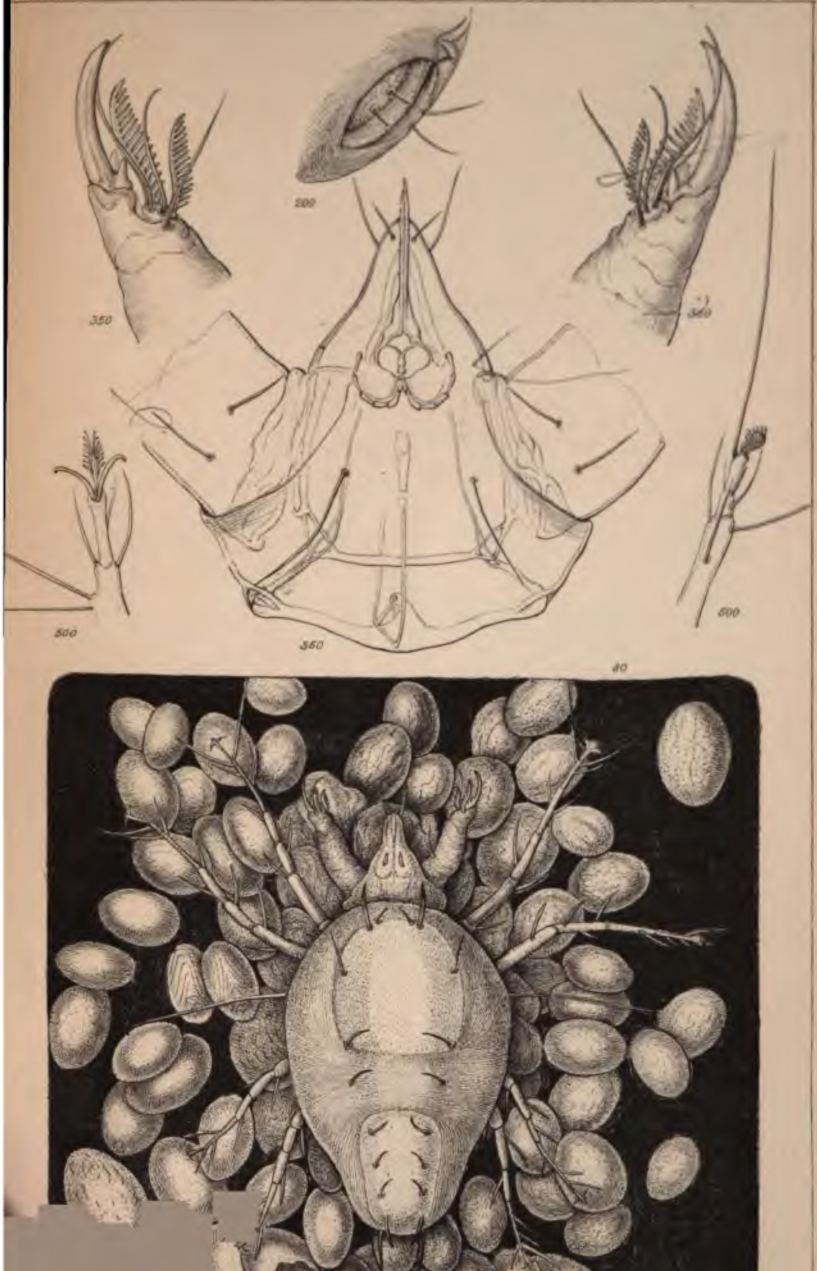
9.—Young individual of *M. Cirrhatuli*.

10.—*Monocystis Eunicæ*, n.sp., from intestine of *E. Harassii*.

