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TRANSACTIONS

OF THE

MICROSCOPICAL SOCIETY

OF

LONDON.

NEW SERIES.

VOLUME IX.

LONDON:
JOHN CHURCHILL, NEW BURLINGTON STREET.
1861.

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TRANSACTIONS.

On the Self-division *of* Micrasterias denticulata. By Mr. Lobb.

(Read October 10th, 1860.)

In the month of April last, Dr. Millar, Mr. Mummery, and myself, went out collecting in Epping Forest, near High Beech, where the Doctor has a residence; and he being well acquainted with the localities, we soon filled our bottles with *Volvox globator, Volvox aureus, Actinophrys sol* and *viridis,* Difflugia, Floscularia, Diatomaceæ, Desmidiaceæ, &c. And I may here take the opportunity of saying, that I know of no place so prolific in microscopic gatherings as Epping Forest, which exceeds even the noted bog at Fisher's Castle, Tunbridge Wells. On examining, the next morning, the Desmidiaceæ, I was favoured with a beautiful view, from commencement to termination, of the self-division of *Micrasterias denticulata,* occupying altogether three hours and a half; the result was to make me feel that Mr. Ralfs is wrong in the figure he gives of the same in his highly valuable work on the British Desmidiaceæ (fig. 1, pl. 7). So humble an individual as myself may well pause on differing from so high an authority, but in this instance I am compelled to do so, and am happy to say that I am not alone in so doing, Mr. Tomkins and Dr. Millar having both witnessed the same, and both of them perfectly agree with me. Mr. Tomkins saw it first, myself next, and lastly Dr. Millar.

The self-division commences by the exudation of a small, perfectly hyaline, membranaceous globule from each half-frustule; very soon a small portion of granular endochrome is seen issuing forth into the globules from the original half-frustules. (See Pl. I, fig. 1.)

The next stage exhibits the globules dividing into three lobes, the endochrome increasing in quantity, sometimes gradually extending itself as in fig. 2, and sometimes entering, as it were, in two streams from the thickened sides of the end lobes of the parent half-frustules, as in fig. 3.

In the next stage the three lobes divide into five; the end lobe remaining unaltered in figure, and only increased in size. (See fig. 4.)

This is followed by the incision of the central and basal lobes, and the central lobes being considerably larger than the basal the whole assumes somewhat the appearance of being composed of seven lobes. (See fig. 5.)

After this a further incision of the central and basal lobes takes place (see fig. 6); then the sinuation of the end lobes, and the denticulation of the whole completes the division (see fig. 7); then separation follows.

In each stage the endochrome increases, but never extends throughout; the hyaline portion becomes less, the frustule is gradually filled, and when self-division is completed, there still remains a perfectly hyaline portion all round the cell.

The figure in Mr. Ralfs's work represents the first exudation from the parent frustules as very large, and filled with a light colouring matter of the same density throughout, leaving no portion hyaline. There is no division into lobes, no incision, no denticulation, no granular endochrome; and all these are so natural, and so perfectly in keeping with the parent frustules, that I do feel justified in differing even from so high an authority, and am compelled to say, that if ever such a self-division was witnessed, it must have been an abnormal one. Having seen many frustules in the course of self-division, and on different occasions, I can with confidence assert, that I have never seen any deviation from the method now described: there is a slight variation in the spreading of the endochrome, which, it should be observed, is always granular.

The self-division only requires to be witnessed, to show that what I have stated is correct; and, should any one observe the phenomenon from its commencement to its close, as I have done, he will, with me, assert that a more beautiful object can hardly be seen even by a microscopist.

There was one object which struck me very forcibly, on looking over the gatherings from Epping Forest, and which I have endeavoured to figure, magnified only seventy-five diameters. It differs, in several respects, from *Actinophrys sol,* though there is some resemblance, both in its circular figure and in the rays that issue from the disc; the central disc is perfectly hyaline, excepting the cell-walls, the cells of the inner disc being larger than the cells (if I may so term them) of the outer disc. It may, or it may not, be new, but I have never seen it figured.

On a Portable Field *or* Clinical Microscope.

By Lionel S. Beale, M.B., F.R.S., &c.

(Read December 10th, 1860.)

This instrument was originally designed for microscopical investigation in connection with medicine, but it has been found applicable to microscopical inquiry generally. Its simplicity and cheapness strongly recommend it for the purposes of teaching. Like some other instruments which have from time to time been proposed, it is composed of draw-tubes like a telescope; but the arrangement of the stage, and the plan adopted for moving the slide, when different parts of the objects are submitted to examination, differ entirely, as far as the author is aware, from those usually adopted. The instrument consists of three tubes, *a, b, c*; *a* carries the eye-piece, is four and a half inches long, and slides in *b*, which is of the same length, but only slides up to its centre in the outer tube *c*. Tube *b* carries the object-glass. There is a bolt on tube *c*, which can be fixed by aid of a rack and tooth, at any height, according to the focal length of the object-glass. This arrangement prevents the risk of the object-glass being forced through the preparation while being focussed. At the lower part of the body is a screw clamp for fixing the preparation in any particular position, and an aperture for throwing the light on opaque objects. The preparation is kept in contact with the flat surface below by a spring, which allows the requisite movements to be made with the hand.

That part of the object which it is desired to examine can easily be placed opposite the object-glass, if the instrument is inverted. Next, the focus is obtained by a screwing movement of the tube *b*; and if it be desired to examine any other parts of the object, this is easily effected by moving the slide with one hand, while the instrument is firmly grasped by the other. Delicate focussing is effected by drawing the tube *a* up and down. By this movement the distance between the eye-piece and object-glass is altered.

Any object-glass may be used with this instrument. I have adopted various powers, from a *three-inch,* magnifying *fifteen diametres,* to a *twelfth,* magnifying *seven hundred* diameters.

In the examination of transparent objects ordinary daylight, or the direct light of a lamp, may be used; or, if more convenient, the light may be reflected from a sheet of white paper, or from a small mirror inclined at the proper angle, and placed on the table.

In examining objects by reflected light, sufficient illumination is obtained from an ordinary wax candle placed at a short distance from the aperture, just above the object. But the most beautiful effects are obtained by using the Lieberkuhn with direct light.

The slide, as has been stated, is kept in contact with the lower part of the instrument, which I have called the stage, by a spring which is therefore made to press on the *back of the slide*. On the other side of the stage the little screw and clamp are placed so that the specimen may be fixed in any position that may be desired.

In using this microscope the slide with the object to be examined is placed upon the stage, the thin glass being upwards towards the object-glass, while the spring is made to press upon the *under* surface of the slide. The little screw is removed. The slide may now be moved in every position, and any particular object to be examined can readily be placed exactly under the object-glass. Tube *a* is withdrawn about two thirds of its length. The tube *c* being firmly held with the left-hand, *b* is grasped with the right, and with a screwing motion the object-glass is brought to its proper focus. The specimen having been fixed with the little clamp, and the bolt arranged at the right height, the instrument may be passed round a class. This microscope seems to be well suited to field-work and botanical purposes. It is not heavy, and, including the powers and an animalcule cage, will easily pack into a tube or case six and a half inches long and two inches in diameter. I constantly use it in clinical teaching. Urinary deposits, specimens of sputum, &c., may be examined by the patient's bedside, and their characters demonstrated to the class. Lately, I have fitted the instrument to a little stand, on which a light has been placed in a suitable position, and the whole has been passed round in class, while the characters of the object shown were being described. When the arrangements are perfected, I believe this form of instrument will be found very valuable for demonstrating the microscopical characters of objects to a large number of persons assembled in classes.

The instrument can be seen at Mr. Matthews', Portugal Street, Lincoln's Inn.

On some Undescribed Species *of* Diatomaceæ.

By George Norman, Esq., of Hull.

(Read November 14th, 1860.)

(Communicated by F. C. S. Roper, F.L.S., F.G S., &c.)

In purposing to give, in this and future short papers, figures and descriptions of new forms of Diatomaceæ from my cabinet, I trust that no apology is needed, but rather, by so doing, to be of service to diatomists.

As a general rule, it may not be deemed advisable to describe a new form from scanty materials, or from single specimens; but when a form occurs that cannot easily be confounded with any described species, the sooner it is made known the better, in order that others may have their attention drawn to it.

I gladly make use of this opportunity to call the attention of those who have facilities for obtaining from their correspondents in Australia, the Pacific Islands, West Indies, &c., the alimentary matter of Ascidians and other molluscs. It will be seen that some of the forms described in this paper are from an Ascidian gathering from the west coast of Australia.

For this gathering I am indebted to the kindness of Dr. J. D. Macdonald, of H.M. Surveying Ship Herald. The great bulk of non-diatomaceous matter in this gathering being calcareous, it was readily cleaned by means of acid; and turned out to be by far the richest in new and undescribed forms of any gathering I have had an opportunity of examining.

Among the beautiful forms, are such as *Navicula bullata, Campylodiscus diplostictus,* &c.; there are a great many which I am unable to refer to any existing genera.

The stomach-contents of the larger Mollusca, such as *Strombus* and *Tridacna,* would, doubtless, be found to be mainly diatomaceous in their nature.

Even land molluscs seem to derive part of their nutrition from the endochrome contained between the siliceous valves of Diatomaceæ, for on recently examining the fæcal matter of our common garden-snail, *Helix aspersa,* I noticed, among other forms, a good many valves of *Nitzschia Amphioxys,* a species which Ehrenberg has found in a great number of samples of soil from various parts of the world, and which seems to have a wider geographical range than any other species that I am acquainted with.

Again, the tadpole of the common Frog seems to be almost exclusively diatominivorous in the selection of its food. I lately examined the stomach-contents of some specimens which had been kept for a few weeks in a small glass tank, when the mass was found to consist of fully sixty per cent. of Diatomaceæ.

These circumstances are mentioned here merely for the purpose of attracting the attention of those who have the opportunity of studying the subject more fully. It is also quite possible that such investigations may tend to clear up the yet, I believe, disputed point, as to the vegetable or animal nature of these beautiful organisms.

1. *Astrolampra Stella*, n. sp., Norm. (Plate II, fig. 1).—Valve of six rays; rays club-formed in the centre and gradually becoming linear towards the margin. Outer edge of disc divided into twelve punctate divisions.

Habitat.—Sierra Leone, in a gathering kindly communicated by Mr. F. Kitton, of Norwich.

This remarkable disc, I place, provisionally, in *Astrolampra*, its structure having little in common with that genus. The unsymmetrical appearance may be, and in all probability, is owing to my specimen being a double valve, for in the centre is seen a series of six indistinct rays, which I have endeavoured to give in the drawing.

Altogether it is a remarkable form, and, probably, ought to constitute a new genus.

By giving it a place in this paper, I hope to call the attention of those who have correspondents at Sierra Leone, to urge them to send material from the coast in that locality.

2. *Surirella Baldjikii*, n. sp., Norm. (Fig. 2).—Valve panduriform, canaliculi conspicuous, widening out towards the margin, absent in constricted portion. Centre of valve a smooth cruciform space; the transverse limb being broader than the longitudinal one, and approaching the margin of the valve at its constricted part. Margin of valve striated; striæ 40 in ·001″·

Marine, in a deposit from Baldjik, near Varna.

This deposit is full of beautiful and interesting forms, many of which are new and undescribed. The piece of earthy deposit I picked out of a cargo of bones discharging in the docks. The captain of the vessel informed me that the cliffs about Baldjik are wholly composed of this white-coloured earth.

It will be worth while obtaining a larger supply of this material, which is the same that yielded the beautiful little form which Mr. Brightwell has described as *Odontidium Baldjikii.*

3. *Coscinodiscus fuscus,* n. sp., Norm. (Fig. 3).—Valve convex, depressed in centre; granules arranged in radiating lines, diminishing in number at intervals, thus forming distinct zones. Granules 20 in ·001″; diameter of valve ·0043″ to ·0067″.

Marine, stomach of Ascidians, North Sea.

Valve, under a low power, opaque, brownish black, lighter in centre, where it is green. At first sight it reminds one of *Eupodiscus Ralfsii;* but the colour is much darker, the granules much smaller, and more crowded together. In this respect it appears to be half way between *E. Ralfsii* and a disc which I found in considerable quantities on bones from Constantinople, and which has been doubtfully referred to *Eupodiscus subtilis.*

The want of anything like a marginal nodule in the species now described, relieves me of any uncertainty as to its proper generic position; hence I refer it, without hesitation, to *Coscinodiscus.* Hitherto it has occurred only in one or two ascidian gatherings, and then only sparsely.

4. *Nitzschia vitrea,* n. sp., Norm. (Fig. 4).—Frustule hyaline, broadly-linear, extremities truncated; valve linear-lanceolate, slightly constricted in centre, and somewhat produced at the ends; puncta conspicuous, bead-like. Striæ very obscure, 58 in ·001″. Length of frustule ·0025″ to ·0055″.

In brackish water, Hull.

It is not often that one has the good fortune to detect a new British form. The present one, however, cannot be referred to any of the species given in Smith's 'Synopsis.'

The only locality that has hitherto yielded it is a small ditch of water influenced by high spring tides. The same locality furnishes *Nitzschia Brébissonii, vivax,* and *bilobata.*

5. *Aulacodiscus Sollittianus,* n. sp., Norm. (Fig. 6).—Disc large, colourless, processes very prominent (about six), submarginal. Granules in radiating lines, 9 in ·001″, absent in centre valve and around base of processes.

In a deposit from Nottingham, Maryland.

Diameter of valve ·009″; processes large, and, under a low power, appearing as if they had rings attached to them.

This fine species I have great pleasure in dedicating to Mr. J. D. Sollitt, whose long services with the microscope, conjointly with Mr. Robert Harrison, have, I think, been insufficiently recognised.

Unfortunately it is very scarce in the small quantity of the deposit I have hitherto worked upon. I expect soon to have a large quantity of the material, when it is to be hoped that it may prove more abundant. The blank centre, large size, and unusual distance from the margin of the nodules, together with the large blank spaces around the same, render this a well-marked species.

Judging from the occurrence, in abundance, of the various species of *Heliopelta* in this deposit, together with *Eupodiscus Rogersii, Craspedodiscus elegans, Aulacodiscus Crux, Sceptroneis caduceus, Triceratium solenoceros, condecorum, undulatum,* and *acutum,* there can be little doubt that it is identical with the Bermuda earth of Professor Bailey, the locality of which has hitherto remained in much doubt. For the small quantity received I am indebted to Messrs. Sullivant and Wormley, of Columbus, Ohio. The deposit was discovered, I believe, by Dr. Johnson, of Baltimore, near Nottingham, in Maryland, not far from the Patuxent River, and within a moderate distance of Piscataway, where the well-known rich deposit occurs.

Bermuda Hundred, on the James River, in Virginia, is distant about a hundred miles from Nottingham, but as all the waters of this district find their way into the great Chesapeake Bay, it is quite possible that the locality suggested by Dr. Arnott may have furnished the sample of Bermuda earth originally sent to this country by Dr. Bailey. I understand, however, from Messrs. Sullivant and Wormley, that Dr. Johnson had examined the country at Bermuda Hundred without finding any deposit whatever. When the larger supply of the Nottingham material arrives, I shall be glad to supply my friends with a portion.

6. *Eupodiscus ovalis,* n. sp., Norm. (Fig. 7).—Valve elliptical, nodule single, submarginal; granules arranged in radiating lines, crowded near the margin, sparser towards the centre. Colour, tawny brown. Length of valve ·0020″ to ·0035.″

Marine, stomach of Ascidians, Shark Bay, Australia.

This species approaches *Eupodiscus fulvus,* differing, however, in the elliptical shape, altered position of the nodule, which in the latter is nearer the margin, and also in the arrangement of the granules, the disc being divided into regular segments by the longest lines of granules.

7. *Navicula bullata,* n. sp., Norm. (Fig. 6).—Valve elliptical, extremities slightly produced. Striæ in a marginal and two central bands; marginal bands of unequal width. The smooth space between the striated bands studded with a line of circular bosses. Striæ moniliform, 14 in ·001″. Length of valve ·0065″; breadth ·0030″.

Hab.—Stomach of Ascidians, Shark Bay, western coast of Australia; kindly communicated by Dr. Macdonald.

This singularly beautiful form is exceedingly rare in the above-mentioned gathering. It belongs unquestionably to the group of forms of which *Nav. lyra* is the type. The remarkable row of bosses on the smooth bands renders it distinct from any known species.

It may be remarked that, in describing the structure of *Coscinodiscus fuscus* and *Aulacodiscus Sollittianus*, I have designated the markings on the valves "granules," instead of adopting the usual method of calling them areolæ, or cells. Hitherto, I believe, most authors have adopted the latter designation in describing the various species of *Coscinodiscus*, *Aulacodiscus*, *Eupodiscus*, &c., and have, by so doing, in my opinion, overlooked the real nature of the construction.

Dr. Wallich has done good service in pointing out the true structure of the markings of *Pleurosigma*, and I feel convinced that all the above-mentioned discs are constructed on the same plan, differing only in the form of the elevations or granules, and their arrangement on the surface of the valve. In *Pleurosigma* the markings are four-sided elevations; while in *Coscinodiscus*, *Eupodiscus*, &c., they are circular when not crowded, but assuming the irregular or hexagonal form when pressing on each other. The same structure appears to exist in *Biddulphia*, *Isthmia*, &c., and probably in all diatoms, not even excepting *Triceratium favus*, the raised portions of silex only differing in form.

On examining a valve of *Coscinodiscus gigas*, or *lineatus*, for instance, with a good one fourth or one twelfth, we find the colour of the valve, in the interstices between the granules, to be pink, whereas the granules themselves are white, or colourless.

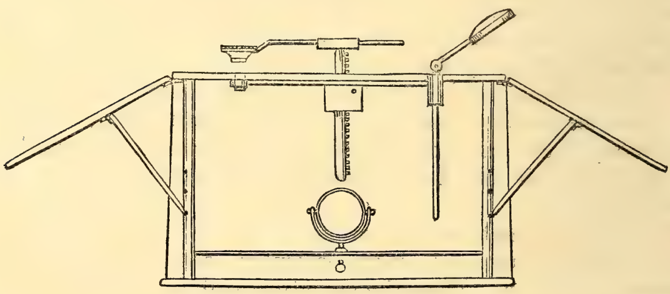
The true structure, however, is better seen in valves where the granules are more circular, and not so much crowded together. Here the structure will be apparent at a glance.

On a Dissecting Microscope, &c.
By James Smith.

(Read November 14th, 1860.)

This microscope, the general design of which I hope, with the assistance of the accompanying drawings, to make sufficiently plain, I consider to be a modification of the one known as Slack's Dissecting Microscope, and which is figured and described in Quekett's 'Practical Treatise.' It may be as well to state in the first instance, that the chief novelty in the construction of my instrument, is the method of fixing on the hand-rests to the stage, by means of hinges—and in such a manner that, when not in use, they fold down at the sides—thus giving the advantage of fixed rests, available in a moment, while, at the same time, the microscope, when they are let down, is not larger than it would be if they were altogether separate from it. They also, when not in use, form with the other parts, a box (as in Mr. Slack's model) in which the dissecting troughs and any other accessory apparatus may be packed away, when necessary.

No. 1.



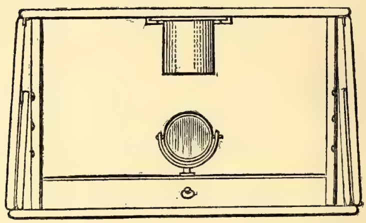
The above drawing shows a front elevation of the microscope as set up for use, and in the following brief description I shall endeavour to give as clear an idea of it as I can, only premising that I have given the various measurements for the sake of greater distinctness, as I presume that the actual size of any particular instrument must, in some measure, depend upon the requirements of the operator. I think, however, that the one hereafter described will be found very convenient for all ordinary purposes.

In the first place, the stage, which consists of a stout piece of mahogany, or a plate of brass, is about seven inches long, by five broad—and it is attached to a good firm base, also of mahogany, by four brass or wooden pillars about five inches high (the two front ones being shown in the drawing), which serve the double purpose of supporting the stage, and of giving the requisite elevation to the hand-rests, by means of notches cut in their sides into which the supports fit. These hand rests are about five inches square and one fifth of an inch thick and are fixed to the sides of the stage by hinges, so that they can be placed at any angle required, by means of the supports, which are two pieces of wood or metal fastened to the rests, as shown in the drawings; these supports are shaped so as not to interfere with the hands in adjusting the mirror, this being one of the points that I have specially kept in view in designing the instrument.