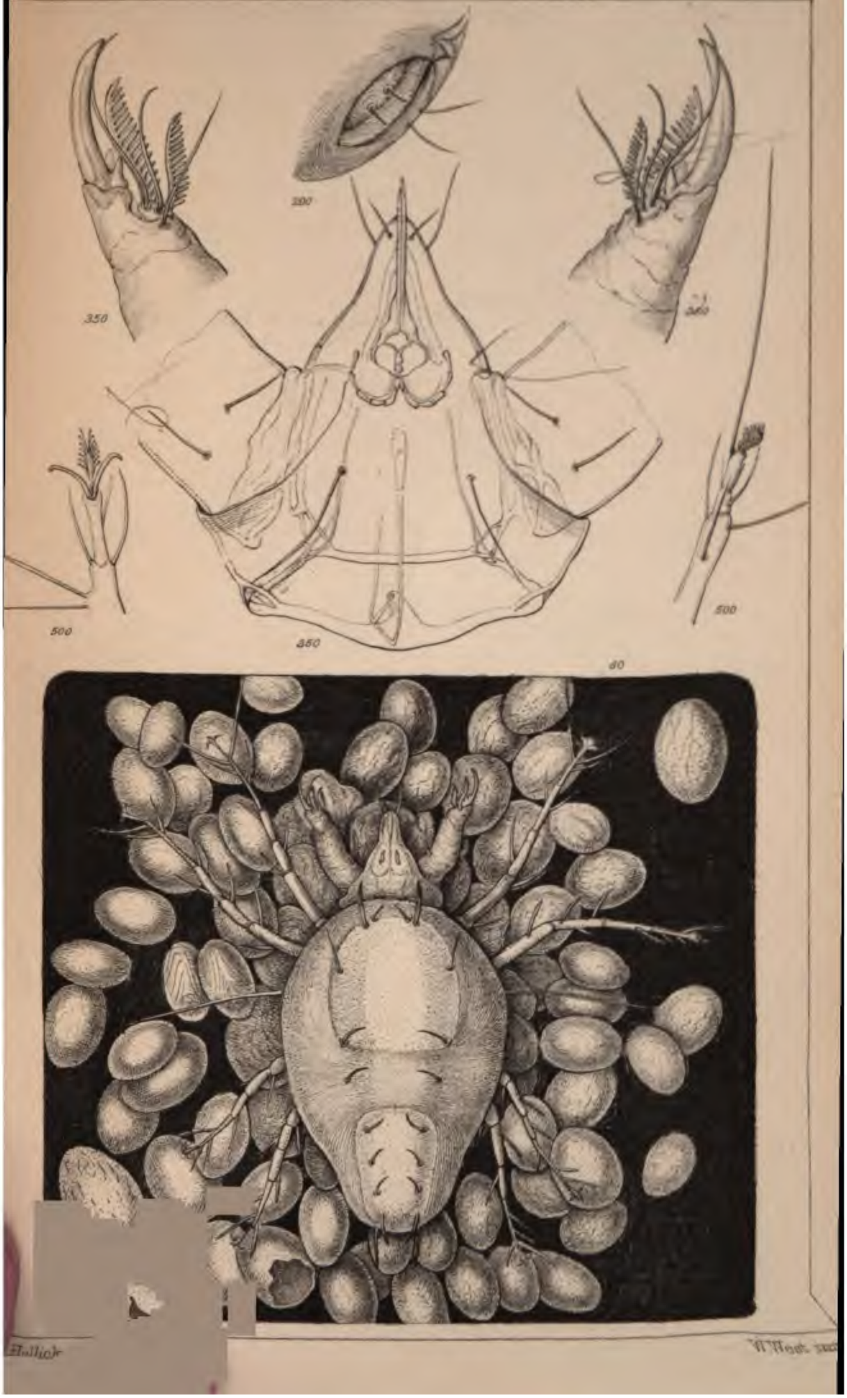
11.—*Monocystis Terebellæ*, Kölliker, from *Terebella nebulosa*.

12.—*Monocystis Phyllodocæ*, a form differing considerably from that described by Claparéde.