The other parts more immediately in connection with the stage are the condenser and the arm for holding the magnifying lenses; the former is attached to the front of the stage by a moveable arm in which it slides up and down, and when not in use it can be taken out of the socket and put away in some convenient place; the horizontal arm carrying the lenses has the usual rack-work and pinion adjustment, and may either slide in and out as figured in the drawing, or also be fitted with a rack-work movement—the arm is turned on one side in order to show a slight bend at the end, holding the glasses, which I think will sometimes be found convenient, when rather a deep trough is being used the sides of which would otherwise prevent the lenses from being brought into focus with the bottom, a circumstance that has in more cases than one proved troublesome to me, as either a lower power had to be used or the subject shifted to a shallower trough. Upon the base of the microscope is a drawer for holding the lenses, knives, and other dissecting instruments, including a small glass syringe, which I find an extremely useful addition to the apparatus. Above the drawer is placed the mirror, which has two sockets, one in the centre for ordinary illumination, and one in the front for oblique light, by which the object under dissection is brilliantly illuminated on a dark ground—a plan in many instances most effective. A very convenient way of doing this would be by putting the mirror upon a socket moving in a groove—so that it could be at once placed in any required position, or when not in use pushed up to the back of the instrument, and thus be altogether out of the way when the space is otherwise needed.

Drawing No. 2 shows the microscope as it appears with the rests let down and when not in use—and it is made complete as a box by a piece of wood (similar to that forming the back)

No. 2.

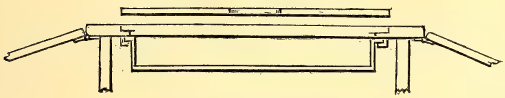


which drops into a groove in front of the drawer and is fastened by small hooks at the top to the stage, and upon this piece the condenser can conveniently be fixed by catches when the instrument is packed up I have thought it better to make this front a separate part, as it might sometimes be found very much in the way if permanently fixed on by hinges. I have not shown it in the drawing, thinking it unnecessary to do so.

Drawing No. 2 also shows the small dark tube devised by Dr. Carpenter, for facilitating dissection without the aid of the glasses, and described at page 192 of his work on the Microscope. This tube (the adding of which as a part of my apparatus I am indebted to him for suggesting) has a piece of ground glass fitted into the bottom, and can either be used for the purpose more immediately intended, or for softening the light, which is often very necessary when working at night with a lamp or candle.

As a fitting addendum to the description of my microscope, I may here give that of a modification of the ordinary dissecting trough, suggested to me by Professor Busk, who has kindly permitted me to add it to my paper. The new trough is made by cutting a small piece (say for example one inch long and a quarter of an inch in width) out of the centre of a gutta-percha one, and inserting in the hole thus left a piece of glass, so as to be on a level with the surface; by this arrangement, the object to be dissected, after being cut open, can be fastened down over the glass by pinning it to the gutta percha on either side, and in this way it can be illuminated either by the condenser or the mirror, as may be found necessary, an advantage too obvious in many instances to need further comment. As pieces of glass of several widths would be required to suit objects of different sizes, thus necessitating the employment of several troughs fitted up in this manner, it has occurred to me, that in case this might form a ground of objection with some to the plan, the same purpose might be answered by simply fitting slips of glass of the sizes most generally useful into flat pieces of gutta percha, which would go into any of the ordinary glass-bottomed troughs, and thus easily be substituted the one for the other.

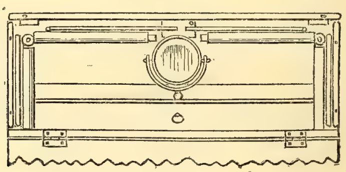
No. 3.

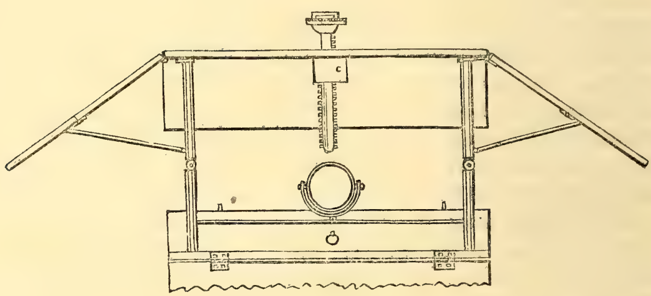


It now only remains for me to notice the arrangement figured in the above drawing, which shows a sectional view of the stage of the microscope, under which is held, by two catches, a large trough, about an inch and a half in depth, and having a glass bottom; a piece of sufficient size is also cut out of the stage, and a moveable plate of glass, or metal, put in its place (as shown in the drawing), which is of course lifted off when the trough is used; another, and perhaps more effectual, way of getting at it would be, by making a portion of the stage nearly equal in length and breadth to the trough to slide in a groove, like the lid of a small box, which could just be pulled out when required. By this method, I think that many dissections, that in the ordinary way would be carried on apart from the microscope, might be made on it; thus allowing the hand-rests, mirror, condenser, and other appurtenances of the instrument, to be made use of more advantageously and with greater ease to the dissector than if a trough of this size were placed on the top of the stage. In order to make this arrangement as complete as possible, I further propose to fit a piece of gutta percha into the bottom of the trough, which could be taken out when wanted (and thus make it serve the place of two troughs); and also to make a small hole in it (fitted with a plug), so as to allow of the water being drained off when necessary into a vessel held below, without having to remove, or otherwise disturb the object under dissection in any way, which might thus, if requisite, be cleaned with a syringe, and after the plug was replaced, the trough could again be filled with clean water, and the dissection proceeded with. It will be apparent from the drawing that this trough can be easily removed when requisite.

NOTE.—It having been suggested to me at the close of the meeting that a more portable form of the microscope might be found convenient, I have endeavoured, as shown in the following drawings, to carry this out.

Nos. 4 and 5.





No. 4 showing the instrument when closed, and No. 5 as it appears when opened out for use; and as the general plan of this is precisely the same as the one previously described, it will be only necessary for me to say that I propose to make the supporting pillars work with hinges, which are prevented by a catch from going out of the perpendicular; these pillars (which, in this case, are joined together at sides by two cross bars for the purpose of giving them greater firmness) are made to fit into four corresponding sockets in the stage, which is now separate from the lower portion of the microscope. Any further detail will, I think, be unnecessary, as I have only attempted to indicate how the reduction in size might be effected without interfering with the distinctive features of my original plan.

On a new Combined Binocular *and* Single Microscope. By F. H. Wenham.

(Read December 12th, 1860.)

At the meeting of this Society in June last, I exhibited and described an improved binocular microscope, on the principle of dividing the image by means of a thin achromatic prism fixed close behind the object-glass. The improvement on a former instrument (which had the defect of being pseudoscopic) consisted in refracting the right and left hand sections into the opposite eye, and by this transposition obtaining a true *orthoscopic* effect by an arrangement equally simple as before. Having since still further advanced the definition, by a modification in the construction of the prism, the performance was so superior to anything that preceded it, that several were made for parties who had seen the results, and which instruments proved satisfactory to their owners.

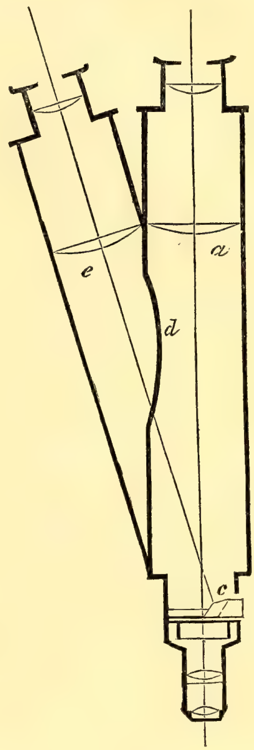
It appearing evident that the use of the binocular microscope was likely to become general, I have directed my attention once again to its improvement, and come before you this evening on the same subject, to announce the attainment of a degree of success in respect to convenience, simplicity, and improved definition, that, considering the nature of the principle, could not have been anticipated.

It is, perhaps, scarcely requisite to urge the advantage of being able to view minute organisms with the aid of both eyes together; for it is admitted that the single microscope affords but little appreciation of undulations of surface or bulk. We have even now a vivid recollection of looking through the microscope for the *first* time, as exhibited at the Society of Arts five and twenty years ago, by our member, Mr. Cornelius Varley. The objects were the wheel animalcule and the sap circulation in the *Chara*. Not having, at that time, the least knowledge of the instrument or objects, we formed no idea of bulk; but observing a moving object in a field of light, supposed the effect similar to the representations of a magic lantern, the then familiar toy of our youth.

The living organisms revealed by the microscope still possess a charm for us beyond all others, for herein can be traced the first links in the chain of creation. Quickly passing from the simple vital plant-cell to higher grades of development, we hover at length in pleasing uncertainty at the confines where the plant may be supposed to end and animal life commence. The waistcoat-pocket may conceal our menagerie, and any locality furnish objects. For example, at this season of the year, draw from the nearest hedge-side ditch a rotten leaf. "Drop it again," the unknowing would say in disgust, it is decomposing, and covered with a loathsome-looking slime; but remove a portion of this, and place it under the microscope, and marvellous is the living host displayed to view, consisting of *Diatomaceæ, Desmidiæ, Oscillatoria, Amœbæ, Rotifers,* &c., all assembled together in one dense crowd, perfect in beauty and cleanliness. An hour may pass away unheeded, in the interest caused by observing the movements of these creatures; but greatly is that interest enhanced by the aid of binocular vision; they appear then not as mere moving discs, but in all the reality due to life and substance.

The chief inconvenience of all the binocular microscopes hitherto made, besides distorted or imperfect definition, has been the necessity of a separate double body; and the constant trouble of shifting this for the single tube very much limits their utility. There is also the difficulty of cleaning the prisms, and a liability to their derangement. In the instrument I have now to describe these objections do not exist; for the effect, as a single microscope, is not in the slightest degree impeded or interfered with, and by a touch of the finger it is instantly converted into a binocular, or back again. The annexed diagram will explain the principle of action; A is the body of an ordinary microscope, moved perpendicularly relative to the stage, with fine motion, &c., precisely as it is commonly made. On the right-hand side, in the neck at B, is cut a square hole, through which a prism, C, having two reflecting surfaces, is made to slide, as close behind the object-glass as possible. This prism is held by the ends only in the sides of a small drawer, so that all the four polished surfaces are accessible, and should slide in so far that its edge may just reach the central line of the objective, and be drawn back against a stop, so as to clear the aperture of the same altogether, in which case the tube A acts without impediment as a single microscope. When the prism is thrust in more or less, it collects a portion of the rays and reflects them to the opposite side of the tube, at D, where an opening is to be made large enough to admit them all, under extreme conditions. Parallel with the direction of these rays is "grafted on" the supplementary tube E, with eye-pieces, &c., and in size corresponding with the main tube. The additional body may either be soldered permanently on to the other, or be made to draw on and off, a double collar holding them together at top, and a clip or bolt at the bottom. In the latter case, when the inclined tube is removed, a cover should drop neatly into the aperture, flush, and be secured by a bolt. But the additional body being no hindrance to the ordinary action of the microscope, it is best always to allow it to remain in place ready for instant use, as required. When the prism is drawn out to its limit, the main body acts just as the usual single instrument, and therefore needs no explanation; but on thrusting it in, a part of the rays are thrown into the eye-piece of the inclined body, and thus the right-hand rays of the object-glass are reflected into the left eye, and the remainder pass directly into the right eye, having nothing intervening to obstruct them in the due performance of their best effect. The prism need not, in all instances, be thrust in to its *fullest* extent, so as to take in the total half of the object-glass, but only partially, to the degree requisite for throwing the object up in relief. In the case of a difficult test the largest share of the direct aperture may be employed, while, by coaxing the illumination for the reflected portion, the instrument can be made to perform well on the diatomaceous tests.

Fig. 1.

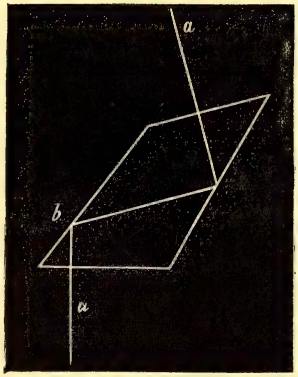


With respect to the illumination, in all cases where possible the opaque principle should be employed, as it gives to objects a far more natural appearance. When transmitted light is needed, a large, angular pencil should be used, otherwise the two fields cannot be equally lighted with the higher powers. I intend to have a split mirror made, each half capable of separable and independent adjustment for each body. The necessity for this will be shown with the *Podura*, for on bringing out the markings with the maximum distinctness for the reflected vision, the direct will be found deficient. On altering the mirror, equal distinctness can be obtained in the direct tube, at the expense of the other. If each tube, therefore, has its own independent mirror, this inconvenience will be obviated.

The adjustment for difference of distance between the eyes is effected as before, the draw tubes being at the minimum limit of proximity when close in, and by drawing these out to a small extent they accommodate for all positions of eyesight. This answers so well in practice as to need no amendment. It will be seen that the reflected rays have further to travel to reach the eye-piece (the radius of each tube being the same). The distance is just equal to that which they have to traverse across the interior of the prism; this causes a slight disagreement of focus between the two, which may be compensated for by drawing out the main tube about a quarter of an inch more than the other, but it would be preferable to make a small difference in the magnifying power of the eye-pieces, which can be simply done by an alteration of distance between their lenses, each eye-piece to be marked for its appropriate tube. By transposing them such an adaptation would often compensate for those whose eyes differ materially in focus, or one being long and the other short-sighted, which is a common defect.

The base into which the prism slides rotates to a small extent, for reflecting the image level with the centres of the eye-tubes; this is the *only* adjustment, and when set right is held fast by a binding screw in the side of the inner fine motion tube. The prisms having two opposite reflecting surfaces, possess the common property of such, that, however much tilted, the direction of the ultimate emergent ray cannot be altered. Great care and nicety is, therefore, needful in working them to the exact angles for the definite direction in which the ray is to be finally reflected, but this having been properly obtained, gives the double-reflecting prism this advantage, that it cannot be readily put out of adjustment. Fig. 2 is an enlarged outline of the prism; a ray of light, A, passing through the base, is totally reflected by the surface, B, towards C, at which surface it is again totally reflected in the direction required. Both the incident and emergent surfaces of the prisms must be perpendicular to the direction of its corresponding ray, as any refraction is objectionable, and the reflecting sides be arranged considerably within the angle of total reflection (which, for crown glass is about 48°). The base of the prism should be of a width only just requisite to include the half aperture of any object-glass, one quarter of an inch is quite sufficient; it should not exceed this for two reasons, first, that the greater the thickness of glass that the ray has to pass through, the more difference there will be in the magnifying power of the two bodies, and second, that a thick prism takes the ray more away from the centre of the main tube, and increases the convergence of the two, bringing the eyes nearly approaching to the disagreeable condition of a squint.

Fig. 2.



Both the transmitting and *reflecting* surfaces of the prism should be accessible for the purpose of wiping, for any particles or mildew adhering to the latter will prevent total reflection at the point of contact. If the prism is well made and polished, and of the smallest size possible for admitting the pencil, the difference between the direct and reflected image is scarcely appreciable, and with this standard of comparison a faulty prism will immediately be detected. By pressing back the spring catch or stop on one side of the prism-slide, it can instantly be withdrawn altogether, and as quickly replaced.

On Changes *of* Form *in the* Red Corpuscles *of* Human Blood.—By William Addison, M.D., F.R.S.

(Communicated by Dr. Lankester. Read December 12th, 1860.)

When freshly drawn, human blood is examined with a microscope, the form in which the red corpuscles appear is well known. The greater part of these bodies adhere together in rolls, a few floating singly in the blood-fluid, or *liquor sanguinis.*

(Plate III, fig. 1.) We may call this form the normal form. But occasionally, without anything having been added to the blood, the forms depicted as alkaline forms (fig. 2) may be seen.

These rough or prickly forms (fig. 2) are with certainty produced by fresh urine, by a weak solution of common salt, and by various liquids rendered slightly alkaline with solution of potash. On the other hand, the forms represented in fig. 3 are determined by adding to the blood a solution of sugar and liquids rendered feebly acid by hydrochloric acid, or by lemon or orange juice.

The tailed forms (fig. 4) occur when blood is submitted to the action of sherry wine.

Make a *saline solution* by dissolving one grain of common salt in two fluid drachms of water, and render it very slightly *alkaline* with solution of potash; also dissolve four grains of refined sugar in two fluid drachms of water, and render it slightly acid to litmus paper with the diluted hydrochloric acid of the London Pharmacopœia.

Receive a small drop of fresh blood upon a slip of glass, and place near to, but not touching it, a similar amount of the saline alkaline solution; also place in a like manner, on the other side of the blood, an equal quantity of the acid-sugar solution; drop down upon the three fluids a thin piece of glass, so that the alkaline fluid may come into contact with one side of the drop of blood, and the acid fluid into contact with the opposite side of it.

Upon examination with the microscope, the forms of the corpuscles which float out into the alkaline fluid will be found quite different from those which float out into the acid fluid. Those in the alkaline fluid have roughened outlines (fig. 2), whereas those in the acid liquid have smooth outlines, and a bright matter, of sundry forms, makes its appearance in their interior (fig. 3). If the corpuscles be followed as they continue to float out in the two fluids, we find them experiencing further, but different, changes of form. In the alkaline fluid the phases A, B, fig. 2, and in the acid fluid the phases C, D, E, fig. 3, will be seen. Again, take a small drop of blood and place close to it an equal quantity of the alkaline-saline liquid, drop down upon them a thin piece of glass, and when a multitude of the corpuscles have floated out into the fluid and have assumed forms fig. 2, add at an edge of the covering-glass a drop of the diluted hydrochloric acid, and these forms will be seen changing into the forms fig. 3. Lastly, take a drop of blood and place near to it an equal amount of the acid-sugar solution, let fall upon them a thin covering-glass, and after a little time numerous corpuscles will be found of the forms represented fig. 3, add at an edge of the covering-glass a drop of *liquor potassæ,* and forms fig. 3 will alter into forms fig. 2. The changes described may take place quickly or more slowly, according as the added fluid flows with more or less rapidity; in the latter case it will be remarked that the corpuscles in progress of change from one form to the other regain for a brief space of time their normal figure and appearance (fig. 1). We are able, then, by an appropriate application of alkaline and acid fluids to impress particular forms upon the red corpuscles of human blood, and we see them during the transition from one form to another regain their normal characters and aspect.

This property of change of form in the corpuscles of the blood is not of long duration, it remains with them but for a limited period after their withdrawal from the circulation, and some of the corpuscles appear to lose it sooner than others, for, after a little time, corpuscles of different forms are to be seen floating side by side in the same current, and the further addition of an alkaline or acid fluid destroys them, without inducing any further change of figure.

We have called forms fig. 2 alkaline, and forms fig. 3 acid forms, not because they are exclusively determined in the one case by alkaline and in the other by acid liquids, but because the alkali potash will change the normal form fig. 1, and also forms fig. 3, into the forms fig. 2, and, again, because the hydrochloric and other acids will alter the normal form, and also the forms fig. 2, into forms fig. 3, when they are properly applied.

In repeating these experiments, it will be seen that corpuscles which approach near to an edge of the covering-glass, whatever may be their form, lose thereby all power of further change.

Now forms *b*, fig. 2, which result from contact with alkaline and saline fluids, are like forms *d*, fig. 3, which are produced in acid liquids, the only difference between them being that those observed in alkaline are deeper coloured than those in acid fluids. Corpuscles of this form *b*, fig. 2, and *d*, fig. 3, are incapable of regaining the normal form. Ultimately, in alkaline fluids, the forms *b*, fig. 2, burst open, and the corpuscles are wholly dissolved; in acid liquids (fig. 3, *d*) they sometimes burst open suddenly, and sometimes suddenly increase in size, the contents of the corpuscles become colourless, and the enlarged capsules, with a granular matter within them, have very much the appearance of the white corpuscles of the blood (fig. 3, *e*).

Dissolve a grain of common salt and half a grain of bicarbonate of soda in two fluid drachms of water, mix this solution with half a fluid ounce of good sherry wine, and filter. This liquid produces the tailed corpuscles (fig. 4). A small drop of blood and an equal quantity of the vino-saline mixture must be placed side by side on a slip of glass, so that their edges may mingle when a thin covering-glass is dropped upon them. In about five or ten minutes numerous corpuscles, where they have floated out in the liquid, will be seen throwing out matter from their interior, two, three, four, or more minute molecular particles fringing their circumference. Some of these molecules separate from the corpuscles and float in the fluid, others elongate into tails, which wave about with a tremulous motion, in a very remarkable manner. These tails all have a little knob at their extremity. After a short time, or upon any motion in the fluid, the tails break away from the corpuscles, but their singular movements do not cease when this has happened. Sometimes a discoid enlargement forms on some part of the tail, and then the tail suddenly retracts itself into a larger granular and coloured particle. That the movements of these tails are of a peculiar kind, and not due to motion in the liquid, is shown by this—that all movement in them ceases entirely when they approach near to either of the edges of the covering, thin glass. In repeating this experiment, if the surfaces of the upper and under glasses come so close together as to press upon the blood-corpuscles—which is known by increase of their diameter—the tails will not appear. The corpuscles must be free from pressure, for the effects described to take place. Moreover, tails are not readily produced if the stand of the microscope and the glasses are cold; the phenomenon takes place much sooner, and the tails are longer, when the instrument and fluids have been for some time in a warm room.

The following have been found to succeed in producing the tailed forms of corpuscles (fig. 4):

1. Sherry wine.
2. Sherry wine and saline solution.
3. One part fresh urine and two or three parts sherry wine.
4. Port wine and quinine.—Dissolve with a gentle warmth one grain of sulphate of quinine in half a fluid ounce of port wine; set it by for two or three days, and then filter the liquid.
5. A mixture of the sherry wine and the saline solution with port wine and quinine.—This mixture seems to improve by keeping.

The following experiments have been tried:

1. One fluid drachm of the mixture No. 5 and one grain of sulphate of strychnia, shaken together.—Tails produced.
2. One fluid drachm of No. 5 and one grain of acetate of morphia.—Tails produced.
3. One fluid drachm of No. 5 and liquor potassæ, just sufficient to remove the acid reaction of the mixed wines.—No tails appeared.

In all these experiments there is no mixing together of the blood and the extraneous fluid previous to the application of the covering-glass, hence there are various degrees of intermingling between the added fluid and the natural fluid of the blood, and it is only where these two fluids are mixed in certain unascertainable proportions that the specific phenomena are to be seen.

Blood consists of a fluid—the liquor sanguinis—and the corpuscles; therefore, before arriving at any conclusion from the preceding experiments, it will be necessary to consider the part played by the fluid element of the blood. The added fluids, when they come, undiluted by the liquor sanguinis, into contact with the red corpuscles, destroy them. The changes of form of the corpuscles are therefore effected, not by the extraneous or added fluid alone, but by a mixture of the added liquid and the liquor sanguinis; and we conceive it to be correct to regard the phenomena described as the results of a change in the quality of the liquor sanguinis, wrought by the added liquor. It is to an unascertained mixture of the extraneous fluid and the natural blood-fluid that the various aspects of the corpuscles must be ascribed. It is well known how speedily elements of diet, medicinal substances, and poisons, are found in the liquor sanguinis, and these experiments show that corpuscles which have been changed in their form from change in the quality of the liquor sanguinis may be altered back again to their normal form by a counteracting agent. But before any actual change of figure in the corpuscles occurs, we must suppose a disposition to the change, and therefore we may conclude that such a disposition may be removed by an appropriate—a counteracting agent. Lastly, we regard the facts as substantiating the doctrine that the fluid element of the blood has a pathology distinct from that of the corpuscles.

TRANSACTIONS.

Report on Slides of Diatomaceæ, *mounted by* E. Samuels, *for* Boston (U. S.) Society of Natural History, *and presented to the* Microscopical Society of London. By Charles Stodder.

(Read October 10th, 1860.)

The diatoms of our coast have been but little studied. These specimens will, on that account alone, possess considerable interest, though they have only been glanced at, for want of time. Those from Quincy appear most promising. The Milton slide contains almost entirely what Mr. Samuels considers a new *Himantidium*. The Bangor and Bemis Lake deposits are similar to other "sub-peat" deposits found all over New England, and described by Ehrenburg and Bailey. These have not been fully studied as yet.

The diatoms from the intestines of Holothurians and Echini are of great interest. They were taken from animals collected for our members, Mr. Jas. M. Barnard and Professor L. Agassiz. Some of the slides, prepared and mounted by Mr. Samuels, coming into my possession last spring, I noticed that they were very rich in genera and species, and that many appeared to be new. I sent specimens to our corresponding member, Mr. A. M. Edwards, of New York, who has paid much attention to this department of science for several years. His interest was excited by the specimens, and a larger quantity of the material was procured from Mr. Samuels, and also some directly from Mr. Barnard, and cleaned by Mr. Edwards, which, although but partially investigated as yet, has yielded a rich harvest of new forms, as well as many but recently published in Europe, together with a great number of old and well-known species.

The discovery of this source of supply of diatoms will yield important scientific results. We obtain specimens from localities otherwise all but inaccessible to the microscopist. We have ascertained that a great many species are common to the Sandwich Islands and to the Mediterranean; some species are found in the Sandwich Islands and the coasts, England, France, Nova Scotia, and Botany Bay; some common to Sandwich Islands, Zanzibar, and Florida.

Diatoms have been long known as the most cosmopolitan of all organism. The information afforded by these slides adds very much to our former knowledge of this character.

They seem to exist as species, almost independent of climate or locality.

Mr. Edwards has undertaken to make a list of the Sandwich Island forms, and to figure and describe the new species, with the view to publication by our society. I have examined these slides, prepared by Mr. Samuels, and have registered, with "Bailey's indicator," some of the new species of Mr. Edwards, as he has communicated them to me verbally or by letter, with his provisional names.

These slides have not been seen by Mr. Edwards, and I only am responsible for any errors or mistakes.

Mr. Edwards's new species are—

Synedra magna.
„ *pacifica.*
Triceratium circulare.
„ *elegans,* with 3 and 4 sides.
„ *undatum,* with 3, 4, and 5 sides.

These variations in the number of sides revive the question whether there is any generic distinction between *Triceratium* and *Amphitetras*. Mr. Brightwell has described several species of four-sided *Triceratium,* and the only distinction I can make out between *T. Wilksii* and *Amp. Wilksii* of Har. et Bai. ('Proc. Phil. Soc.') is the number of sides.

Among the rare or recently described forms in the Sandwich Islands, are *T. dubium* (Brightwell), found also on the coast of Florida, *Cocconeis fimbriata* (Brightwell), *Biddulphia reticulata* (Roper). The *Campylodiscus* figured by Brightwell, in 'Jour. Mic. Soc.,' as *C. striatus* (Ehrenberg), is abundant, but bears but little resemblance to Ehrenberg's description or original figure. I propose to call it *C. Brightwellii.*

Synedra undulata, Greg. (= *Toxarium undulans,* Bail.), is abundant, also, at Quincy, Mass.; so is *S. Hennedyana,* Grey. The two specimens have an expansion in the middle, but one is straight, the other undulated; now, we have likewise two forms, rather rare, one straight, the other undulating, but without the expansion: are all four one species? *Naviculæ* of the type of *N. didyma* are plentiful; some appear identical with described species, but they are so variable that they recall Dr. Gregory's query, whether they should not all be considered one species. The same observations apply to *Naviculæ* of the type of *N. lyra*.

There are two forms of Ehrenberg's genus *Actinocyclus*, called by most authorities *Eupodiscus*; one resembles *E. sparsus*, Greg. *E. tenellus*, Bréb., and the *Actinocyclus* of Ehrenberg ('Mic. Geol.' Taf. xix, fig. 5, c. 10). Also *Coscinodiscus lunæ* (Tab. 35A, group xxi, fig. 7); *Cos. gemmifer* (Tab. 35A, group xxii, fig. 3). This form is distinguished by rays composed of lines of contiguous dots, with other dots irregularly scattered between the rays. The number of rays is very variable, from six upwards; sometimes the rays are so crowded, that the intermediate dots *almost* form continuous rays, only distinguishable by their irregular distance from each other; colour, usually some shade of brown.

The other form of *Actinocyclus* has very fine lines for rays, not always continuous; and the whole surface of the disc is covered with a very fine network of, probably, hexagonal markings, too fine to be well made out with my instrument. This form is represented by *Eupodiscus fulvus*, W. Sm., and possibly by *E. subtilis*, Ralfs; by a great many of Ehrenberg's species, 'Mic. Geol.,' Tab. xviii, fig. 8, c. 18, Richmond,
,, ,, xxviii, gr. 22, fig. 7,
,, ,, xxxv, A, gr. 17, fig. 1, and 2, guano,
,, ,, ,, gr. 18, fig. 1, 2, and 3, guano, Saldanha Bay;
also Strafford Cliffs and Rappahanock Cliffs, var. colour, usually blue or purple, sometimes brown, and sometimes colourless. Both of these forms have generally, but not always, a nodule or process near the margin, resembling the "feet" of *Eupodiscus* and *Aulacodiscus*; which is probably the reason of their having been taken for *Eupodisci*, though the structure of the valve appears entirely different from the true species of that genus. Ehrenberg does not figure or describe the nodule, but on examining the *Actinocycli* of Saldanha Bay, in the Bailey collection, received, I believe, by Bailey from Ehrenberg, I find the nodule is present in them.

Ehrenberg's figures are sufficient to indicate the genus, but not the species, except by the number of the rays, which is not a good specific character, neither is colour. But I am well satisfied that many of the so-called *Eupodisci* are Ehrenberg's *Actinocyclus*; in fact, it is almost admitted by Smith.

These two forms of *Actinocyclus* should probably be placed in two genera. They have quite a different structure; that of the first-mentioned is not cellular, but the dots are projecting papillæ or tubercles, as may be easily seen in oblique examples. The whole group of *Actinocycli* and *Eupodisci* requires revision, and I believe that Mr. Edwards intends to undertake the task.

We have quite abundant and variable *Stauroptera aspera*, Ehr. = *Stauroneis pulchella*, W. S. Ehrenberg made a sub-genus of those *Stauroneis* that were striated or marked; but improved instruments having shown that all the *Stauroneis* are marked, and none smooth, the sub-genus should be cancelled, but the original specific names should stand.

There are a great many species of other genera, some of which will undoubtedly prove to be new; but these are not worked up as yet, or I have not received Mr. Edwards's results. There are also several new forms, whose position in classification is as yet quite doubtful.

The Sandwich Island slides in this parcel represent very well the character of all the others examined, except perhaps in the genera Nitzschia, Amphora, and Campylodiscus, which have been found much more abundant in number and species than here, some of the species of which will probably prove to be new; spicules of sponges are very abundant.

On the Zanzibar slides I have seen two specimens of an *Auliscus*, probably new; and several of an *Isthmia*, certainly so.

MICROSCOPICAL SOCIETY.

ANNUAL MEETING.

February 13th, 1861.

Dr. Lankester in the chair.

Report of Council.

According to annual custom, the Council have to make the following report on the state and progress of the Society during the past year.

The Society at present consists of—

Compounders - - -	41
Annual Subscribers - -	259
Honorary and absent -	5

giving a total of - - - 305 for the number of members this day on the books; of these 35 have been elected during the past year, and are included in the above number. The Council have to regret the loss by death of 5 members—P. W. Fry, Esq., Geo. Jackson, Esq., Rev. David Laing, Charles May, Esq., and Dr. James Forbes Young. Three of these, viz., Mr. Fry, Mr. Jackson, and Dr. Young, were among the original members who founded the Society. The Council have also received seven resignations. During the past year the Library has received an accession of 73 books; of these 25 consist of various complete works, many of which are of great value: among these may be particularly noticed the works of Leuwenhock, 2 vols. 4to., and Swammerdam's 'Historia Insectorum,' 3 vols. fol., presented with other works by Dr. Millar, and the valuable contributions of the Hackney Microscopical Society, presented through Mr. Roper; four works also have been purchased with the Library Fund; and the remaining works consist of serial publications, presented by the various editors, with the exception of one, the 'Annals of Natural History,' which is purchased, as it appears, for the use of the Society.

The cabinet of objects has received an accession of 66 slides, including 27 from the Boston (U. S.) Natural History Society, 14 from Dr. Carpenter, being specimens of Polyozoa

AUDITORS' REPORT.

From February 8, 1860, to February 13, 1861.

Receipts.

	£	s.	d.
Balance of last year	25	16	10
Entrance fees of members	38	17	0
Compositions invested	52	10	0
Subscriptions	274	7	0
Sale of 'Transactions'	0	12	9
„ Soirée tickets	3	18	0
	£396	1	7

Payments.

	£	s.	d.
By Salary of Assistant Secretary	21	0	0
„ Curator	8	0	0
Delivery of Journals	9	7	7
Editors of ditto	128	12	0
Ray Society	1	1	0
Commission on £365 9*s.*	18	5	6
Soirée expenses	26	6	11
Library fund	1	10	0
Petty expenses (oil, stationery, postage, &c.)	22	8	4
Tea and Coffee	19	4	0
Printing	10	6	0
Purchase of £59 13*s.* 6*d.* Consols	54	15	0
Balance in Treasurer's hands	75	5	3
	£396	1	7

8th February, 1861.

We, the undersigned, have examined the Treasurer's accounts, with the documents and vouchers, and found them to be correct, and also to state that there is a year's interest due on £485 15*s.* 3*d.*

HENRY DEANE,
F. H. WENHAM, } *Auditors.*

and illustrations of the development of Comatula, and some micro-photographs by the late Mr. Jackson.

At the first meeting of the present session an elaborate report was made by a committee, consisting of Mr. Farrants, Mr. Lobb, and Mr. Legg, appointed to examine, arrange, and report upon the objects in the cabinet. This task has been performed by these gentlemen in a most satisfactory manner, as may be seen by the report; and the result of their investigation is, that at the date of the report, October 3, 1860, the cabinet contained 832 objects, which for facility of reference they had arranged under 13 heads or classes, distinguished by the capital letters from A to M. They at the same time made a suggestion as to an arrangement by which the objects might be allowed to be taken out by the members under certain regulations, to which arrangement the Council have given their assent.

The Journal has continued to be published regularly, and circulated as usual.

The President then delivered the following address:

The President's Address *for the year* 1861.

By Professor John Quekett, F.R.S.

Gentlemen,—Before proceeding to the general business which usually occupies the attention of the members of the Microscopical Society on this, the evening of the anniversary, I have much to say to you in the way of apology for my seeming neglect in never having occupied the chair, to which, unknown to me, I had been elected by the Council. Feeling that the state of my health did not allow me to perform the duties of the office in such a manner as I could wish, I did all in my power to prevent the appointment when it was hinted to me as likely to be made. Not having been consulted in the matter, nor officially informed of the intention of the Council, but hearing through a private source that I had been proposed to fill the office of President, I wrote a letter to the Council, telling them that, had my health permitted, I should have felt much honoured by the appointment; but that, as things stood, I must necessarily decline it. In February last, however, and but a few evenings before the Anniversary, I was, for the first time, officially informed that my letter, declining the position of

President, had come to hand too late; and that the election must stand good. I regret to say that my apprehensions with regard to the state of my health have been more than realised; for, without a single exception, from the time of the *soirée*, which was held in this room in April of the past year, I have been prevented, by illness, from attending any of the meetings.

Knowing, as you all do, the part taken by me in assisting to establish this Society in the outset, and that I have performed the duties of Secretary for a period of nineteen years, during many of which I was unassisted, my declining so honorable a post as that of President must, at first sight, have given rise to the idea that either my views as to the usefulness of the Society had changed, or that my occupations, being numerous, would not allow me time for microscopical investigation, nor for the transaction of any business connected with the Society; but when I state the truth, viz., that I have been physically incapable of performing these duties, I feel sure that no further apology will be needed, more especially as I endeavoured in every way to prevent my appointment, having, on more than one occasion, previously refused it on the same grounds. I can only add, that should it please the Almighty Disposer of events that my health should be restored, I shall hope to be able, at some future time, to show you that a long period of unavoidable absence has in no way diminished my love for this Society, nor the zeal and energy with which I once assisted in carrying on its affairs.

Since the Anniversary, which was held on the 8th of February in the past year, there have been nine meetings of the Society; and, in addition to the subjects which have been brought forward orally, no less than thirteen papers have been read; and of these, four relate to the Diatomaceæ, a subject which, perhaps, more than any other, has, from the earliest days of the invention of the Achromatic Microscope, occupied the time and attention of the most persevering and painstaking portion of our Microscopic community; a certain number occupying themselves with the nature of the markings on the surfaces of the valves, whilst others are engaged in classifying and arranging the numerous species which are daily being procured from all parts of the habitable globe. We are indebted to Dr. Greville, Dr. Wallich, Mr. Norman of Hull, and Mr. Tuffen West, for these papers, all of which have been published in full in the 'Transactions' of the Society, and many of them have been delineated by the accurate pencil of the last-named gentleman.

The paper by Dr. Greville is a very elaborate one: it is entitled a "Monograph of the Genus *Asterolampra,* including *Asteromphalus* and *Spatangidium.*" The material employed for investigation was obtained from three very different sources; the first consisted of soundings from the Indian Ocean; the second, of a deposit from the United States, prepared for examination by Mr. E. W. Dallas; and the third, of a substance known as the Monterey Stone, prepared by Professor Walker-Arnott. One great object of this paper is to point out how far the genus *Spatangidium* of De Brébisson should have been adopted in his former paper; the species formerly described as belonging to this genus being considered as strictly referable to *Asterolampra* or *Asteromphalus.*

The paper by Mr. Tuffen West is entitled "Remarks on some Diatomaceæ, new or imperfectly described, and on a new Desmid." The sources from which the algæ upon which Mr. West's observations have been madewere various, some of them being from the British coasts, others from the Mauritius and from the so-called Barbadoes earth. The genus *Triceratium* is the one principally mentioned; and of this no less than seven species are described, and figures of each given, with the usual accuracy of this accomplished artist.

Five other genera are then alluded to, and one or more species of each described of these genera; that of *Attheya* is new, and its species *A. decora* was found by Mr. Atthey plentifully on Cresswell Sands, in June, 1859, and in May, 1860, in Druridge Bay. At first sight this species is considered to resemble *Striatella unipunctata* in miniature; but the presence of spinous processes at the angles, and the entire absence of stripes or attachment of any kind render the establishment of a new genus perfectly necessary.

The paper of Mr. Norman, read in June, is a continuation of that brought before the Society in January, 1860. It is a list of the various forms of Diatomaceæ in the neighbourhood of Hull. The genera *Pinnularia, Stauroneis, Pleurosigma, Synedra, Gomphonema, Meridion,* and upwards of thirty others, are represented each by one or more species, tending to show not only the richness of the locality, but also the zeal, activity, and powers of discernment of the microscopists of that town in this particular department of scientific inquiry.

Volvox globator, which within the last few years has occupied so much of the attention of microscopical observers, has points in its history still remaining to be cleared up. Dr. Hicks has done much to make the matter clearer, and has pointed out a stage, viz., the amœboid, in which this Protean form agrees with that of three other members of the vegetable kingdom.

At the same meeting, Dr. Wallich, in a paper, entered into a discussion on the structure of the diatom valve; believing, from his observations, that the growth of the valve ceases either at or shortly after its liberation from the parent. That, subsequently, no change in shape occurs in the *siliceous* valve except at its margins. That the markings are circular, and arranged determinately according to species; the figure being dependent upon forces occurring during its connection with the parent frustule; the size and relative fineness of markings depending upon the condition of the frustule while in the stage of generation. As to the gelatinous envelope, its growth may probably go on indefinitely.

The next paper relates to the zoophyte division of the animal kingdom.

Professor Allman described, in a paper read 14th March, 1860, a new genus of Lucernariidæ, *Carduella,* identical with the species *L. cyathiformis* of Sars, but differing from the true Lucernariidæ in the margin of the circular disc not being produced into the rays, the tentacles not springing from the edge of the cup, and in these being situated in a single circle.

From a careful description of its anatomy, he believes it to represent a true hydrozoan type, notwithstanding a resemblance to the actinozoan, in the presence of the vertical lamellæ connecting the stomach with the outer wall of the animal.

The papers relating to the improvement in the microscope itself, and in the apparatus connected with it, have been, during the last year, more numerous than in any preceding one. Thus, there have been two on the Binocular form, by Mr. Wenham; one on a Portable Field or Clinical Microscope, by Dr. Lionel Beale; and another on a Dissecting Instrument, by Mr. James Smith. All these are fully described and illustrated in the 'Transactions,' and are worthy of the greatest attention from their being the contrivances of men qualified in every possible way to show to the uninitiated what is truly good and useful. Mr. Wenham's invention, however, is one which requires more than a passing notice, as it is likely to prove of greater use to the observer than any other form of instrument which has yet been brought before the notice of the members of this Society; and glad should I be if the limits of this address would allow me to enter fully into some of its advantages.