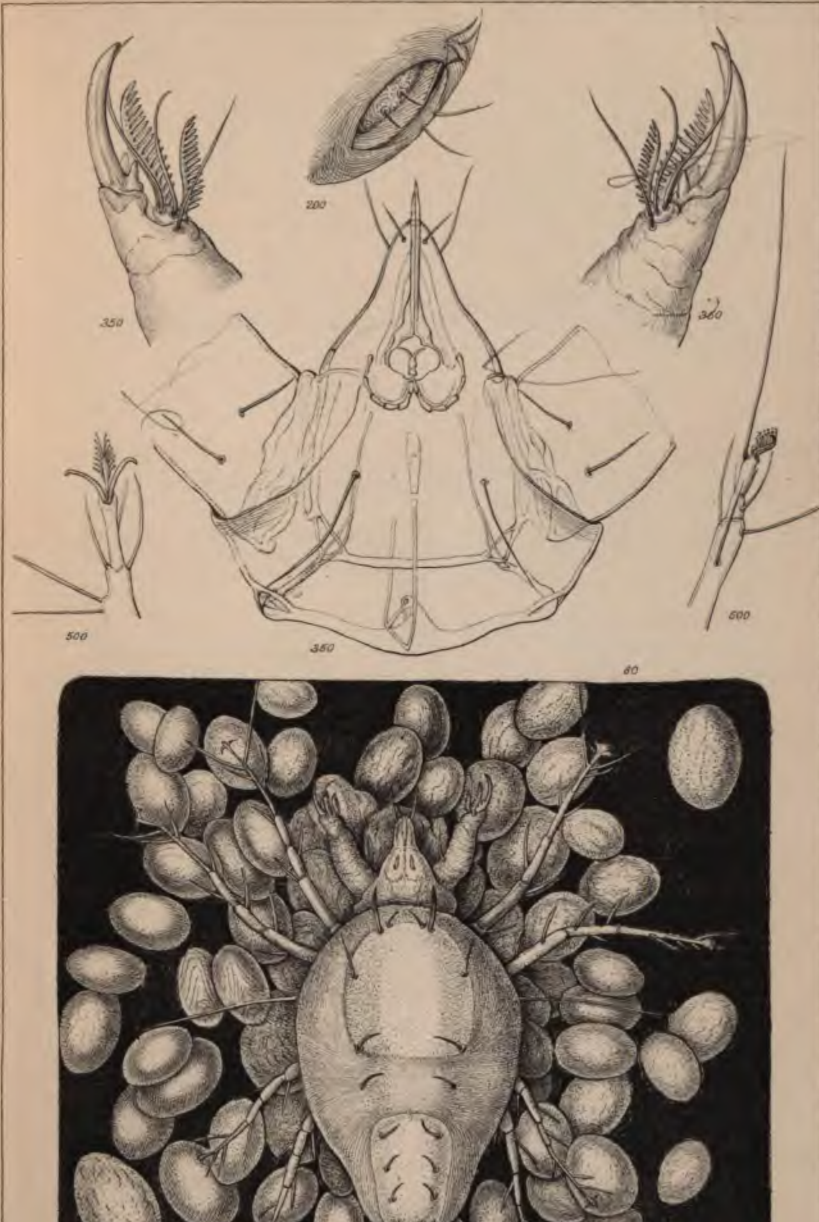
13.—Somatic granules from *M. Lumbricorum*.



W. West



Hullick W. West sc.



A. T. Hollick del. Tuffen West sc.

W. West

DESCRIPTION OF PLATE VI.

Illustrating Mr. Richard Beck's paper on an Acarus and its Agamic Reproduction.

In the lower part of the plate is shown the position usually taken by this Acarus after arriving at maturity, viz., that of standing over and guarding a large number of eggs. The shells of those eggs already hatched refract a most brilliant blue, and the presence of the parent is often detected by the eye catching this colour.