The next duty I have to perform is a painful one, viz., to remind you that although our little community scarcely numbers three hundred strong, yet within the last year no less than five of our members have been taken from us by the unsparing hand of death. These are James Forbes Young, Charles May, David Laing, P. W. Fry, and George Jackson; and of all the losses the Society has met with since its formation, no greater one has happened than that of so valuable a member as Mr. Jackson, for there is hardly one amongst us who has used the microscope as a scientific instrument, but has been more or less indebted to Mr. Jackson's skill for the instrument employed in taking accurate measurements of minute objects.

Mr. George Jackson was the eldest son of a farmer at Higher Yellington, in South Devon, and was born in 1792. At an early age he exhibited a strong mechanical genius; his first attempts in that direction being to manufacture a mouse-trap, his grandmother having promised him a guinea for the first that was caught, under the impression that such a thing was impossible; a mouse, however, was soon trapped, and the promised guinea as quickly reduced to a half-crown. Then sixpence a head was the price affixed; but still, even at this reduced rate, the money earned from the efficiency of the trap was considered too much for so young an artist, and payments consequently ceased altogether. He was educated at the Ashburton Grammar School, whither his innate tendencies, also followed him; and if ever young Jackson was missing, he was sure to be found in the workshop of Mr. Ireland, the carpenter. Numerous lasting memorials of his skill, in the form of writing-desks, work-boxes, &c., still remain to evidence this early predilection.

Mr. Jackson was articled to Mr. Gervis, a surgeon and medical practitioner at Ashburton, whose sons had been his schoolfellows, and whose second daughter he afterwards married. He attended the lectures at the United Hospitals of St. Thomas and Guy, and took the diploma of Member of the Royal College of Surgeons of London in 1813.

At an early period of his life he was an excellent manipulator with the table blowpipe, and supplied himself and many of his relatives and friends with most excellent thermometers, hydrometers, and barometers. He also constructed a transit instrument, which was erected, when in use, on a stone cantilever firmly embedded into the wall behind his house. In 1826, he was rewarded by the Society of Arts for an ingenious and useful instantaneous light-apparatus, being a modification of the hydrogen and spongy platinum lamp.

Mr. Jackson was an early lover of the microscope, and many years before the existence of our Society constructed a very efficient instrument for using the doublet lenses introduced by the late Dr. Wollaston; the two lower pairs of these he framed and figured for himself. This was followed by the production of a large-sized instrument, capable of effecting all that the best microscopes of that period were able to do. At the turning-lathe and planing-machine he was a thorough workman, and these instruments he had constructed on his own plans, and much of them by his own hands. He was the first to show the great importance of employing the latter for perfecting the instrument and economising labour.

Mr. Jackson was one of the original members of our Society at its formation in 1840, and most of his various suggestions for the improvement of his favorite instrument have been laid before the members.

The first of these was a paper "On Microscopic Measurement," read September 23d, 1840, and printed in the 'Microscopic Journal,' vol. i, p. 11—a subject with which his name has become so intimately connected.

In April, 1841, he described a portable candle-lamp for illumination by reflection, some observations on which will be found in the 'Microscopic Journal,' vol. ii, p. 77. This was followed in November, 1847, by his paper on "The Eyepiece Micrometer," published in the 'Transactions of the Society,' vol. ii, p. 134.

The small but elegant little ruling-machine, which he constructed for the division of these micrometers, is a most efficient arrangement, and although, I believe, never figured or described, yet he had no hesitation in exhibiting it to any person who was interested in such matters.

It was about this period that he also constructed a very complete and serviceable cutting-machine for producing thin sections of woods, &c.

In 1852 Mr. Jackson was elected President of this Society, and I am sure that the members will all bear witness with me in stating that he was at all times most active in advancing the true interests of the Society.

In conjunction with Dr. Carpenter, Dr. Lankester, and your President, he was appointed by the Council of the Society of Arts a member of the committee, to assist in awarding their premium for the best and cheapest microscopes.

In May, 1857, he exhibited and described a new form of travelling microscope, four of which he has constructed as presents to various relatives.

Soon after the process of photography on collodion had become practised, Mr. Jackson turned his attention, with his accustomed clear-headed assiduity, to this engaging branch of art, constructed for himself a camera box, travelling arrangements for micro-photographs, and with a good achromatic lens, manufactured by Ross, set to work with his usual perseverance and industry to take the portraits of all his relatives and friends, scientific or not, the liberal distribution of which among his large circle of acquaintances afforded him unalloyed pleasure. The Society's museum is enriched by his liberality with micro-photographs of some sixteen of its members.

Several other short notices from our deceased member have also appeared in the pages of the 'Quarterly Journal of Microscopical Science,' as "On thin glass Covers" (vol. i, p. 141), "On Micrometers and Micrometry" (vol. iv, p. 241), "On Microscopical Photographic Portraits" (vol. vii, p. 122). He also undertook to oblige his friend, the late Dr. Pereira, with the measurement of the starch granules of various amylaceous substances for the last edition of his 'Elements of Materia Medica' then in preparation, twenty-five of which have been published in that work.

One of the greatest improvements in the microscope as a working instrument was that carried out by Mr. Jackson in the construction of the continuous bar, supporting the body of the instrument above the stage, and carrying a small secondary body below, the whole bar being planed from end to end on one level, and with rack; this secondary body carrying the achromatic or other condenser, polarising prism, dark well, &c. In this way the axis of the instrument is perfectly continuous, and no centering or adjustment is required.

Three sets of castings were made from the patterns which he had constructed, two of which were given to his friends, Mr. Alfred White and the late Mr. Greening; and the patterns were then transferred to Messrs. Smith and Beck, and exist in the present form of their No. 1 instrument.

In 1858 Mr. Jackson was elected one of the managers of the London Institution.

In his own profession in mechanical surgery he exhibited considerable tact and skill; and although such requirements were seldom brought into action, yet it was a source of great delight to him if he could by some simple contrivance alleviate the sufferings of his patients, and thus facilitate their cure. One of the last undertakings of his life was the production of a very simple and most efficient contrivance for reducing dislocations of the shoulder-joint—an operation at times, in very muscular subjects, very difficult to perform.

His quiet and unassuming manners, his clear and upright mind, rendered him generally beloved; and the readiness with which he was ever willing to communicate to others whatever knowledge he might have acquired made his acquaintance and society both profitable and engaging to all who had the privilege of his friendship.

The other gentlemen whose loss we regret were more distinguished for their love of science than for their practical investigations.

The several reports which have been read to you will show that the Society is in a flourishing condition; its members, its list of books, and its museum are being daily increased; and though your President has been unable to perform the duties of his office, yet owing to the kindness of friends his place has been most ably filled, and in the hope that in years to come more and more will join our ranks, he begs to resign the chair to one who is in every way calculated to do it honour.

Descriptions *of* New *and* Rare Diatoms. Series I.

By R. K. Greville, LL.D., F.R.S.E., &c.

(Read March 12th.)

Stictodiscus, n. gen., *Grev.*

Frustules simple, discoid, divided by radiating lines into numerous plicate compartments. Lines not reaching the centre. Compartments furnished with conspicuous transparent, pore-like puncta. (In the four typical species, large scattered puncta also occupy the blank central portion of the disc.)

This genus is founded primarily upon *Discoplea? Rota* and *D.? Rotula* of Ehrenberg, and two most beautiful diatoms which occur in a deposit found in the Island of Trinidad. While engaged in preparing a description of the two latter, my friend, Mr. Ralfs, directed my attention to the idea thrown out by Ehrenberg, that *Actinoptychus dives,* and *Cyclotella Rota,* and *C. Rotula* might be generically associated; and that they would come very conveniently into the new genus I was proposing to establish. The words of Ehrenberg are (under his definition of *Discoplea? Rota*)—"Proxime ad *Actinoptychum divitem* in Græciâ fossilem accedens forma, et cum ea forsan, et cum sequente (*Discoplea? Rotula*) in peculiari genere reponenda." ('Bericht. Berl. Akad.,' 1844, p. 202). I entirely concur in this view. Four of the species enumerated in this paper, namely, *Stictodiscus Buryanus, S. Johnsonianus, S. Rota,* and *S. Rotula,* may be considered typical, being distinguished not only by the pore-like puncta or papillæ, or whatever they may be called, which occupy a definite (?) arrangement within the compartments, but by large puncta remotely scattered over the convex and otherwise blank centre of the disc. The remaining species, which agree in general habit, and in the presence of definitely arranged puncta or cellules within the compartments, may be at least retained provisionally.

For the discovery of the deposit in Trinidad, new, I believe, to the microscopic world, we are indebted to Dr. John Davy, well known for his researches in various departments of natural history. He kindly informs me that, from his observations made in Trinidad, he is disposed to consider the formation in which the deposit occurs as connected with the New Red Sandstone; adjoining to which is the sandstone, probably of the same description, in which the Pitch Lake is situated. The extent of the deposit is not known; but, like that in Barbadoes, it is probably large both in surface and depth. It does not contain a great variety of diatomaceous forms; but various new and interesting species have already been observed in it.

Stictodiscus Buryanus, n. sp., Grev.—Pore-like puncta at the marginal extremity of each compartment, forming a pyramidal group; rays 30; diameter ·0040″ (Pl. IV, fig. 1).

Hab. Deposit at South Naparima, Trinidad; Mrs. Bury.

The disc of this superlatively beautiful diatom is transparent and gently convex, remotely dotted over with large, clear, pore-like puncta, exhibiting also the shadows of puncta belonging to the lower valve. The marginal groups consist of six or seven. The radiating lines (septa?) are free for more than half their length, and then, after anastomosing, become faint and inconspicuous before reaching the centre. When these lines are accurately focussed, the plicate character of the disc is not visible, but by changing the focus it becomes conspicuous (fig. 2). A single specimen only has hitherto been observed, for which my cabinet is indebted to the generous kindness of its discoverer.

Stictodiscus Rota (Ehr.), Grev.—" Disco amplo superficie inæqualiter papillosa, papillis centralibus majoribus, margine radiis 52 æqualibus centrum non attingentibus intervallorum papillis sparsis."

Discoplea? Rota, Ehr., 'Bericht. Berl. Akad.,' 1844, p. 202; 'Microgeol.,' pl. xxxv, A. 22, fig. 6.

Cyclotella Rota, Kütz., 'Sp. Alg.,' p. 19; Ralfs in Pritch. 'Infus.,' 4th edit., p. 812.

Hab. Southern Ocean.

The figure given of this diatom, by Ehrenberg, indicates very clearly that it is a genuine *Stictodiscus*. The valve is very large, the radiating lines much shorter than in the other species; the puncta within the compartments disposed, apparently, in an irregular double series, and extend as far as the termination of the lines. The whole central space is covered with numerous large puncta, as in the preceding species.

Stictodiscus Rotula (Ehr.), Grev.—Puncta equal, remotely scattered over the blank centre of the disc, those within the compartments irregularly (?) disposed; rays 20.

Discoplea? Rotula, Ehr., 'Microgeol.,' pl. xxxv, A. 22, fig. 7.

Cyclotella Rotula, Kütz., 'Sp. Alg.,' p. 19; Ralfs in Pritch. 'Infus.,' 4th edit., p. 840.

Hab. Southern Ocean.

A very small species compared with the preceding, but evidently closely allied to it, the prominent character of the scattered central puncta being distinctly exhibited in Ehrenberg's rude figure. The small number of rays at once separates it from all the others.

Stictodiscus Johnsonianus, n. sp., Grev.—Pore-like puncta of each compartment equal, forming a short linear series; rays 50; diameter ·0034″. (Pl. IV, fig. 3.)

Hab. Deposit at South Naparima, Trinidad; Christopher Johnson, Esq.

Not less beautiful than *Stictodiscus Buryanus*, and well distinguished by the single series of puncta in each compartment, which extends from the margin to about a third of the distance between it and the centre. Other puncta are scattered over the surface of the disc, as in the two previous species. A single example only has been found, for the possession of which I have again to acknowledge the kindness of Mrs. Bury.

Stictodiscus insignis, n. sp., Grev.—Cellules large at the margin, forming a moniliform series in each compartment to near the centre; rays 46; diameter ·0021″. (Pl. IV, fig. 4.)

Hab. Barbadoes deposit; very rare.

A small but exquisite diatom, of which I have as yet only seen two individuals. It will be at once recognised by the puncta, or in this instance rather cellules, which, commencing at the margin, continue in a moniliform series, and decreasing gradually in size until they approach the centre, when they lose their radiating character and occupy the entire surface.

In this species we do not find the peculiar puncta scattered over the central portion of the disc, so characteristic of the three preceding species, while the centre itself is fully occupied with puncta or minute cellules similar to those of the compartments. The valve is also much less convex.

Stictodiscus dives (Ehr.), Grev.—Pore-like puncta in each compartment minute, equal, forming a single series; rays 52 (centre minutely punctate?).

Discoplea? dives, Ehr.

Actinoptychus dives, Ehr. 'Microgeol,' Pl. xix, fig. 12; Ralfs in Pritch. 'Infus.' 4th ed., p. 840.

Cyclotella dives, Kütz., 'Sp. Alg.,' p. 20.

Hab. Egina.

The appearance of this disc, as far as we can judge from Ehrenberg's figure, is sufficiently striking to justify its provisional admission into the genus. No central punctation, however, is exhibited in the figure.

Coscinodiscus.

Coscinodiscus armatus, n. sp., Grev.—Cellules minute, equal, radiating, about 13 in ·001″; the disc furnished, towards the margin, with numerous, radiating, spine-like ridges. Diameter ·0025″ to ·0035″. (Pl. IV, fig. 5.)

Hab. Barbadoes deposit; very rare.

A curious species, resembling very closely, in the marginal ridge-like spines or processes, *Brightwellia Johnsoni* (Ralfs, MS.); one of the most beautiful of the many new diatoms which have been found in this deposit. When the disc is viewed in the position in which it usually presents itself, that is, vertically, these processes appear as short, thickened lines tapering towards the centre; but an oblique view brings out their real character.

Coscinodiscus tuberculatus, n. sp., Grev.—Disc with a deep pore-like umbilicus; cellules radiating, subequal, the longer series terminating in marginal tubercles; cellules 9 in ·001″; marginal striæ 25 in ·001″. Diameter ·0025″ to ·0035″, or more. (Fig. 6.)

Hab. Barbadoes deposit; frequent.

Cellules hexagonal; those immediately surrounding the umbilicus small; the rest nearly equal till near the margin, where they become again smaller. The longer rays of cellules appear to be in pairs, and it is the line of separation between them which terminates in the tubercle. The latter, on an oblique view, is seen to form an obtuse process. The margin is distinctly and rather broadly striated.

Coscinodiscus biradiatus, n. sp., Grev.—Granules distinct, filling up the centre irregularly, afterwards radiating, large, prominent, somewhat quadrangular, gradually diminishing in size to the margin; rays distant, the long ones alternating with a shorter series; margin with a row of minute puncta. Diameter ·0035″. (Fig. 7.)

Hab. Barbadoes deposit; rare.

An object of exceeding beauty and brilliancy. The disc is very convex; and in taking a vertical view, and in passing the focus down the side of the disc, the effect is very striking; the prominence of the granules being so great as to cause the rays, when so viewed in perspective, to resemble the ribs and tubercles of a *Cardium*. There is no umbilicus.

Coscinodiscus elegantulus, n. sp., Grev.—Granules minute, subequal, irregularly scattered over a central space equal to about a third of the diameter of the disc; they afterwards form a single series of distant, often somewhat curved, rays; margin with a row of very minute puncta. Diameter ·0017″. (Fig. 8.)

Hab. Barbadoes deposit; rare.

A very delicate, transparent little disc, easily overlooked, but well marked by its wide fringe-like rays.

Coscinodiscus Barbadensis, n. sp., Grev.—Disc divided into compartments by double lines of punctiform cellules, the intervals between the lines being so clearly defined as to present the appearance of rays; cellules within the compartments less conspicuously radiate, subequal, except at the margin; 15 in ·001″; diameter of disc ·0025″. (Fig. 9.)

Hab. Barbadoes deposit; very rare.

Disc convex, very delicate, and apt to be overlooked even by careful observers. Under a moderately magnifying power it would scarcely be taken for a *Coscinodiscus*, as it rather suggests the idea of an *Actinocyclus* (Ehrenberg, not Smith); but, under a higher power, the apparent rays are found to result from the space left between two lines of cellules, which radiate from the centre to the circumference. Further observations may determine the presence of an umbilical pore. One of my specimens is injured at that part; and the other shows, although obscurely, an approach to such a character.

TRICERATIUM.

Triceratium capitatum, n. sp., Ralfs.—Valve with the angles much produced and capitate, and separated from the centre by a transverse line; surface with indistinct, scattered puncta, and two spines. Distance between the angles about ·0019″. (Fig. 10.)

Hab. Barbadoes deposit; extremely rare.

"A small species, with very indistinct puncta. Valves, irrespective of the produced angles, straight or slightly convex." (Ralfs.) The frustule appears to be not unfrequently imperfect or mutilated. I had examined half a dozen examples before I perceived any trace of puncta at all. Mr. Rylands then kindly communicated a specimen, in which, in addition to the central puncta, a few larger and more definite puncta were scattered on the narrow portion of the produced angles, and the surface was also furnished with two conspicuous spines. I have subsequently found two frustules myself, exhibiting very distinctly these characters.

Triceratium Westianum, n. sp., Grev.—Sides of the valve deeply and sharply concave; angles forming segments of circles, separated from the centre by transverse lines; margin of the angles with very short radiating lines; surface strongly punctate; distance between the angles ·0018.″ (Fig. 11.)

Hab. Barbadoes deposit; extremely rare.

I have much pleasure in dedicating this remarkable and ornate species to my friend, Mr. Tuffen West, the unrivalled illustrator of the Diatomaceæ, and who is well acquainted with the nature of the objects themselves. It is allied to *Triceratium castellatum,* described by himself, from the same deposit, in the eighth volume of the 'Transactions of the Microscopical Society;' but is, in several important characters, perfectly distinct. Like most of the species of *Triceratia* discovered in this mine of novelties, it is excessively rare. I have only met with six specimens.

Triceratium Barbadense, n. sp., Grev.—Sides of the frustule gently concave; angles broadly rounded, separated from the centre by transverse lines; whole valve closely and minutely punctate. Distance between the angles ·0016″. (Fig. 12.)

Hab. Barbadoes deposit; excessively rare.

Allied to *T. castellatum,* but differs in the form; the sides of the valve not being nearly so deeply concave, and the angles, instead of swelling into segments of circles, being merely broadly rounded.

Triceratium nitidum, n. sp., Grev.—Sides of frustule rather deeply concave, angles ovate, separated from the centre by transverse lines; whole valve punctate; puncta of the central space radiating, and becoming conspicuous as they reach the margin. Distance between the angles, ·0014″. (Fig. 13.)

Hab. Barbadoes deposit; extremely rare.

I am not aware of any described species for which this can be mistaken. A good character exists in the puncta of the centre, which radiate in single lines, becoming gradually larger and the lines more distinct as they approach the margin.

Triceratium cellulosum, n. sp., Grev.—Sides of the valve straight; angles with pseudo-nodules, obtuse, separated from the centre by transverse lines; centre and angles coarsely and irregularly cellulose; cellules of the former more or less ovate or oval, and disposed in a radiating direction, though not in lines; those of the latter in rows parallel with the separating line. Distance between the angles ·0026″. (Fig. 14.)

Hab. Barbadoes deposit; exceedingly rare.

Large and robust, as compared with many of the Barbadoes species; and so peculiar in its characters as to be instantaneously recognised. The cellules of the angles are somewhat quadrate, and hence those parts of the valve have a sort of cancellated aspect. The lines which separate the angles from the central area appear as linear spaces left unoccupied by the cellules.

Murrayfield, Edinburgh; January 15th, 1861.

The following new species of *Triceratium* have also been discovered in the Barbadoes deposit, and will be figured and more fully described in a future number.

T. aculeatum, Grev.—Sides of valve gently and evenly concave; angles somewhat obtuse, with a decided pseudonodule; granules irregularly radiant; centre convex, with three spines. Distance between the angles ·0022″.

T. cornutum, Grev.—Valve (in my specimen four-angled) with straight sides, and sharp angles furnished with strong horn-like processes; surface minutely granulose in radiating lines; centre with three spines. Distance between the angles ·0015″.

T. productum, Grev.—Valve punctate; angles produced, capitate; centre divided into compartments by radiating, vein-like lines. Distance between the angles ·0027″.

T. inconspicuum, Grev.—Minute, sparsely punctate; valves (in my specimens four-angled) with the angles semicircular, separated from the centre by a transverse line; centre bordered with a row of puncta. Distance between the angles ·0005″.

T. delicatum, Grev.—Minute; valve with slightly concave sides and broadly rounded angles, filled up with transverse rows of fine puncta; centre containing a pale, obtusely triangular band, within which is a triangular spot bordered with puncta. Distance between the angles ·0012″.

T. ornatum, Grev.—Valve with rounded angles and convex sides; conspicuous pearly granules sparingly scattered in the semi-blank central space, and forming a broad marginal band of radiating lines, which are 7 in ·001″. Distance between the angles ·0024″.

T. labyrinthæum, Grev.—Valve with rounded angles and slightly convex sides; the centre occupied with a network of widely anastomosing, vein-like lines, from the boundary of which short lines are given off towards the margin; spaces enclosed by the anastomosing lines finely punctate. Distance between the angles ·0023″.

T. blanditum, Grev.— Sides of valve (in my specimen four-angled) deeply concave; angles sub-hemispherical; centre with a small blank space; granules conspicuous, subremote, equal, forming straight, equidistant, parallel lines, 11 in ·001″. Distance between the angles ·0020″.

TRANSACTIONS.

On the Metamorphoses *of a* Coccus *found upon* Oranges.* By Richard Beck.

(Read March 13th, 1861.)

If the external surface of almost any of the sweet oranges be only cursorily examined, it will be found more or less spotted with small scales, the shields of a coccus or scale insect; they are adherent to the rind of the orange, but can easily be detached; and, on turning one of the larger ones over, it will be found, on examination under a low power, to present, as the most striking feature, a large accumulation of eggs lying beneath a cottony secretion (Plate V, fig. 1, *b*); very frequently these eggs are in the process of hatching, and, under such circumstances, we have the insect in its larva state (fig. 3).

The body is white, oval, and very flat: there are two antennæ proceeding from underneath; they are about one fourth the length of the body, rather hairy, and of eight or nine joints, two very small light-pink ocelli, or simple eyes, occur one on each side, at the very edge of the body, and about where the long curves of the oval commence; considerably below the antennæ is a proboscis, a long and apparently horny tube, proceeding from a conical base. These, with the exception of a few isolated hairs, are the only external organs of the head that are apparent. The legs are six in number, each consisting of, I think, four members; the terminal ones being provided with a hook, and two or more very small suckers hardly to be distinguished from

* The author considers these observations as very incomplete; his object in laying them before the society in such a state was to afford any member an opportunity of investigating the subject whilst the oranges were in season, having since found that the same coccus is in great quantities on plants in this country, and that the eggs are now hatching; he would still call the attention of microscopists to the subject.

hairs. At the extremity of the body two exceedingly minute hairs trail behind for some considerable length; and besides these are numerous setæ and orifices, parts, I believe, of the organ for the secretion of the cottony substance and the hard shield.

The locomotive power of the larva—and this is the only time it makes use of it—is I believe very limited; frequently it settles close to the parent home, and I imagine that when once the proboscis is inserted in the orange it is never removed; the insect thus located, the skin on the back changes to a darker colour, thickens, and ultimately becomes a cast skin, the coccus having retreated between the secretions of the hard shield, as a protection above, and the cottony substance as a close attachment below, but to neither of them is it ever adherent; at this stage it also loses every trace of antennæ, legs, and eyes, whilst, on the contrary, the proboscis is more fully developed: this is evidently the pupa state, and thus far I have been unable to detect any difference between male and female.

The first indication that I have found of the male insect is the presence of two dark and rather diffused red spots in the head, and also a simultaneous disappearance of the proboscis (fig. 4). Then after a skin is cast, there is an entire disappearance of the organs for the secretions of the shield, which is completed of a long and narrow shape; one stage more in advance and the ocelli are black and distinct, and there can be traced two long antennæ and two wings at the side; six legs are also in process of development, the two in front being directed forward, which is a peculiarity of the pupa of this genus; and at the extremity of the body is a protuberance I imagine to be the male organ (fig. 5). Another skin is yet cast, and then there is a perfect male insect (fig. 6). The ocelli are four, two above and two below; the antennæ, eight or nine jointed, very delicate, hairy, and nearly the length of the whole body; the legs have four members, the terminal one of each being provided with a single hook and two or more delicate suckers; the wings project considerably beyond the body, they are transparent, but covered with very minute hairs, and strengthened by a simple ribbing of two corrugations which unite at the base. The two halterers or poisers are oval, and terminate with a hair bent like a hook at the extremity; and that which I presume to be the male organ is long, attenuated, and attached at its base to, and immediately above, a truncated projection which has an aperture at its apex.

We thus find in the male complete insect metamorphoses.

I am unable to say as much of the female, though I presume such must be the case, as only a perfect insect is capable of reproducing its species. I have not as yet paid as much attention to this sex, but so far as my investigations have gone, after it has changed into the pupa state all external organs entirely disappear, excepting those at the extremity of the body, and the proboscis, which becomes stronger and larger (fig. 8); the secretion of the shield is continued until nearly four or five times the size of the male, and the body of the insect bears about the same proportion; it then deposits its eggs, between one and two hundred in number, which are placed on end in great regularity, and the first ones will frequently be found hatching before the last are laid.

The external surface of the shield of the male (fig. 7) gives very marked indications of the three changes that have taken place: first, there is the cast skin of the larva; secondly, the shield for the pupa; and thirdly, a thin and short addition to the shield for the wings of the imago, which I believe is lifted up when the insect escapes.

There are also three similar indications on the external surface of the female shield, and these may also warrant the conclusion that its metamorphoses have been complete.

It is somewhat surprising that these cocci are to be found in a living state at all, after the change they must have experienced in the climate; it is, however, very evident that the larva and pupa states are much hardier than that of the imago; at least so far as the males are concerned, I have found it very difficult to obtain any alive after the external organs were fully developed. As it is, the circumstances under which they appear are very favorable to their examination; one single orange, if well selected, will supply every condition I have mentioned; and I imagine that from the fact of the shield being such a complete protection, the metamorphoses are more distinct in their development than under the more ordinary circumstances where the insect itself is exposed. I have invariably used Mr. Wenham's binocular arrangement with the microscope, and I can only say that for this class of investigations the results are perfectly marvellous.

On the Microscopic Characters *of the* Crystals *of* Arsenious Acid. By William A. Guy, M.B. Cantab., Professor of Forensic Medicine, King's College, London.

(Read May 8th, 1861.)

In submitting to your society this paper on the miscroscopic characters of the crystals of arsenious acid, I have two principal objects in view. I wish, in the first place, to illustrate, by a striking instance, the great value of the binocular microscope as a means of diagnosis; and, in the second place, to give a more exact account than any at present in existence of the crystalline forms assumed by a very important poison. That to render such an account is not a work of mere supererogation, a reference to the descriptions of the crystals given in works of authority would readily prove.

Most authors describe the crystals as regular octahedra, without recognising any other crystalline forms. Some writers, however, speak of the regular octahedron and its modifications, or of forms traceable to the octahedron; and acicular crystals, long prismatic needles, triangular and hexagonal plates, and even tetrahedra, are to be met with in the descriptions of authors.*

I may add that, in illustrated works, the octahedral crystals are usually figured in the form in which they are most readily identified; the less usual positions of the octahedra and the rarer forms and modifications of the crystal being omitted.

The imperfect and somewhat conflicting accounts thus given of the crystals of arsenious acid are, doubtless, to be explained, partly by the difficulty of examining them, whether by lens or microscope, when sublimed, as they were formerly, in thick reduction-tubes of narrow bore; partly to the great variety of lights and shadows presented by the crystals, especially when viewed by transmitted light; and partly to the imperfect relief given to the crystals when examined by the monocular microscope.

* Consult Pereira's 'Materia Medica,' 4th edition, p. 685, in which the tetrahedron is mentioned as one form of the crystal; Miller's 'Elements of Chemistry,' part ii, p. 961, in which mention is made of long prismatic needles, isomorphous with those of oxide of antimony; and Taylor, on 'Poisons,' 2d edition, p. 385, in which equilateral triangular plates are specified. Pereira cites a foreign authority (Wöhler) who found in a cobalt roasting-furnace arsenious acid crystallised in hexahedral plates derived from a right rhombic prism.

The substitution of the modern form of reduction-tube, in which the vapours of arsenious acid are made to pass through a narrow glass tube with thin sides, has made the examination by the microscope more easy; but the simple plan which I suggested about three years since, for obtaining the crystals on a flat surface, has offered still greater facilities, of which it is but natural that I should have largely availed myself. The knowledge of the subject thus obtained may be said to have been completed by the use of the binocular microscope.

The most superficial and cursory examination of the first specimens obtained upon a flat surface sufficed to convince me that very much remained to be done before our knowledge of the true crystalline characters of arsenious acid could be placed on a level with the practical importance of such knowledge. In the first place, it was quite clear that those descriptions which spoke only of the regular octahedron as the one proper form of the crystal were wholly inadequate; and that even those which recognised, not only the perfect crystal, but all the forms traceable to the octahedron were still insufficient. We ought to know what particular forms to look for. Again, it must be interesting, and might be practically important to know something more of the alleged acicular or prismatic crystals, of the triangular and hexagonal plates, and of the tetrahedra, described and figured in Pereira's work. The crystallographer, too, could scarcely abstain from speculating on the possible occurrence among these octahedra of those other members of the regular system, the cube and the rhombic dodecahedron. Some, if not all, of these questions I hope to be able to answer, without proving tedious to those who have not the special interest in this subject which I have myself. Reverting to my early examinations of the crystalline deposits of arsenious acid as obtained on a flat surface, I may state that I encountered many forms and appearances which I was not able to explain to my own satisfaction. When viewed by transmitted light, a large proportion of the crystals wore the appearance of dark squares, a smaller number of dark oblong figures, a still smaller number of long, thick, black lines. These latter, the long lines, I took to be the acicular or prismatic crystals described in books. The dark squares and oblongs were not so readily explained. Then, again, I encountered among the crystals transmitting or reflecting light, in addition to forms which might be merely different attitudes or postures of the regular octahedron, or of the truncated octahedron, or of the lengthened octahedron, well-formed triangular prisms, terminated at either end by triangular facettes, also twin-crystals or *mâcles,* also equilateral triangles resting on half the adjoining triangle as a base. I will not take up your time further by specifying all the forms which at first puzzled and perplexed me. Suffice it to say that, in the full consciousness that I did not understand the things I saw, I determined to turn for awhile from nature on the small scale to art on the large. I procured octahedra of wood, and not being satisfied with them, prevailed on Messrs. Powell, of Whitefriars, to make me the crystals of glass now before you. By studying these large models, placing them in all sorts of positions, and viewing them from different points and in different lights, I was prepared to understand most of the appearances under the microscope. The broader shadows of the transparent glass crystals were reproduced in the small crystals of arsenious acid, and the several postures which I caused the large crystals to assume were recognisable under the microscope. I found that the sublimed crystals adhered to the flat surface of glass by their solid angles, by their edges, and by their faces, as well as in positions less easily described. I also inferred that the dark squares were crystals (octahedra) adhering to the glass by their solid angles, in which position, as my glass model taught me, the play of lights and shadows was such as to occasion confusion and possible darkness. This suspicion, which was strengthened somewhat when I examined the sublimates by reflected light, became certainty under the binocular microscope. Under that admirable instrument, with reflected light, there are no dark masses, and no obscure forms. The meaning of the dark oblong forms and of the dark lines which I at first identified with the acicular or prismatic crystals of authors did not occur to me till later in my inquiries.

I have mentioned the frequent occurrence of the three-sided prism with bevelled extremities. I do not mean the figure sometimes described as a lengthened octahedron, but a figure having the deceptive appearance of a triangular prism. Was this a distinct crystalline form, or might it not be some aspect of the octahedron? It obviously could not be brought about by any attitude of the whole crystal; but my wooden model, supplied by Professor Tennant, is cut in half by a plane parallel to, and equidistant from, two of its faces, and these two equal halves of the-crystal are made to rotate on each other, so as to show the twin-crystal, or *mâcle*. Here, then, without supposing any new form of crystal, there was new material for speculation. I had seen the twin-crystal, or *mâcle,* in almost every specimen I examined. Hence, it was clear that half-crystals were among the possibilities of arsenious acid sublimed. Well, this half-crystal which I was soon encouraged to have made in glass, when placed in a certain position, gave me the precise figure which had perplexed me; it gave also the equilateral triangle with the half adjoining triangle for its base (one of the commonest crystalline forms); also, the half-triangle itself; also the hexagon, and the hexagon tipped with three small, dark, triangular facettes.

Now this appearance of a triangular prism, terminated at each end with an equilateral triangle, is given by the tilting forward of the half-crystal; and just as the whole crystal adhering by a solid angle becomes by transmitted light a dark square, so this half-crystal appears as a dark oblong.

But the long dark lines which I had taken for needles or prisms, what were they? Possibly not distinct and separate crystals, but only deceptive appearances like the dark squares and oblongs. Could they be the forward edges of large deep plates, owing their dark appearance to the same depth of crystalline mass? It was reserved for the binocular microscope to demonstrate this. On examining with this instrument a vast number of specimens, and passing under review thousands and thousands of crystals, I find many large hexagonal plates with their edges thrown forward, but very few prismatic crystals. I also find triangular plates of various thickness, square plates also of varying substance, and a few rhombic and rhomboidal plates. But my catalogue is not yet exhausted. Before I made use of the binocular microscope, I thought that I had encountered one or two cubes; but as the assertion that I had met with cubes was received somewhat incredulously, I looked for them in the field of the binocular with great interest. I found several figures which approached very closely to the cube, and in one instance encountered a perfect cubical crystal. I say this without any sort of hesitation. I have also more frequently met with the rhombic dodecahedron, and its *mâcle,* or twin-crystal. I have not yet seen a tetrahedron; though in one specimen obtained from Scheele's green, and abounding in triangles less symmetrically formed than usual, I thought that I discerned the marks of the tetrahedron. Be this as it may, I am quite sure that this form of crystal should be set down among mere possibilities: I have not seen it in any one of many hundreds of specimens of crystalline deposit obtained from arsenious acid itself, or from the metal arsenic. It is probable that the deep triangular plates, which abound in some specimens, have been taken for tetrahedra.

I have now briefly sketched the course of experiments, observations, and inferences by which I was gradually possessed of my existing knowledge of these interesting crystalline forms. Something I learnt from actual examination; such, for instance, as the common appearances of the perfect octahedron, and the fact of the existence of plates of various forms, as well as of crystals other than the octahedron. Something more I learnt by inferences drawn from the close examination of models of the crystal and half-crystal, opaque and transparent. I understood at once the twin-crystal, or *mâcle*. I inferred that the equilateral triangle mounted on a half-triangle as its base, the hexagon with three-shaded points, and the triangular prism were merely phases of the half-crystal; and I thought it likely that some of the detached equilateral triangles and some of the hexagons might be explained in the same manner. But I remained quite satisfied with the belief that a considerable number of the long narrow crystals were prisms. I was not quite satisfied of the existence of triangular plates or of hexagonal plates. I spoke doubtfully about cubes, and had not been able to make out the rhombic dodecahedron; and I felt that my views concerning the large part played by the half-crystal, though highly probable, were still only probable. But under the binocular microscope all my doubts were dissipated, all my errors corrected, some surmises confirmed, and most of my inferences justified. That which had been a work partly of observation, and partly of reasoning, became a simple matter of sensation. If there is any one who doubts the value of this form of the microscope, or is disposed to treat it simply as a philosophical toy, I will ask him to examine these crystals with the monocular microscope by transmitted light, and with the binocular microscope by reflected light; and I would especially commend to his attention the crystalline and globular sublimate (crystals of arsenious acid, and globules of metallic arsenic) shown in the capillary reduction-tube. The fine relief and perfect roundness of the tube and its contents is, at one and the same time, a proof of the utility and of the faithfulness of the binocular microscope.

With a view to give completeness to this paper, I will first briefly describe and illustrate by appropriate engravings, corresponding with the large diagrams and models shown at the meeting, the various attitudes and appearances of the entire octahedron and of the half-crystal, as deduced from the study of models of wood and glass,* and then exhibit some

* Since the paper was read, I have added studies of the rhombic dodecahedron, similar to those of the octahedron which were shown in the diagrams exhibited at the meeting. This addition goes far towards exhausting the crystalline forms of sublimed arsenious acid.

of the leading forms as seen under the monocular microscope by transmitted light, and under the binocular microscope by reflected light. I also append, at the desire of the editors of the Journal, a short account of the best mode of obtaining the crystals of arsenious acid for microscopic examination.

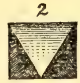
1. *The entire crystal.*

a. The crystal adhering by one of its edges, and displaying two sides (fig. 1).

1

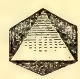
b. The crystal adhering by one of its faces, and displaying three sides (fig. 2).

2



c. The crystal adhering by one of its faces, and so seen as to display four sides (fig. 3).

3



d. The crystal adhering by a solid angle, so as to show four equal faces (fig. 4). In this position the crystals appear by transmitted light as black squares.

4

e. The crystal adhering by one of its faces, and showing the lights and shadows of the transparent model (fig. 5).

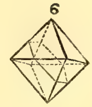
5

2. *The half-crystal.*

The regular octahedron may be divided into two symmetrical bodies—

1. By a plane parallel to two faces of the crystal (fig. 6).

6



The sections thus formed are bounded by a hexagon and by an equilateral triangle, and they have the appearance shown in fig. 7.

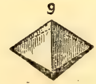
7

2. By a plane passing through four edges of the crystal, each section being a four-side pyramid on a square base (fig. 8).

8

3. By a plane cutting the equilateral triangular faces of the crystal into two equal right-angled triangles, each section presenting a rhombic face (fig. 9).

9



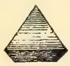
The first section supplies the following forms:

a. The equilateral triangle (fig. 10).

b. The equilateral triangle resting on half the adjoining triangle as a base (fig. 11).

10

11

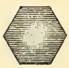


This is a very common aspect of the half-crystal.

c. The hexagon. (fig. 12.)

d. The hexagon with the three small triangular facettes in shadow (fig. 13).

12



13

This also is a very common aspect of the half-crystal.

e. The half-triangle (fig. 14.)

f. The edge of the half-crystal tilted forward, so as to give the appearance of a triangular prism (fig. 15).

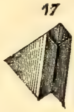
14

15

This again is a very common aspect of the half-crystal.

16

17



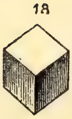
g. The *mâcle* or twin-crystal, formed by the partial rotation of two half-crystals on each other (fig. 16).

h. The same, with the triangular face of one half-crystal visible (fig. 17).

The second and third sections are of rare occurrence, and do not assume appearances requiring more minute description.

3. *The rhombic dodecahedron.*

18

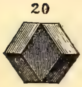


a. Three sides visible, so as to resemble the perspective of a cube (fig. 18).

19

b. Four sides visible, and a solid angle projected forward (fig. 19).

20

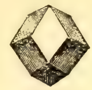


c. Five sides visible (fig. 20).

21

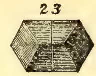
d. Five sides visible; another aspect of the crystal (fig. 21).

22



e. Six sides visible (fig. 22).

23



f. The *mâcle* or twin-crystal of the rhombic dodecahedron (fig. 23).

24

g. The *mâcle* or twin-crystal; another view (fig. 24).

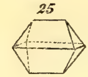
Having now figured some of the leading appearances which the models of the octahedron and rhombic dodecahedron, with their half-crystals, may be made to assume by changes of position, I proceed to give a brief summary of the crystalline forms which I have been able to distinctly recognise in the course of my examinations of the sublimates of arsenious acid.

1. The crystalline sublimates of arsenious acid consist of regular octahedra, rhombic dodecahedra, cubes, plates, and prisms.

2. The regular octahedra may be entire and homogeneous, or they may be variously truncated and notched, mottled and figured; and they may assume any of the forms depicted in figures 1, 2, 3, 4, and 5.

3. The entire regular octahedron may also be modified as in the annexed engraving (fig. 25).

25



4. The octahedron may present itself as a half-crystal in any of the forms depicted in figures 7 to 15, inclusive.

5. The half-crystals may be combined to form *mâcles,* or twin-crystals, as in figures 16 and 17.

6. The entire crystal and the half-crystal may have their edges notched, so as to yield figures resembling the trefoil, or *fleur-de-lis,* as in the annexed figure (fig. 26).