In the upper part of the plate are shown the falces, with their fangs and combs, and between them the piercers and sucking apparatus of the mouth.

The two small diagrams at the side represent the extremities of two feet, each provided with two claws, two rows of tenent hairs, and one of them having an unusually long terminal hair.

The figure at the very top represents the anus.

DESCRIPTION OF PLATE VII.

Illustrating Mr. Tuffen West's paper on the Egg of Scatophaga and on the Cast Skin of an Ephemeron.

Figs. 1 to 7 represent the structure of the Egg of Scatophaga.

Fig.

1.—Ventral aspect.

2.—Lateral aspect.

3.—The opening on side view; *p*, the delicate pellicle investing the young larva.

4.—Portion of the egg-case, about the middle, showing its reticulate and elevato-punctate structure.

5.—Part of tip of one of the divergent appendages, to show the minute punctation on its surface.

6.—Part of the dark portion of the cover, with its 4-5 angular reticulation and translucent spots.

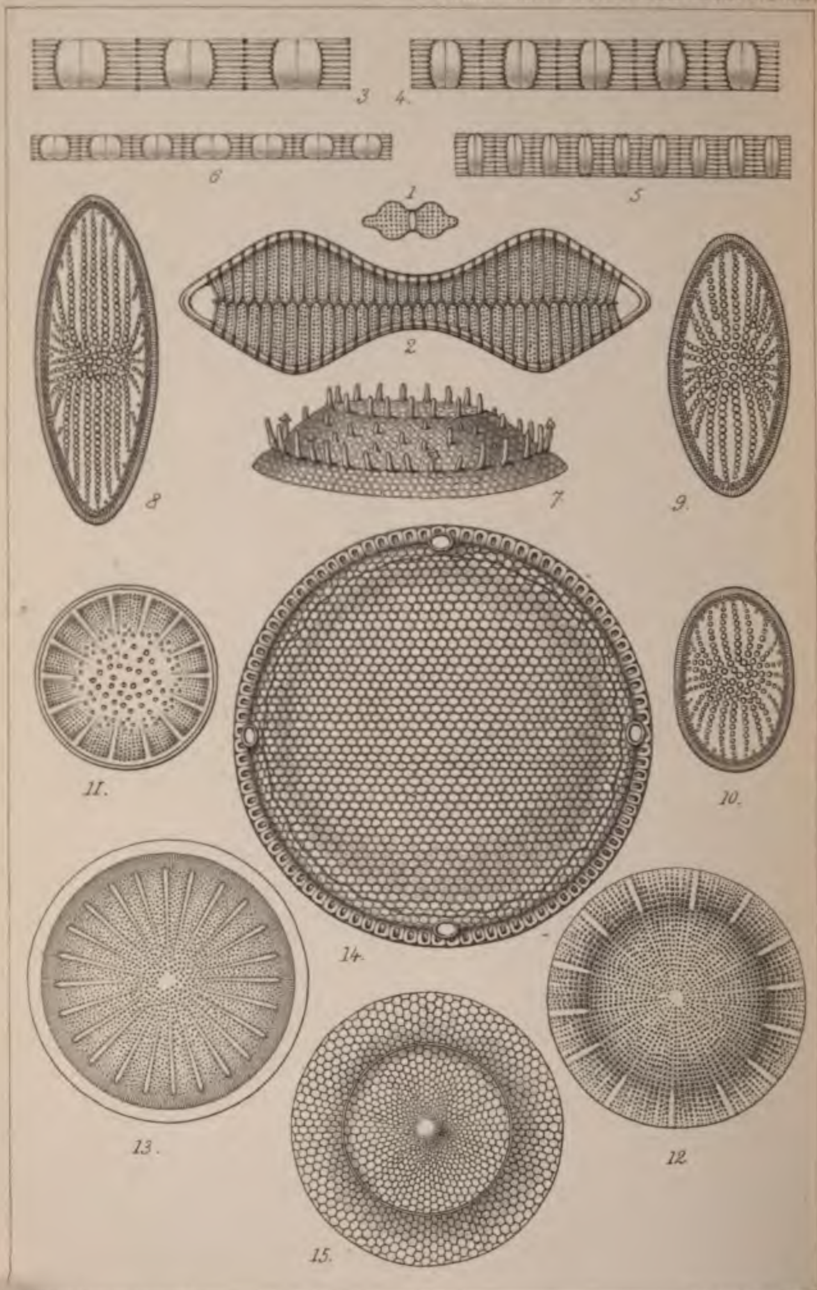
Figs. 8 to 11 illustrate the Notes on Cast Skin of an Ephemeron.

8.—Cast skin entire, except the ends of the tails; *p. x.*, pro-thorax *m. s.*, mesothorax; *m. t.*, metathorax; *a. p.*, alar pellicle, &c.

9.—Exuviæ of head, under surface; *a a*, antennæ; *e e*, *pe*, *pe*, eyes *tr*, *tr*, tracheæ.

10.—Profile view of head of an allied species; this is added as explanatory of the preceding figure; similar letters apply to it, with the addition of *o*, one of the ocelli. The grotesque appearance imparted by the upper pair of eyes, borne aloft on stout columns, is well seen.

11.—End of foot, consisting of a recurved, sharply-pointed claw, attached to the side of a pedicellate oval pulvillus. The cast skin figured, when placed on a square of thin covering-glass, adhered sufficiently to bear removal upside down from the spot where it was obtained to a distant apartment.



Greville, del. on stone by F. Hutt.   W. H. McFarlane Lith. Edin.

DESCRIPTION OF PLATES VIII & IX,

Illustrating Dr. Greville's paper on New Diatoms. Series XIX.

Fig.
1.—*Plagiogramma orientale.*
2.—*Gephyria constricta*, valve.
3—6.—*Melosira costata.*
7.—*Cresswellia rudis.*
8—10.—*Coscinodiscus Lewisianus.*
11.— „ *Normanianus.*
12.— „ *Barbadensis.*
13.— „ *elegans.*
14.—*Eupodiscus Hardmanianus.*
15.—*Croispedodiscus umbonatus.*
16.—*Biddulphia Chinensis.*
17.— „ *podagrosa.*
18.—*Triceratium repletum.*
19.— „ *picturatum.*
20.— „ *lautum.*
21.— „ *quinquelobatum.*
22—28.—*Syringidium Dæmon.*
29.—*Navicula spectatissima.*
30, 31.—*Stauroneis rotundata.*
32.— „ *scaphulæformis.*

All the figures × 400 diameters, except fig. 16, which is × 200.

DESCRIPTION OF PLATE X,

Illustrating Dr. Bastian's paper on Pacchionian Bodies.

Fig.

1.—Different forms of Pacchionian bodies seen on surface of arachnoid.

2.—Appearance of epithelial covering of Pacchionian body.

3.—Tesselated epithelial cells from surface of pericardium.

4.—Solitary cells of same kind from Pacchionian body.

5.—Homogeneous, structureless network of tissue from surface of same body.

a. Spiral elastic tissue.