26

7. The rhombic dodecahedron may present itself entire in any of the forms depicted in figures 18 to 22.

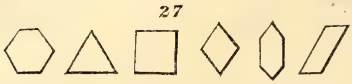
8. The rhombic dodecahedron may present itself as a half-crystal; and two half-crystals may be united to produce the *mâcles,* or twin-crystals depicted in figures 23 and 24.

9. The cube is a very rare form among the crystals of arsenious acid.

10. The plates present themselves as hexagons, equilateral triangles, squares, rhombs, and rhomboids; and they may be of any thickness, from that of thin iridescent films, to the

third or the half of the diameters of the faces of the plates. They may also greatly exceed in size the largest crystals of the groups in which they are found. The principal forms are shown in the annexed figure (fig. 27).

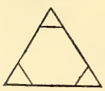
27



28

11. Sometimes compound plates of large size and symmetrical form are found united at angles corresponding with those of the faces of the octahedron, as in fig. 28. At other times they are grouped with great irregularity. In other instances plates, such as the equilateral triangle, are found built up by a hexagonal plate symmetrically joined to three equilateral triangles, as in fig. 29.

29



30

12. The prisms are either four-sided prisms of small size, or they are large four-sided rectangular prisms terminated by four-sided pyramids (fig. 30).

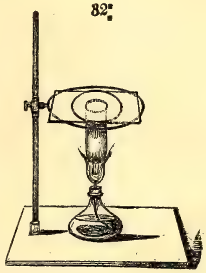
31

13. Sometimes the prisms are shorter, and present the form depicted in the subjoined figure (fig. 31).

To this detailed description it is only necessary to add that there is great variety to be found in groups of crystals of arsenious acid produced at the same time and in the same way. In some groups the crystals are perfect, free from spot or blemish, transparent, and brilliant; in others, notched or truncated, mottled and figured, and translucent; in some the regular octahedron is the prevailing form, other forms being exceptional; in others, plates predominte, and are nearly as numerous as the crystals themselves; occasionally equilateral triangular plates occupy the whole field, to the exclusion of almost all other forms. The lithographic plate (Pl. VI) appended to the paper, and showing the sublimates as they appear by the monocular and binocular microscope, by transmitted and reflected light, will give some idea of the variety of forms which the crystals assume.

The best mode of obtaining the crystals of arsenious acid may be described in a few words. The apparatus required consists of a spirit-lamp with small flame, specimen tubes of small diameter and not exceeding an inch in length, and slides or discs of crown glass. A few grains of arsenious acid are placed in a clean and dry specimen tube, and this in a convenient holder, consisting of a slip of copper or brass punched or drilled to receive it. The tube is to be held over the flame of the lamp till the acid collects as crystals, or as a white powder, round the orifice of the tube. The slides or discs are then to be heated in the flame of the lamp, so as to drive off the moisture, and raise considerably the temperature, of the glass. The slide or disc, thus heated, is to be placed over the mouth of the tube, and kept there till bright spots appear on its under surface. The spirit-lamp is then to be removed, and the glass allowed to cool. The process may be conducted with the two hands over the lamp, or the holder may be supported on a retort-stand, as is shown in figure 32, and the spirit-lamp removed for a time after each operation. Good results can only be obtained when the slide or disc is heated; but if too much heat is used, the crystals are dissipated as soon as formed. When the operation is quite successful, we obtain one of the most beautiful of microscopic objects, and one of the very best illustrations of the value of the binocular microscope as a means of identification and diagnosis.*

32.



On a New Hemispherical Condenser *for the* Microscope, *and its use in illustrating an important principle in Microscopic Illumination.* By the Rev. J. B. Reade, F.R.S.

(Read May 8th, 1861.)

The condenser which I am now using has been so favorably received by several of my friends, that I am induced, at their request, to offer a description of it to the members of our society. I need scarcely say, that an unpretending single lens cannot be proposed as a rival to the almost perfect combinations in use among us; but it may, perhaps, take its place as an efficient adjunct to the microscopes of those observers who are disinclined, from one consideration or another, to procure more expensive apparatus.

The condenser consists of a hemisphere of glass, about one and three-quarter inches in diameter, with an arrangement of stops by which difficult test objects are well defined under half-inch object-glasses of 90° aperture. It is set in a thin brass ring, and screws upon a cylinder adapted, like other fittings, to the opening of the sub-stage of the microscope.

* For a more detailed description of the mode of obtaining crystals of arsenious acid, consult a paper in 'Beale's Archives,' No. III, 1858, and the second edition of my 'Principles of Forensic Medicine,' in which several of the forms depicted here will be found figured.

The hemisphere in question has been many years in my possession, though I did not apply it to the table microscope until February, 1860. It happened to be one of the lenses which Mr. Chamberlain, the optician, called "a sporting lot;" and I may say, that on more than one occasion I have successfully used it in following optical game. In the year 1837 it did me good service when connected with the condensing lens of a solar microscope, inasmuch as it gave me great light with little or no heat, and thereby prevented all risk in the use of *achromatic object-glasses* and objects mounted in balsam.

The arrangement for this purpose is as follows:—A beam of solar light, containing both colorific and calorific rays, was transmitted through the condensing lens of the instrument; and, owing to the different refrangibility of these components of the beam, we have a cone of light-giving rays formed within a cone of heat-giving rays, and the principal focus of heat is further from the lens than the principal focus of light. But when these rays cross the axis, the cone of heat-giving rays lies within the cone of light-giving rays; and, if the hemispherical lens be placed in these second cones, at the distance of its own focal length from the principal focus of heat, it will be at a greater distance than its focal length from the principal focus of light; and, consequently, the rays of heat will be rendered parallel, while the rays of light will converge to a second focus, exhibiting great intensity of illumination, but without any sensible heat.

I have approximately measured the heating power of the calorific rays in the second cone, when rendered parallel by the hemispherical lens; and I found, in the month of December, that the mercury in a sensitive thermometer, when placed in the second focus, did not reach 90° Fah., while, at the same time, the heat in the focus of the first cone was sufficient to discharge gunpowder.

The admirable drawing, by Lens Aldous, of the magnified head of a flea mounted in balsam, from which his well-known lithograph was made, is a good illustration of the practical value of this application of the lens; and it is probable that a cemented achromatic object-glass was then, for the first time, used with safety in the solar microscope.

I also used the hemisphere, with a central disc of tinfoil upon its plain surface, as a means of obtaining a black-ground illumination in the solar microscope; and nothing can exceed the beauty of the brilliant tint of the *Volvox globator* and *Hydra viridis* under this arrangement. I found it impossible, however, to take a photograph of these objects under this illumination, though with direct solar light I had no difficulty whatever.

It is probable that a similar application of the hemispherical lens and central stop to the oxyhydrogen microscope, which our variable climate almost compels us to use, would in like manner throw into the pictures on the screen the additional charm of natural colours, and thereby greatly enhance the interest of the exhibition.

Notwithstanding my use of the condenser in the experiments just described, it did not occur to me to extend the application of it, until I was, as it were, driven by necessity. My old parishioners and other kind friends presented me with a valuable microscope at the commencement of last year; and not having, in the first instance, any of the well-known condensers at hand, I used the light of two lamps placed at right angles to each other, and by means of suitable lenses I threw sufficient light on the rectangular markings of the *P. acuminatum* and other similar tests. I was much pleased with the effect of this simple method of illumination; and I am glad to find that Mr. Tomkins has also used it, but with considerable improvement, by employing two achromatic prisms, which give brilliant illumination, while the "marking shadows" are in deep relief.

In order to obtain any proper definition of the markings, I found it necessary so to turn the valve of the diatom, that a line of markings might lie at right angles to a line of light. In fact, in any other position the markings are scarcely visible; and the conclusion seemed forced upon me, that the ordinary spot lens contains in its circle of light a large portion of unnecessary, if not injurious, illumination. With this impression on my mind, it suddenly occurred to me, that my old friend, "the kettle-drum," as Mr. Gravatt calls my condenser, might play an important part, if its plain surface were covered with tinfoil suitably pierced at the circumference for the tranmission of two pencils of light at right angles to each other. I made the experiment, and happily I can fall back upon the testimony of well-qualified observers as to the success which attended it. The direct illumination of only one lamp was now sufficient, and, instead of rotating the object—always a difficult process in the absence of suitable adjustments—it was easier to rotate the secondary stage which held the condenser, and so gain the proper position of the two points of light. It may be well to state, that by taking out the eye-piece, and looking at the points of light down the body of the tube, we may at once, by the rotation of the sub-stage, place them in the right position for illuminating any rectangularly marked valve whose position on the stage of the microscope is known. One point of light must lie over the end of the valve for bringing out the horizontal lines; the other will be opposite the side of the valve, and will act on the longitudinal lines; and resolution into dots or squares will be immediately effected by adjusting the distance of the condenser.

For oblique or diagonal markings, the apertures at the circumference of the diaphragm must no longer be placed at 90° apart, but at such an angle as is indicated by the markings themselves. In the case of the *P. angulatum,* where there are three lines of markings, there must be three apertures, since with two apertures only, we should exhibit, according to their position, any two, and but two, of these three lines, in turn, and, at the same time, give a sort of unnatural elongation to the peculiar markings on the valve. The size of the apertures is 24° at the circumference and opposite side, and $\frac{4}{10}$ths of an inch in the direction of the radius. The latter dimension must be less in diaphragms for smaller hemispheres, and must never exceed half the radius of the condenser.

In order to secure the best effect, the distance between the apertures must be adjusted with considerable accuracy. For this purpose I use a diaphragm of thin brass, or of strong tinfoil, having one aperture only, and by its rotation under a given valve of the *P. angulatum,* for instance, I bring into view the three lines of markings in succession, first the horizontal lines, and then the oblique lines, by rotating the diaphragm to the right and left, and thus the three points at which the apertures are to be made can be determined with the utmost precision. If the aperture for the horizontal lines be made at the distance of 180° from the place thus obtained, these lines will be illuminated on their opposite sides, and the three apertures will be 120° apart, as in the diaphragm first cut out for me by Mr. Waterhouse, who happened to be working with me at the time. But in practice I find it not only better, but indispensable, to illuminate all the markings on the same side, as by the first method, and preserve thereby that uniform direction of the shadows which is the key to accurate definition. A set of diaphragms thus obtained, and a diaphragm with a minute circular aperture in the centre only, for the central adjustment of the lens, complete the furniture of the condenser; and a brass ring sliding outside the top of the cylinder on which the condenser is screwed conveniently holds the diaphragms in their place, and admits of their being readily changed.

In the application of this condenser to the resolution of lined test objects, it will be seen that the principle sought to be carried out is to throw the axis of the pencil of illuminating rays in a direction at right angles to the line to be resolved. In all cases where the precise position of such lines is known, a supplementary diaphragm may be cut with the apertures in their correct mutual positions; but as these position angles greatly vary in different diatoms on the same slide, my friend, Mr. Waterhouse, ingeniously suggests the use of a pair of similar diaphragms overlying each other, and capable of revolution round a common centre. For this purpose the diaphragm next the condenser must be fixed in position, and moveable with the lens, by means of the pinion motion of the sub-stage, while the other is attached to a deep hoop fitted upon the brass tube carrying the lens, so as to be conveniently rotated by the finger and thumb, applied to a narrow milled ring, but sufficiently small to pass through the opening of the second stage, when the condenser is required to be removed for other purposes. To carry out this suggestion, place two diaphragms together, and mark out on their circumference the positions of six adjacent apertures; cut out one aperture, pass over two, and cut out the remaining three; then turn them face to face, so that the small stops between the apertures may coincide, and, by the rotation of one diaphragm upon the other, the stop between two apertures, or little prisms, as they virtually are, may be made to vary from about 30° to 120°. This will be ample scope for all bilinear, oblique, and rectangular markings. This method of arrangement also admits of the introduction of a third aperture for the *P. angulatum*, &c., and the whole diaphragm system is thus brought within the least possible compass.

The lens in its present form is simple, cheap, and easy of adjustment, though of course not free from chromatic aberration; but the proper adjustment of the apertures to the object examined seems to prevent this error from being very apparent, and a pierced diaphragm beneath as well as upon the condenser has advantages in this direction, as well as occasionally in others. The central pencil of about $\frac{1}{20}$th of an inch in diameter, which gains intensity from the construction, is itself virtually achromatic, and is also very effective for direct central illumination where obliquity is not required, or would be injurious.

The angle of aperture of the lens is necessarily small; and therefore I cannot help thinking, with Mr. Tomkins, that if it were possible by the application of rotating pierced diaphragms to stop out the light *in the right place* of a Gillet's, or perhaps still better, from its greater angle of aperture, a Powell's condenser, we should approach perfection in resolving difficult markings under the deepest powers.

My old black-ground illumination, which led to the formation of valuable condensers by Messrs. Shadbolt and Ross, may be produced with very good effect by the hemisphere and a single aperture; and I feel sure that the members of our society will be much pleased with the brilliant definition and detail of a scale of Podura under this illumination and the half-inch object-glass. I have in my possession the same scale which my old and valued friend, Andrew Ross, saw with his first achromatic $\frac{1}{8}$th, in his little workshop at St. John's, Clerkenwell, and I shall never forget the expression of his astonishment. But the present half-inch is superior in all respects to that $\frac{1}{8}$th.

It is now generally known that I offer the hemispherical condenser as the special adjunct of the new half-inch object-glass of 90° aperture. Mr. Thomas Ross sent me his first object-glass of this new construction, for examination and report; and I believe, like many others, he hesitated to give implicit credence to my account of its working. As he was ignorant of the power of the "kettle-drum condenser," he thought that the asserted resolution of that old microscopic nebula, the *P. angulatum*, under so low a power as a half-inch, even of large aperture, indicated the partiality of friendship rather than the severity of honest criticism. Accordingly I was summoned before a microscopic jury, consisting of Messrs. Leonard, Millar, Lobb, and Roper; and after sufficient and careful examination, Mr. Leonard, as the judge, decided that I might "take a rule *nisi*."

As the half-inch and the condenser had not only not flinched from any fair work, but had even trespassed on the domain of the $\frac{1}{4}$th and the $\frac{1}{8}$th, I thought that I would show at last what they could not do; and therefore, without the slightest expectation of taking anything for my pains, I placed on the stage of the microscope a slide of the Amician test, the *Navicula rhomboides*, which was kindly presented to me by Mr. Powell, whose fine $\frac{1}{16}$th, with its unequalled achromatic condenser, reveals the exquisite skill which is bestowed on this almost invisible work of the great Creator. It does one good, both mentally and morally, to review such a work as this; and, to my astonishment and delight, I witnessed its resolution under my new arrangement. It is necessary, in this instance, to use a deep eye-piece for attaining the requisite amplification; and as eye-pieces are instruments for measuring the imperfections of object-glasses, this result led to a definite opinion as to the quality of the power employed.

I will only add, that when combined with the hemispherical condenser and the whole series of eye-pieces, the new half-inch is a battery of microscopic powers, and will be a good substitute, in case of slender purses, for the $\frac{4}{10}$th, $\frac{6}{10}$th, $\frac{1}{8}$th, and other fractions. I may therefore be permitted to congratulate our society on the valuable results consequent upon the attainment of almost unlimited aperture, combined with perfect flatness of field, in powers as low as the $\frac{1}{2}$ and $\frac{4}{10}$th; and let it not be forgotten, that English opticians still take the lead in these improvements, which should yield honour as well as profit to themselves.

On the SEED *of* DICTYOLOMA PERUVIANA, D.C., &c. By HY. B. BRADY, F.L.S.

(Read June 12th, 1861.)

THERE are few points of greater interest to the microscopist, or that better repay his attention, than the external character of the seeds of plants. Many, from their mere superficial beauty, have become popular show-objects; but a deeper interest is awakened, and an almost boundless field of investigation is suggested, by such phenomena as those presented by the peculiar spiral cells of the testa of Collomia, Ruellia, or Salvia; the curious hairs from the seeds of Cobæa or Acanthodium; the beautiful surface markings on those of Papaver, Lychnis, or Silene; the coma of Hoya and other Asclepiads; or the membranous wings so common amongst the Bignoniaceæ. That there are many new and valuable facts to be gathered from a systematic study of these structures, no one who has given much attention to them can doubt, and I only regret that my own observations, though extending over a considerable time, have as yet been too desultory and disconnected to be of much practical value. Recently, however, a specimen was placed in my hands so peculiar in some of its characters that I have thought it might properly form the subject of a short notice.

The seed of *Eccremocarpus scaber*, a half-hardy climbing plant, common in our gardens, is familiar to most as a microscopic object; but as an acquaintance with this will render the rest of my paper more intelligible, I may be allowed to advert to it in a few words.

When mature, it is a roundish or kidney-shaped seed, about a quarter of an inch in diameter, thickest at the centre, and gradually thinner towards the outer edge, which we find expanded into a thin, membranous wing (Pl. VII, fig. 5). Careful examination shows that the cells on the outer layer of the testa, which appear on the body of the seed in the form of irregular projections, are, towards the circumference, excessively developed, especially in length, and it is in this way that the expansion alluded to is formed. The *side* walls of these elongated cells become much thickened in the process of growth, thus affording to the wing the necessary strength and firmness, whilst the *front* and *back* walls retain their original transparency, being marked only by a very delicate subspiral deposit. A glance at the accompanying sketch (fig. 6) will supply any deficiencies of this verbal description.

This introduction will, I trust, render intelligible the more complicated structure which is observable in *Dictyoloma Peruviana.* A general idea of this beautiful seed may be gathered from fig. 1. Endlicher's description of it, which is very defective and partially incorrect, runs thus:—"*Semina late reniformia, compressa, dorso in alas duas parallelas radiatim reticulatas, fibra marginali connexas expansa, sinu ventrali umbilicata.*" As we may infer from the above, it is broad, kidney-shaped, and flattened. Besides possessing a wing formed in a similar manner to that of Eccremocarpus, by the expansion of the testa round the edge, there are several succesively smaller, lateral wings in the same plane, the margins of which form a series of concentric rings over either surface of the seed. These smaller wings lie close to the surface, and appear almost like a continuous coat of connected cells; indeed, those nearest the centre seem to be more or less connected through their entire length to the seed itself, the outer extremities only being raised above the general surface, thus keeping up the appearance of concentric rings above alluded to. The alæ, as they approach the circumference, become successively larger, and to a greater extent free. The sectional sketch, fig. 2, represents, as nearly as I can make out from the small materials at my command, the arrangement of the wings.

But perhaps the structure of the alæ themselves is the most remarkable feature in the case. Each wing appears to consist of a series of radiating fibres connected at their outer margin, the spaces between them being left quite open.

Fig. 3 represents a portion of the outer sets of wings under a higher magnifying power, and this sketch will also serve to show their position with regard to each other. I was some time before I could satisfactorily account for this singular character, and it is only after a number of observations on other winged seeds bearing more or less on my specimen that I am enabled to speak with confidence about it. The separate wings seem to be formed in the manner I have just described in reference to Eccremocarpus. The cells of the outer layer of the testa are developed to a great length, and the *side walls* are thickened in the same way; but the *front* and *back* walls, not being supported by deposit of any sort, are ruptured at a very early stage, and gradually disappear, leaving the *side walls only* as a sort of framework or skeleton. The frequent raggedness of the sides of the fibres is best accounted for in this way, and the appearance of one of the inner wings carefully removed from the seed (fig. 4) fully confirms this view, as it still retains portions of the delicate cell-wall only partially disintegrated. I had hoped that an examination of the ovules in a very early stage would have shown the *outer* wings entire, but in the only flower which I have had an opportunity of dissecting the ovary was too immature to throw any light on the subject. Altogether, the specimen I have described reminds one strongly of the leaf of *Ouvirandra fenestralis*, and though botanically the phenomena are not identical, it loses nothing in interest by such association.

In conclusion, I must acknowledge my thanks to my friend, Professor Oliver, for the specimen from which this notice is written, and Mr. Tuffen West for memoranda from seeds in his own collection bearing somewhat on the present case.

DESCRIPTIONS *of* NEW *and* RARE DIATOMS. SERIES II.

By R. K. GREVILLE, LL.D., F.R.S.E., &c.

(Read June 12th, 1861.)

RYLANDSIA, n. gen., *Grev.* and *Ralfs*.

FRUSTULE simple, disciform, cellulose; disc with smooth rays, dilated at their base, and not reaching the centre. (No umbilical lines nor hyaline area.)