6. More highly developed tissue of same kind, presenting slight traces of fibrillation.

7. Interlacing bundles of fibrous tissue fully developed from more mature Pacchionian body.

8. Ordinary fibrous tissue from surface of mature body.

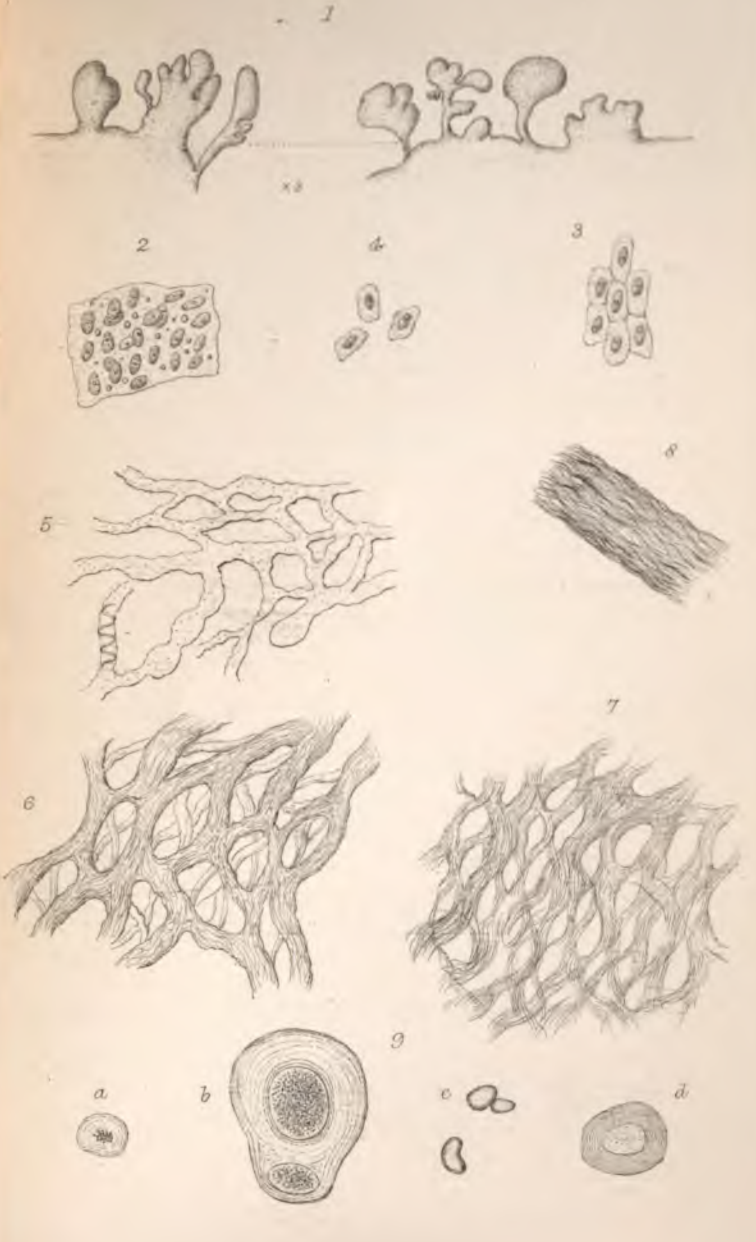
9. Different forms of calcareous deposit.

a. Granules with concentrically arranged tissue developing around them.

b. Body of same kind, only larger and more mature.

c. Simple, highly refractive, calcareous nodules.

d. A much larger one, showing concentric markings.