This remarkable genus appears to belong to the group represented by *Asterolampra,* but differs essentially in the absence of umbilical lines and of the hyaline area, so conspicuous in all the discs referred to that genus. In the only known species of the genus now proposed, the valve is cellulose, very much in the manner of *Coscinodiscus radiatus;* and the rays, two in number, have their dilated bases separated by a considerable interval, and have no connection whatever with each other. This singular diatom is worthily dedicated to my friend Thomas George Rylands, Esq., of Heath House, Warrington, a very acute observer, who communicated it to me soon after its discovery by Mr. Ralfs.

Rylandsia biradiata, n. sp., Grev. (Pl. VIII, fig. 1).

Hab. Barbadoes deposit, very rare; John Ralfs, Esq., T. G. Rylands, Esq., Dr. Greville.

A considerable number of specimens of this curious disc have now been seen, and it is satisfactory to know that it is quite constant to its characters. The cellules in the centre of the valve between the bases of the rays are large; they then suddenly become smaller, and decrease gradually in size as they radiate to the circumference. The rays are broadly cuneate at the base, and linear as they reach the margin; they appear to be tubular, as in *Asterolampra,* and a faint shadow indicates the continuance of this structure through the middle of the dilated bases. In a single instance the two valves occurred *in situ,* the rays of the lower crossing those of the upper valve.

COSCINODISCUS.

Coscinodicus symmetricus, n. sp., Grev.—Granules radiating, distinct, all equal and equidistant; seven of the radiating lines extending from the centrical granule to the circumference; margin striated. Granules 10 in ·100″; marginal striæ 15 in ·001″. Diameter ·0031″. (Pl. VIII, fig. 2.)

Hab. Barbadoes deposit; excessively rare.

One of the most beautiful of the granuliferous group of *Coscinodisci,* and well characterised by the equal distribution of the granules. It is also distinguished by the manner in which the radiating lines are arranged. From the central granule proceed seven long lines, and within the compartments so formed the next two longest are disposed, one on each side, so as to form two equal sides of the triangle, and so on until the whole space is filled up.

CRESSWELLIA.

Creswellia superba, n. sp., Grev.—Valves hemispherical, depressed, with a broadly expanded hyaline margin; areolation large; connecting processes robust, spine-like, situated nearer to the margin than the apex. Diameter ·0024″ to ·0054″. (Pl. VIII, figs. 3, 4, 5.)

Hab. Barbadoes deposit; frequent.

A splendid species, with very large areolation. Average specimens possess from six to eight connecting processes, but examples occur with from four or five, up to the giant represented at fig. 5, with nineteen. I have never seen Ehrenberg's *Stephanopyxis diadema;* but if Kutzing's definition be correct, " disci medii depressi annulo dense denticulato"—my present diatom must be distinct. Kutzing, besides, gives the number of teeth in the crown as thirty, whereas it is a very rare circumstance indeed to see so many in *Cresswellia superba* as appear in fig. 5.

EUODIA.

Euodia Barbadensis, n. sp., Grev.—Frustules semilunate, ends slightly produced, lower margin straight; surface cellulose, with a small, irregular, central blank space. Distance between the angles ·0015″ to ·0020″. (Figs 6, 7.)

Hab. Barbadoes deposit; extremely rare.

Valve yellowish; short, vein-like lines are given off from the margin, sufficiently conspicuous in the larger specimens, but less so in small ones. The upper margin is conical-convex, so as to give the frustule very much the outline of a cocked hat. Cellulation rather large, but under a low power appearing as granules.

TRICERATIUM.

Triceratium cornutum, n. sp., Grev.—Valve (4-angled?) with straight sides and sharp angles furnished with strong, horn-like processes; surface minutely granulose, in lines radiating from the centre, on which are three spines; granules at the margin 15 in ·001″. Distance between the angles ·0015″. (Fig. 8.)

Hab. Barbadoes deposit; excessively rare.

The only frustule, a very perfect one, which has come under my notice, has four angles with exceedingly strong, horn-like processes, which, as they cast a dark shadow, render the frustule conspicuous. The granules are very minute in the centre, but increase in size as they radiate to the margin. It is quite distinct from the few species already described, having spinous lateral surfaces.

Triceratium productum, n. sp., Grev.—Valve punctate;

angles produced, capitate; centre divided into compartments by radiating, vein-like veins. Distance between the angles ·0027″. (Fig. 9.)

Hab. Barbadoes deposit; excessively rare.

This beautiful species is evidently related to *T. truncatum* and *T. venosum;* to the former very closely, while, at the same time, it is abundantly distinct; the truly capitate, produced angles taking the place of the broad, truncate angles of that diatom.

Triceratium inconspicuum, n. sp., Grev.—Minute, sparsely punctate; angles of the valve semicircular, subtruncate, separated from the centre by a transverse line; centre bordered with a row of puncta. Distance between the angles ·0005″. (Fig. 10.)

Hab. Barbadoes deposit; excessively rare.

Of this exceedingly minute species I have seen half a dozen specimens, all of which have four angles. In its characters it comes very near to some varieties of *T. brachiatum,* but is separated by its size alone, which scarcely exceeds that of *T. exiguum.*

Triceratium delicatum, n. sp., Grev.—Minute; valve with slightly concave sides and broadly rounded angles filled up with transverse rows of fine puncta; centre containing a pale, obtusely triangular band, within which is a triangular spot, bordered with puncta. Distance between the angles ·0012″. (Fig. 11.)

Hab. Barbadoes deposit; excessively rare.

A minute species, difficult to define in few words. The eye is first impressed with the pale (blank), triangular band, which exactly fills up the centre of the valve by the angles reaching to the concave margin, and, consequently, separating the angles of the valve from the parts within. In the central spot, which is edged with a row of distinct puncta, I have been unable to trace any particular structure. A peculiar feature in this little diatom is a considerable space between the sides of the pale band and the transverse rows of puncta which occupy the angles. These puncta also gradually decrease in size as they approach the apex.

Triceratium labyrinthæum, n. sp., Grev. — Valve with rounded angles and somewhat convex sides, the centre having a network of flexuose, widely anastomosing, vein-like lines, the inclosed spaces being finely punctate. Distance between the angles ·0023″. (Fig. 12.)

Hab. Barbadoes deposit; excessively rare.

Of all the curious *Triceratia* which have been discovered in this inexhaustible deposit the present species is one of the most remarkable. About half a dozen examples have been observed. The interval between the margin and the central labyrinth of lines is blank, with the exception of a few short, vein-like lines given off from the central network, some of which nearly reach the margin. In this, as in many other instances, a figure will convey a better idea of the object than the most elaborate description.

Triceratium areolatum, n. sp., Grev.—Valve with slightly concave sides and acute angles; surface covered with rather large, circular areolæ, while very short, vein-like lines project from the sides of the valve. Distance between the angles ·0026″. (Fig. 13.)

Hab. Barbadoes deposit; extremely rare.

I do not know any member of the genus with which this diatom can be compared, unless it be *T. acutum*, Ehr., with which it agrees in the rather peculiar areolation. From that species, however, it differs in the sides of the valve being decidedly, although slightly, concave, and in the angles not being in the smallest degree elongated. The short, vein-like lines present, in addition, a conspicuous differential character. Nevertheless, I am not certain of its being distinct.

Triceratium tessellatum, n. sp., Grev.—Valve with straight sides and rounded angles, somewhat convex in the centre; surface filled with subquadrate, large, more or less concentric granules, becoming smaller at the angles; margin with a row of minute granules, 11 in ·001″. Distance between the angles ·0025″. (Fig. 14.)

Hab. Deposit on the banks of Pertuxent River, near Nottingham, Maryland, United States.

Distinguished by the large size and more or less square form of the granules, especially those of the convex centre. Smaller granules completely fill up the angles. In some examples the convexity of the centre is scarcely at all apparent.

Triceratium robustum, n. sp., Grev.—Valve with straight or very slightly concave sides and rounded angles with pseudo-nodules; surface filled with irregularly shaped, coarse granules, those in the circumference of the convex centre and at the angles small, the rest large. Distance between the angles ·0030″ to ·0040″. (Fig. 15.)

Hab. Cove, Calvert County, Maryland, United States.

A strong, coarse-looking species, with a large, clear, pseudo-nodular space at the angles. The granules are very irregular, small ones being often mixed with the large ones. Sometimes a concentric arrangement is conspicuous, but in other cases it is very partial, being most distinct between the convex centre and the angles, where also the largest granules occur. This diatom is subject to occasional distortion, several examples having occurred to me in which the sides were of very unequal lengths.

Triceratium Browneanum, n. sp., Grev.—Small; valve with straight sides and rounded angles with obscure pseudo-nodules; surface filled up with small, round, equal, irregularly disposed granules. Distance between the angles about ·0020″. (Fig. 16.)

Hab. In mud, Savannah, Georgia, U.S.

Probably not a rare species, as it occurs tolerably abundantly in a slide kindly communicated to me by my friend, Mr. George Mansfield Browne, of Liverpool. It is well marked by the equal size throughout the entire valve of the round granules, which, although not crowded, are rather closely situated. The angles are thickened, but can scarcely be said to possess a pseudo-nodule.

Triceratium ? blanditum, n. sp., Grev.—Sides of valve deeply concave; angles broadly rounded; centre with a small, blank space; granules conspicuous, subremote, equal, forming straight, equidistant, parallel lines. Distance between the angles in the four-angled frustule ·0020″. (Fig. 17.)

Hab. Barbadoes deposit; excessively rare.

A very striking object, which I introduce with some hesitation as a *Triceratium. Amphitetras,* however, is now admitted to be separated from that genus by a very slender line. I have seen only two frustules, both of which are four-angled, and very conspicuous for the equal size of the granules, their equidistance, and the perfectly straight, parallel lines in which they are arranged. The small, circular, blank space is only defined by the absence of granules. There is also a small, vacant space opposite to each concavity of the valve. This species may have some affinity with *Amphitetras parallela* of Ehrenberg, found in a fossil state in Greece.

COCCONEIS.

Cocconeis Grantiana, n. sp., Grev.—Very minute; valve elliptic, smooth, with a slender median line and nodule, the margin furnished with a moniliform row of large, oblong granules. Length ·0011″. (Fig. 18).

Hab. On marine shells, Macduff; John Grant, Esq.

A beautiful little object, the smooth disc rendering the marginal row of brilliant, bead-like granules more conspicuous. Mr. Grant, to whom I am indebted for a specimen, aptly compares the entire frustule to a jeweller's ornament set with gems.

Cocconeis granulifera, n. sp., Grev.—Minute, elliptic-oblong, with a median line and rather large nodule; disc with remote radiating lines of large, oval granules (three in each line), reaching from the median line to the margin. Radiating lines 5 in ·001″. Length ·0015″. (Pl. VIII, fig. 19.)

Hab. On Pectens, Carrickfergus; John Grant, Esq.

The characteristic features of this little species are the very large granules, the small size of the valve being considered (three only being found in each line), and the distance between the radiating lines themselves, there being only about thirteen on each side. Both this and the preceding appear to be clearly distinct from all described species.

DESCRIPTIONS *of* NEW *and* RARE DIATOMS. SERIES III.

By R. K. GREVILLE, LL.D., F.R.S.E., &c.

(Read June 12th, 1861.)

BRIGHTWELLIA, *Ralfs.*

Brightwellia elaborata, n. sp., Grev.—Cellules of coronal circle roundish; border composed of uniform, radiating lines, connected by numerous transverse lines. Diameter ·0034″. (Pl. IX, fig. 1.)

Hab. Barbadoes deposit; excessively rare.

This exquisite diatom bears a considerable general resemblance to *Brightwellia Johnsoni* of Ralfs, MS., being of the same size and having a very similar corŏnal circle of large cells. But an essential difference is found in the structure of the border. In *B. Johnsoni* it is composed of radiating lines of round cellules, which decrease in size from the corona to the margin, where they are quite minute; while at irregular intervals dark, strong, radiating lines occur, which appear to project like a spinous ridge, as in my *Coscinodiscus armatus.* In the present species, on the contrary, the border is formed by a close series of straight, uniform, radiating lines, connected by transverse (or concentric) lines or bars, which thus produce rows of quadrate cellules, increasing in size from the coronal circle to the margin. Two of the radiating lines, with their connecting bars, might not unaptly be compared to a microscopic ladder.

This beautiful genus appears to be a very natural one; its characteristic feature being the coronal circle of large cellules, and the curved or spiral arrangement of the cellules within the circle. The typical species, *B. coronata,* has never, I believe, been found entire, the greater portion of the border being always absent. On two occasions only have I obtained a fragment in which, along with part of the corona, was a portion of perfect margin. Do the coronal cells in this species invariably retain their oblong character? Examples have certainly come under my notice in which they were more round than oblong, but I unfortunately omitted to mark them. It is, however, by no means improbable that the valves referred to may belong to an undescribed species.

TRICERATIUM.

Triceratium notabilis, n. sp., Grev.—Large. Valve punctate, with straight sides; angles broad, much produced, dilated, oblong or somewhat rhomboidal, with a conspicuous pseudo-nodule; centre convex, with radiating puncta and several spines. Distance between the angles ·0025″ to ·0040″. (Figs. 2, 3.)

Hab. Barbadoes deposit; rare.

Of this fine diatom above a dozen examples, including broken specimens, have come under my observation. It is evidently related to *T. coniferum,* but is a much larger species, and conspicuous for the very produced angles, which are equal in length to the straight sides of the valve. The prevailing form of the angle is rhomboidal, but it is occasionally oblong, as in fig. 3. The centre of the valve is convex, and the puncta radiating as in *T. coniferum,* a character omitted to be brought out in the figure of that species in the 'Microscopical Journal.' The centre is also furnished with spines, no fewer than seven being present in fig. 3, while in the specimen represented at fig. 2, two are situated at the base of each angle. The Barbadoes deposit has yielded me several other frustules, which form a highly characteristic little group, of which *T. coniferum* may be regarded as the type, but whether some of them ought to be considered species or mere varieties is extremely difficult to say. They all agree in the radiating punctation, convex centre, spines, and pseudo-nodules, but differ considerably in form and relative proportions. Of these diatoms figures will be given on a future occasion.

Triceratium microcephalum, n. sp., Grev.—Valve with convex sides and slender, produced, subcapitate angles, furnished with pseudo-nodules; entire surface, except a small, central, circular space, minutely punctate. Distance between the angles ·0026″. (Fig. 4.)

Hab. Barbadoes deposit; excessively rare.

In general outline this species bears a close resemblance to *T. productum* of my Series II, but differs essentially in the absence of all vein-like lines. From *T. capitatum* of Ralfs it is removed by the much larger size, shorter angles, the absence of spines, and by the minute and close punctation of the whole surface.

Triceratium insignis, n. sp., Grev.—Large. Valve with concave sides, and broadly rounded angles, furnished with minutely punctate pseudo-nodules; surface filled with radiating lines of minute, distinct granules, except a small, central, blank space; margin with short, broad striæ, 9 in ·001″. Distance between the angles ·0034. (Fig. 5.)

Hab. Barbadoes deposit; excessively rare.

A remarkably fine and ornate species, possessing most distinctive characters. At first sight the angles have the appearance of being separated from the centre by a transverse line, but this is not the case. The effect is produced by the radiating lines of granules curving up the prominent angles, and being viewed, as it were, in prospective, the extremities of the lines form a transverse row of dark points. A very conspicuous feature in the valve is the termination of what are doubtless strong, broad striæ in the front view, and which are curved over the edge of the valve in the side view. The radiating lines of granules which closely cover the surface do not quite reach the margin, but leave a narrow, blank space.

Triceratium rotundatum, n. sp., Grev.—Small. Valve with deeply concave sides and broadly rounded angles, the ends of which are filled with minute puncta, bordered with a few larger ones; centre blank, surrounded by an irregular, triangular band of still larger granules, between which and the granules of the angles is a transverse, blank space; concave margins, with a few distant, large granules. Distance between the angles ·0020″. (Fig. 6.)

Hab. Barbadoes deposit; extremely rare.

About the size of *T. castellatum* and *T. Westianum*; but the angles do not form segments of circles as in those species, being merely broadly rounded. About six granules compose the marginal row in the concavities of the valve.

Triceratium amœnum, n. sp., Grev.—Small. Valve with straight sides and rounded, incrassated angles; centre somewhat convex, with subremote radiating puncta, which gradually increase in size from the centre to the circumference. Distance between the angles about ·0024″. (Fig. 7.)

Hab. Nottingham deposit, Maryland, U.S.

Not rare, yet I cannot refer it to any described species. It is a neat and brilliant little diatom. The puncta or minute granules are rather distant, the largest being those immediately external to the raised centre; in the angles they again become smaller. The angles themselves are frequently, though not invariably, slightly dilated, as in fig. 7, and are thickened in substance, but no distinct pseudo-nodule is perceptible.

Triceratium obscurum, n. sp., Grev.—Small. Valve thin and delicate, with nearly straight sides and rounded angles; puncta equal, very minute, radiating in straight lines. Distance between the angles ·0024″. (Fig. 8.)

Hab. South Naparima deposit, Trinidad.

Contour exactly resembling that of *T. condecorum*, but the radiating lines of puncta are perfectly straight. The puncta are also somewhat more minute.

Triceratium Harrisonianum, n. sp., Norman and Grev.—Large. Valve with convex sides and slightly produced, rounded angles; pearly granules forming a marginal band of radiating rows, and thinly scattered over the ample central space, in which is a conspicuous network of large, elongated, radiating cellules, sending down lines between the rows of granules to the margin; rows 4 in ·001″. Distance between the angles ·0070″. (Fig. 9.)

Hab. Barbadoes deposit (Springfield Estate); exceedingly rare; George Norman, Esq.

A truly splendid diatom, belonging to a small, very natural group, and, as is frequent in such cases, extremely difficult to define satisfactorily. It may be, indeed, that most of them constitute but one species; and if so, it becomes all the more necessary that they should be carefully figured and described. This I hope to be able to do in a future series. *T. margaritaceum*, described by Ralfs in the last edition of 'Pritchard's Infusoria,' is the only one hitherto published, and, as the first known, may stand as the type. It is comparatively a small species, the distance between the angles being only about ·0030″, often less. All the members of the group, however, possess the same structural arrangement, the central portion of the valve being composed of large, radiating, elongated cellules, which towards the margin become smaller and quadrangular, each of the quadrangular cellules containing a round, pearly granule. In none of the species are these characters seen so conspicuously as in our new *T. Harrisonianum*. The outline of the valve in these species varies considerably. According to Ralfs, the sides of the valve in *T. margaritaceum* are straight or slightly convex, and the angles rounded. In all the specimens I have seen they are straight or very nearly so, but other valves in my possession have the sides decidedly convex, along with a generally distinct aspect at once appreciable by the eye, but difficult to convey in words. Among other characters, the value of which I do not at present venture to estimate, is the slightly produced angle in combination with the more or less convexity of the side, as seen in the present and following species. This feature has not been observed in *T. margaritaceum*, and may eventually be found to facilitate the diagnosis of these most perplexing diatoms.

We have much pleasure in dedicating this fine species to Mr. Harrison, of Hull, who has devoted much attention to the microscopical investigation of the *Diatomaceæ*.

Triceratium giganteum, n. sp., Grev.—Large. Valve with slightly convex sides, and rounded, somewhat produced, angles; pearly granules, forming a marginal band of radiating lines; central space filled with minute, scattered spines. Distance between the angles ·0066″. (Fig. 10.)

Hab. Barbadoes deposit; exceedingly rare; Christopher Johnson, Esq., George Norman, Esq.

Scarcely less splendid than the preceding, and more remarkable on account of the singular spinulose, central surface. It is a robust species, with large, round, somewhat flattened, granules, and a very strong margin. For the specimen in my cabinet, from which my drawing was made, I am indebted to the kindness of my friend, Mrs. Bury. The only other frustule hitherto discovered, so far as I know, is in Mr. George Norman's collection.

AMPHITETRAS.

Amphitetras minuta, n. sp., Grev.—Minute. Valve with deeply concave sides and rounded angles; lines of very minute puncta, radiating from the centre to every part of the circumference. Distance between the angles ·0014″. (Fig. 11.)

Hab. Nottingham deposit, Maryland, United States.

I have seen several frustules of this inconspicuous little diatom, which is extremely liable to be overlooked. All are four-angled, and I venture to place it provisionally in the present genus.

TRANSACTIONS.

Descriptions *of* New *and* Rare Diatoms. Series IV.

By R. K. Greville, LL.D., F.R.S.E., &c.

(Read June 12th, 1861.)

Stictodiscus.

Stictodiscus Californicus, n. sp., Grev.—Puncta equal, large, in rows of a single series; rays obscure, terminating in conspicuous, linear-oblong bases within the broad margin; central puncta somewhat remotely scattered. Diameter ·0038″. (Pl. X, fig. 1.)