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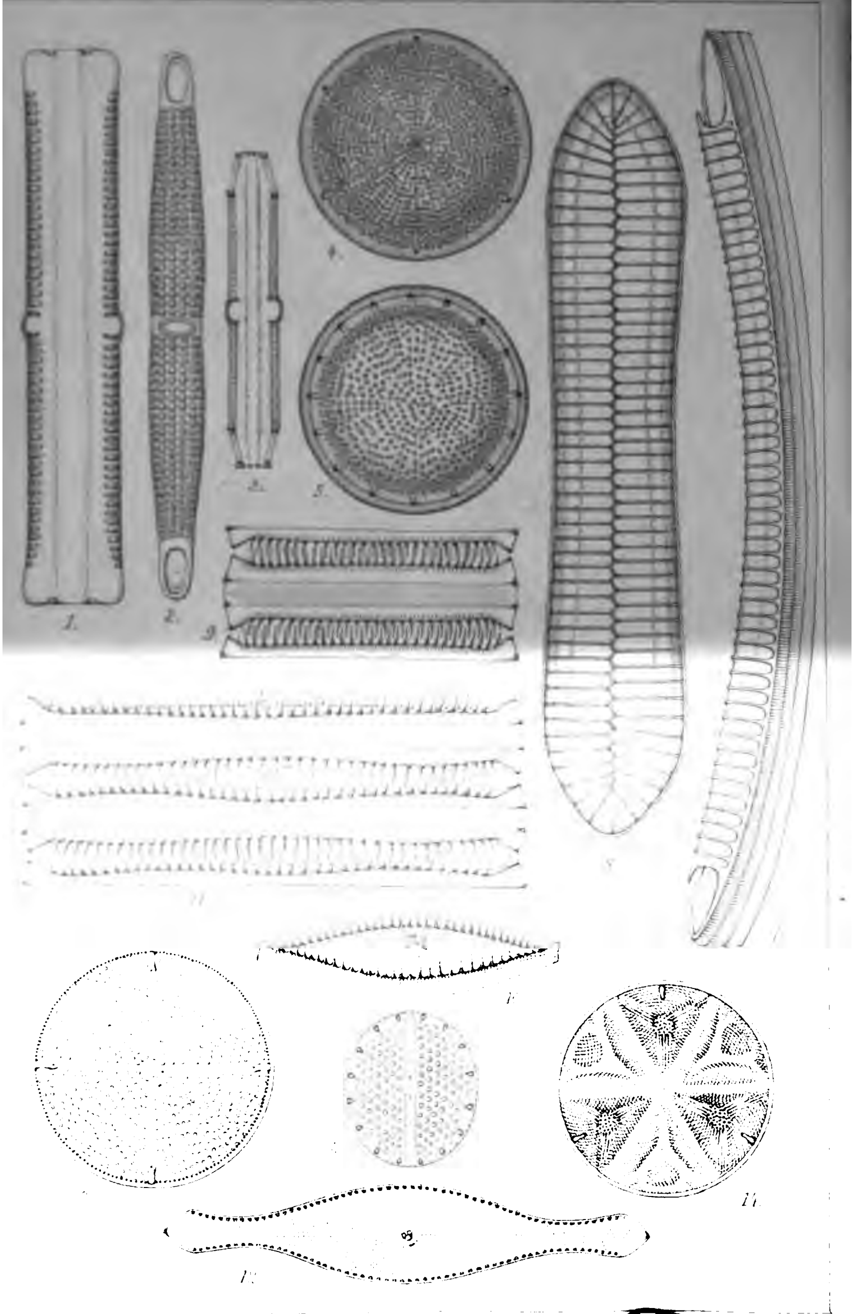

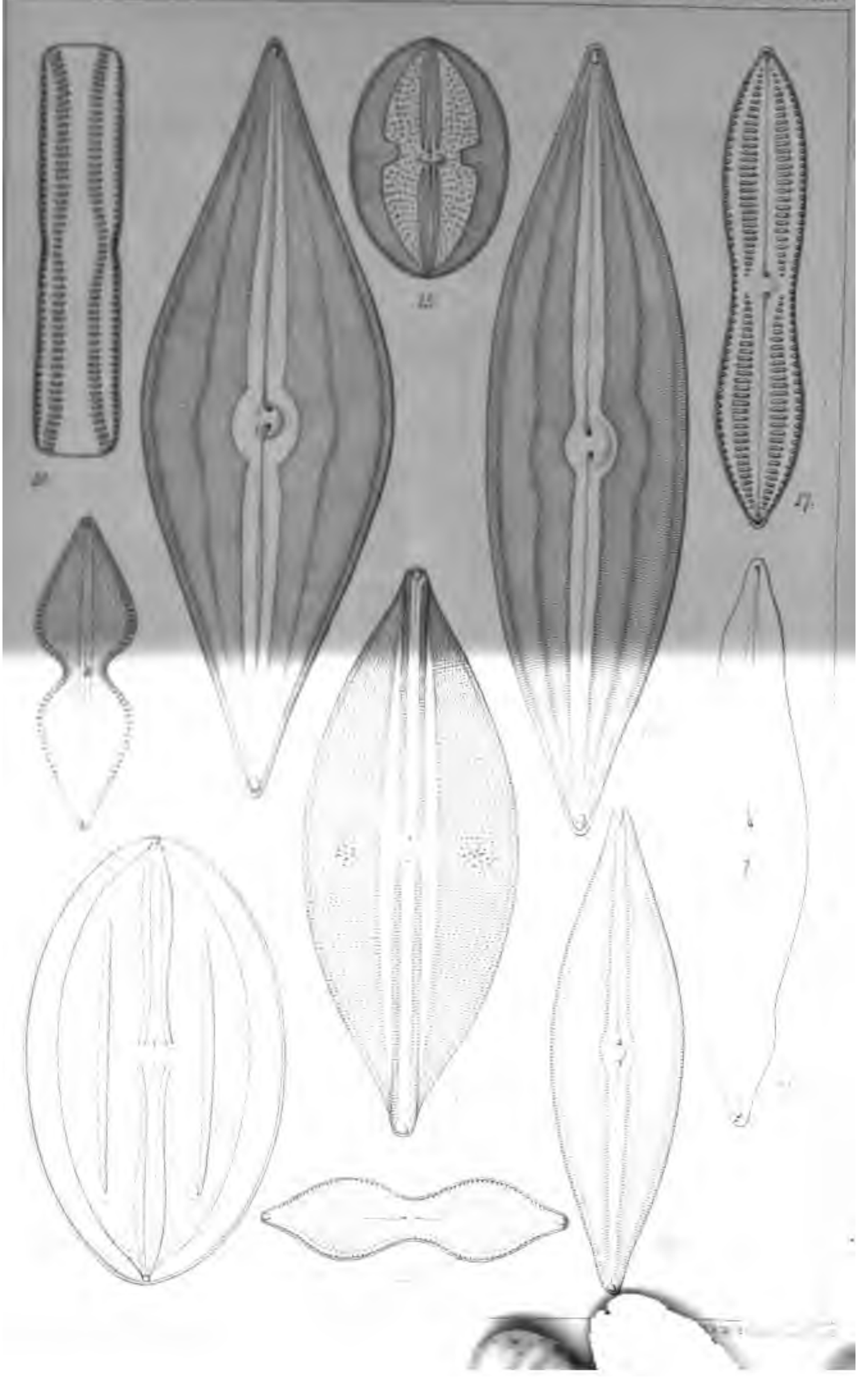

DESCRIPTION OF PLATES XI & XII,

Illustrating Dr. Greville's paper on New Diatoms. Series XX.

Fig.

1.—*Plagiogramma elongatum*, front view.
2.— „ „ valve.
3.— „ *angulatum*, front view.
4.—*Cestodiscus Stokesianus.*
5.— „ *pulchellus.*
6.—*Aulacodiscus sparsus.*
7.—*Gephyria gigantea*, lower valve, front view.
8.— „ „ valve, side view.
9.—*Rutilaria elliptica*, front view.
10.— „ „ valve.
11.— „ *superba*, front view.
12.— „ „ valve, side view.
13.—*Cocconeis armata.*
14.—*Omphalopelta Moronensis.*
15.—*Navicula excavata.*
16.— „ *Egyptiaca*, front view.
17.— „ „ side view.
18, 19.— „ *permagna*, very large, from Berbice.
20.— „ „ small var., from Berbice.
21.— „ „ var. from Delaware River, U.S. (outline of Dr. Lewis's figure).
22.— „ *Zanzibarica.*
23.— „ *Jamaicensis.*
24.— „ *strangulata.*
25.— „ *rimosa.*

All the figures are × 400 diameters.