Hab. Monterey stone.

A genuine *Stictodiscus*, distinguished from *S. Johnsonianus* (which it resembles in the puncta, being arranged in single rows) by the obscure and much shorter rays, by the broad margin, and linear-oblong bases of the rays. Although the latter are decidedly obscure compared with the same parts in the other species, a careful adjustment shows their presence, as well as the anastomosing lines towards the centre, which exist in *S. Buryanus* and *S. Johnsonianus*. When the surface of the disc is exactly in focus, the puncta appear simple; but by slightly lowering the focus a pore becomes visible in the middle of each punctum; and on viewing the valve from within, the pores are very conspicuous, and placed on the summits of little circular convex cavities (plane on the outer surface, convex on the inner surface, of the valve), strongly resembling the discs in the woody fibre of the Coniferæ, which are themselves little, plano-convex boxes, with an orifice. The border of the disc is bounded by a row of minute puncta. The number of rays is upwards of forty.

Stictodiscus Kittonianus, n. sp., Grev.—Disc umbonate, with a central nucleus; rays numerous; puncta minute, equal, forming a double series in each compartment, and closely covering the central space. Diameter about ·0020″. (Figs. 2, 3.)

Hab. Nottingham deposit, Maryland, U.S.; Richmond, Virginia, F. Kitton, Esq.

A small but beautiful species, with very numerous puncta of equal size throughout, and especially distinguished by the umbonate surface and central nucleus of the disc. The rays terminate simply at the margin, which is unmarked by puncta or striæ of any kind. My best thanks are due to Mr. Kitton for a specimen exhibiting the front view, which forms a very interesting object. It shows the frustule to be composed of two unequally umbonate valves, each of them furnished with a broad, folded-down edge, as in the lid of a pill-box, which edge is divided into large, square cellules, corresponding in number with the rays and compartments as seen in the side view. These cellules are the more conspicuous from being destitute of any kind of sculpture. Mr. Kitton informs me that, in addition to the localities above recorded, he has observed this diatom in the Pescataway, Rappahannock, and Monterey deposits.

COSCINODISCUS.

Coscinodiscus patellæformis, n. sp., Grev.—Central granules minute, round, numerous, from which proceed a number of rays, terminating about half way between the centre and the margin in an irregular circle of minute, dark, spine-like tubercles, beyond which are radiating lines of sub-contiguous granules increasing in size to the circumference; margin with a row of minute puncta. Diameter about ·0034″. (Fig. 4.)

Hab. Barbadoes deposit; very rare.

This curious diatom has much the appearance, under a low magnifying power, of *Coscinodiscus biradiatus,* with some adventitious matter adhering to the disc. Indeed, I passed over several specimens under this impression; but I was at length induced to examine them more carefully, and perceived that several important characters indicated a distinct species. The radiating lines which occupy the outer half of the disc are composed of coarse granules almost touching one another, and increasing in size as they approach the margin. But a more remarkable feature is found in another series of radiating lines, occupying not exactly the centre, but what may be termed the crown of the disc, and terminating about half way down. These have all the appearance of a separate structure, closely united to the original one, the whole bearing a strong resemblance to some of the *Patellæ.* The last-mentioned series, or, as they may be called, the coronal rays, are somewhat irregular in length, and consequently do not form an exact circle. They terminate in one or occasionally in two spinous processes, which are evidently analogous to those with which some of the rays in *C. armatus* and other diatoms are furnished.

TRICERATIUM.

The first seven of the following species constitute a very interesting and exceedingly natural little group, and present an excellent illustration of the difficulty of distinguishing between closely allied forms. Without attempting to dogmatise upon the *questio vexata* of "What is a species?" we may safely venture to figure and describe, with benefit to science, such organisms as we have reason to believe exhibit characters by which they may at any time be identified. Such characters are necessarily sometimes minute, but are not thereby of less value. In a systematic work the species about to be described would arrange themselves at once into two sections—the first containing those which have simple (not striated) margins and the central triangular space filled up with radiating lines; the second those which have striated margins and the central triangular space blank. There is another peculiarity, also, which separates the two sections. In the first the angles of the central triangle are lengthened out until they reach the pseudo-nodule; in the second the angles are not lengthened out, but each is kept with a short strong line which never reaches the pseudo-nodule, but terminates in a fork more or less connected with other vein-like lines. I have not satisfied myself about the nature of the short line referred to. In *T. pulcherrimum* (fig. 6) it takes the form of a small spine, distinctly seen within the pseudo-nodule. In *T. marginatum* it may also be seen, but with some difficulty, through the intervening lower pseudo-nodule. These little spines must be regarded as analogous to the short lines holding a similar relative position to the angles of the inner triangle in the species of the second section. In some instances, especially in *T. variegatum*, I have observed the short line to be slightly raised, suggesting the idea, which is confirmed by the position of the spine in the species of the first section, that this organ belongs properly to the framework of the inner triangle, and that the lines which appear to emanate from it belong to the system of costæ or vein-like lines which divide the border of the valve into compartments.

Triceratium marginatum, Br.—Valve with slightly convex sides, rounded angles, double pseudo-nodules, and simple margin; centre a triangular space, filled with radiating moniliform lines; border divided by transverse lines into punctated compartments. Distance between the angles, about ·0026″. (Fig. 5.)

Triceratium marginatum, Brightw., 'Mic. Journ.,' vol. iv, p. 275, pl. xvi, fig. 13. Ralfs, in 'Pritch. Infus.,' 1861, p. 854.

Hab. Barbadoes deposit, chiefly from Cambridge Estate; extremely rare; T. Brightwell, Esq., F. Kitton, Esq., Dr. Greville.

Although this fine species has been, in all essential points, correctly figured in Mr. Brightwell's paper quoted above, I have a twofold purpose in introducing another illustration in this place. It is very desirable that the student should be able at once to compare with it the new and allied species I am about to describe, most of which I have received under the same name. I wish, besides, to represent a structural arrangement which does not appear in Mr. Brightwell's figure. This consists of a circular, blank space surrounding the apex of the angle of the inner triangle and the inferior pseudo-nodule. It contains no puncta; and several faint, short lines, and two dark and longer ones, radiate from it. It is probable that this character may be more or less obscure in some individuals, as it is by no means conspicuous in Mr. Kitton's specimen, which he has kindly permitted me to examine. It would appear that no dependence can be placed on the number of lateral costæ. In Mr. Kitton's example there are two on each of two sides, and three on the other. In my own the number on two sides is similar, but there is only one on the third side. Mr. Brightwell's figure shows four on each of two sides and three on the other. With regard to the radiating lines of the inner triangle, I am inclined to consider them as modified costæ. Much depends upon the angle at which they are viewed. In my own specimen they have all the appearance of lines of puncta, but in Mr. Kitton's valve the costate character comes clearly out, with the addition of being nodulose, especially as the costæ approach the margin of the inner triangle.

Triceratium pulcherrimum, n. sp., Grev.—Valve with slightly convex sides, rounded angles, and simple margin; centre a triangular space, filled with radiating costæ; border divided by transverse lines into punctated compartments, which are continued round the large, oblong pseudo-nodules. Distance between the angles ·0045″. (Fig. 6.)

Hab. Barbadoes deposit, C. Johnson, Esq.; exceedingly rare.

One of the most beautiful diatoms known, and closely allied to the preceding. In this case the radiating lines of the centre are genuine costæ, each of which, as it terminates at the margin of the inner triangle, becomes capitate, producing an exquisitely ornamental effect. The pseudo-nodules are large, flat, and oblong; and an approach is made to the double pseudo-nodule of the preceding species, by their being traversed by two fine oblique lines, which, meet at the apices of the angles of the inner triangle; and what brings the approach still closer, is the fact that it is the division next the angle of the valve only which is punctate. A remarkable peculiarity consists in the pseudo-nodules not being situated in the extreme angle, as in the other species of the group, but leaving space for the lateral costæ to be visibly continued round them. These costæ are widely separated throughout the greater length of the border, but increase rapidly in number as they turn round the angle, so that there are about twenty on each side. The angles of the inner triangle are lengthened out until they enter the punctate portion of the pseudo-nodule, and terminate in a short spine. In this and the preceding species the puncta in the lateral compartments are rather widely scattered.

Triceratium Abercrombieanum, n. sp., Grev.—Valve with nearly straight sides, obtuse angles, and striated margin; centre a blank triangular space; border divided by transverse costæ into punctated compartments; a short line from each angle of the central triangle terminating in a wide fork with incurved apices, a faint, undulating line passing along the middle of each border. Distance between the angles, about ·0023″. (Figs. 7—9.)

Hab. Barbadoes deposit, C. Johnson, Esq., Dr. Greville; extremely rare.

At a hasty glance this might readily pass for a variety of the preceding species; but the presence of a striated margin, and the totally different centre, immediately dispel the impression. The pseudo-nodule, besides, is single; and although in one instance (fig. 9) the fork of the apex of the short line terminating the angles of the central triangle forms an enclosed, roundish space, instead of remaining open, it is unconnected with the pseudo-nodule, and contains puncta. A remarkable character in this species is a faint undulating line which passes along the middle of the border, commencing at the outer angle of the fork above mentioned, and ending at the corresponding point in the opposite angle of the valve. This line, which, although faint, may be traced without any difficulty, I have found uniformly present in the four specimens which I have had an opportunity of examining. By a reference to the plate it will be perceived that some variation is liable to occur in the lines at the angles, as well as in the number of the lateral costæ. The puncta are considerably more numerous than in *T. marginatum.* I have much pleasure in dedicating this diatom to my acute correspondent, Dr. Abercrombie, of Cheltenham.

Triceratium inopinatum, n. sp., Grev.—Valve with nearly straight sides, rounded angles, and striated margin; centre a blank triangular space; border divided by transverse costæ into minutely punctated compartments; a short line from each angle of the central triangle terminating in a small, roundish compartment, joined to the pseudo-nodule; no undulating line along the border. Distance between the angles ·0020″. (Fig. 10.)

Hab. Barbadoes deposit; extremely rare.

The only question which can arise relative to the validity of the present species is whether it be not a variety of the preceding. Had the separation been proposed on account of the apparently double pseudo-nodule alone, I should have felt some hesitation. It might have been said that in one of the varieties of *T. Abercrombieanum* the short lines proceeding from the angles of the central triangle terminate in enclosed spaces, owing to the incurved apices of the fork becoming united; and that if these enclosed spaces had been pushed forward to a junction with the pseudo-nodule, we should just have the appearance exhibited by the diatom now under consideration. It may be remarked, however, that the enclosed spaces above mentioned preserve their relative distance from the pseudo-nodule, as distinctly as if the apices of the fork had remained open. In the present species there is, at first sight, the appearance of an actual double pseudo-nodule; but it is an appearance only, the second one being merely the fork of the short line meeting at the base of the pseudo-nodule, and thereby indicating a different relative position of the parts from what occurs in the preceding species. In addition to what has been said, the total absence of the undulating line so remarkable in the border of that diatom seems to confirm the view I have taken of the propriety of regarding *T. inopinatum* as distinct.

Triceratium approximatum, n. sp., Grev.—Valve with straight sides, obtuse angles, and striated margin; centre a blank, triangular space; border divided by transverse costæ into punctated compartments; a short line from each angle of the central triangle terminating in a wide, shallow fork; pseudo-nodule single, sending out two spurs from the base;

no undulating line in the border. Distance between the angles ·0029″. (Fig. 11.)

Hab. Barbadoes deposit; excessively rare.

A fine species, coming nearest to *T. Abercrombieanum,* but wanting the undulating border line. The fork referred to in the specific characters here assumes a *Patera*-like form. Whether any dependence can be placed on the two little spurs at the base of the pseudo-nodule, a character I have not observed in any other species of the group, it is impossible at present to say. The puncta are numerous.

Triceratium gratiosum, n. sp., Grev.—Valve with slightly convex sides, obtuse angles, and striated margin; centre a triangular, blank space; border divided by transverse costæ into closely punctated compartments; a short line from each angle of the inner triangle terminating in a fork, from the centre of which spring two other lines, curving outwards to the margin. Distance between the angles, ·0029″ to ·0035″. (Figs. 12, 13.)

Hab. Barbadoes deposit; extremely rare; George Norman, Esq., Dr. Greville.

A very elegant species, closely and conspicuously punctate. The arrangement of the vein-like lines at the angles is peculiar, and serves at once to distinguish it from all its allies. Two lines spring from a point within the fork already mentioned, near its base, and curve gracefully outward until they reach the margin. In the examples which I have examined, the lateral costæ alternate more or less regularly with imperfect ones, extending about half-way across the border.

Triceratium variegatum, n. sp., Grev.—Valve with straight sides, obtuse angles, and striated margin; centre a blank, triangular spaee; border divided by transverse costæ into very minutely punctated compartments; a short line from each angle of the central triangle terminating in a deep, campanulate fork, the lines of which reach the margin. Distance between the angles, ·0027″. (Fig. 14.)

Hab. Barbadoes deposit; excessively rare; George Norman, Esq.

Of this beautiful diatom I have seen only a single specimen; but it differs so materially from all the preceding, that no doubt whatever can exist regarding its claim to being ranked as a distinct species. It will be recognised at once by the graceful campanulate or vase-like compartment at each angle of the valve, which is very minutely, yet more distinctly punctate than the border. A very minute, deflexed line may also be seen given off externally on each side from near the base of this compartment.

Triceratium nebulosum, n. sp., Grev.—Valve with concave sides and broadly rounded angles, the ends of which are filled with a cloud of minute puncta; centre occupied with an indefinite cluster of small puncta, while larger ones are remotely scattered over the rest of the space. Distance between the angles ·0032″. (Fig. 15.)

Hab. Barbadoes deposit; exceedingly rare; George Norman, Esq.

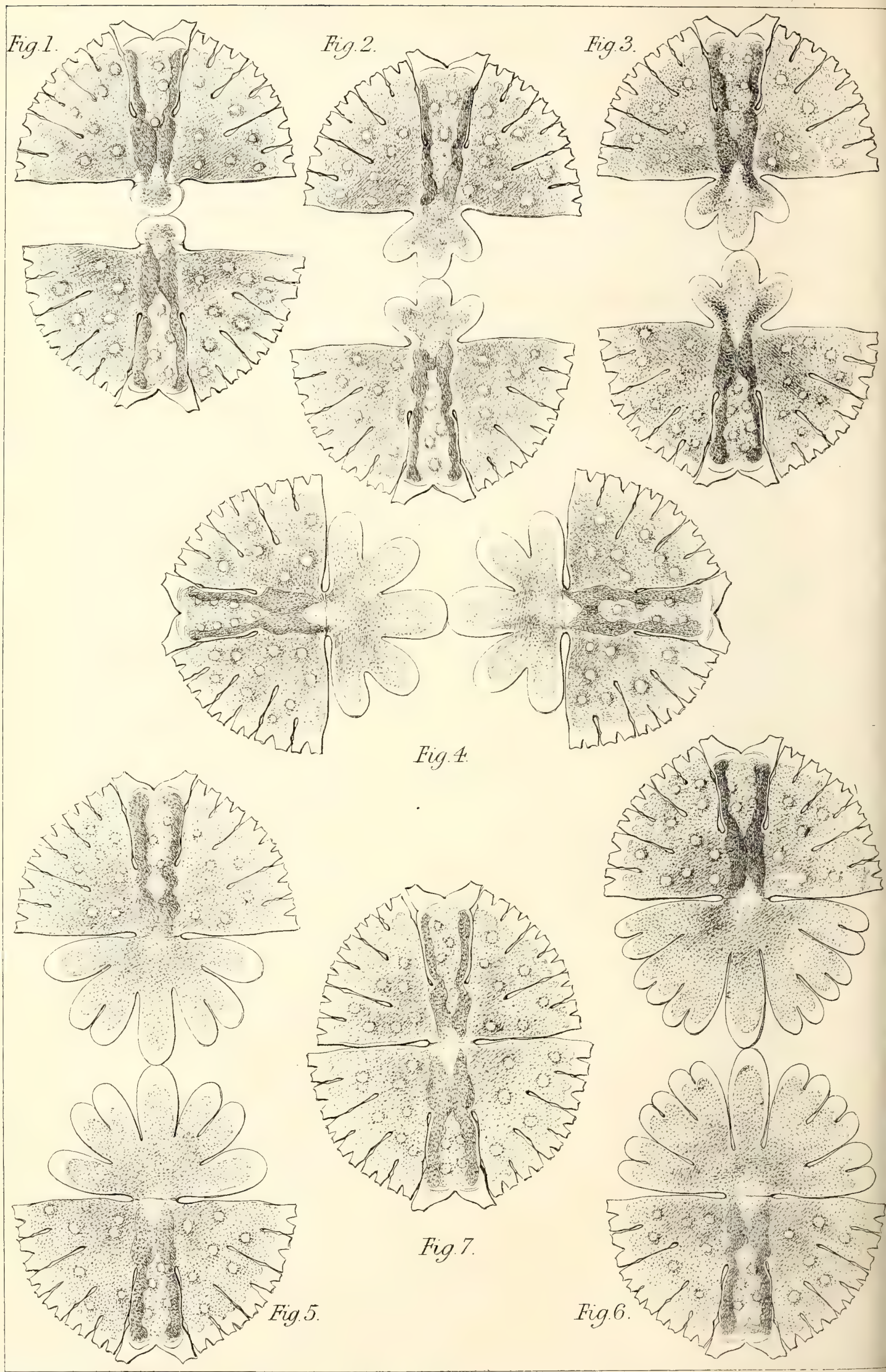
This species bears some resemblance in general outline to *T. trisulcum* of Bailey; figured in Pritchard's 'Infusoria,' 4th edit., pl. viii., fig. 27; but there are no transverse lines separating the angles from the centre. It is otherwise nearly allied to the same diatom, in the angles being crowded with minute puncta and in those of the centre being remotely scattered. These latter, however, are more numerous than in Professor Bailey's species, and there is, besides, a marginal line of irregularly disposed and more closely approximated puncta in the concave sides of the valve. It is also allied to my *T. rotundatum*, a much smaller species, from which it differs in the sides being much less deeply concave, in the absence of the single lateral row of large granules, and in the arrangement of the central granules generally.

AMPHIPRORA.

Amphiprora conspicua, n. sp., Grev.—Front view broadly winged, much constricted, truncated at the ends; a row of linear nodules at some distance within the margin; striæ conspicuous, about 18 in ·001″. Length ·0046″. (Fig. 16.)

Hab. Sierra Leone, F. Kitton, Esq.

The finest species, perhaps, of the whole genus; allied to *A. alata*, but quite distinct. In the first place, the frustule is far from being equally hyaline; and instead of the striæ being perceived with some difficulty, they are rather coarse and very conspicuous. Then, in *A. alata* the number of striæ (which I have been unable to ascertain satisfactorily for myself) is given by Smith as 42 in ·001″, which is adopted by Ralfs in the last edition of Pritchard's 'Infusoria;' but in our new species they may be set down at 18 in ·001″. I have found them vary a little, but I assume this number as the average. Again, a certain number of the striæ swell into a sort of linear nodule at some distance within the margin, and the line thus formed, following the marginal curve, constitutes a most peculiar and striking character. There seems to be no fixed rule as to the proportion of striæ which exhibit this feature. Sometimes it is every fourth, at others every third striæ. In addition to these differences there is yet another, in which the diatom under consideration agrees with *A. pulchra* of Bailey ('Mic. Obs. in South Carolina, &c.,' p. 38, pl. ii, figs. 16—18), the striæ near the margin being punctate. The surface of the valve is undulate, so that a portion only is in focus at one time, and the striæ consequently appear to decussate obliquely in waving lines. I may add that, although I have seen a number of specimens, I have never observed one in the twisted state so common in *A. alata.*



Tuffen West sc

W West imp.

DESCRIPTION OF PLATE I,

Illustrating Mr. Lobb's paper on the Self-division of *Micrasterias denticulata*.

Fig.

1.—*Micrasterias denticulata* in the first stage of self-division.

2.— „ „ in the second stage of self-division.

3.— „ „ in the second stage of self-division, the endochrome coming in differently to what it does in figure 2.

4.— „ „ in the third stage of self-division.

5.— „ „ in the fourth stage of self-division.

6.— „ „ in the fifth stage of self-division.

7.— „ „ self-division completed.

DESCRIPTION OF PLATE II,

Illustrating Mr. G. Norman's paper on some Undescribed Species of Diatomaceæ.

Fig.

1.—*Asterolampra Stella.*

2.—*Surirella Baldjikii.*

3.—*Coscinodiscus fuscus.*

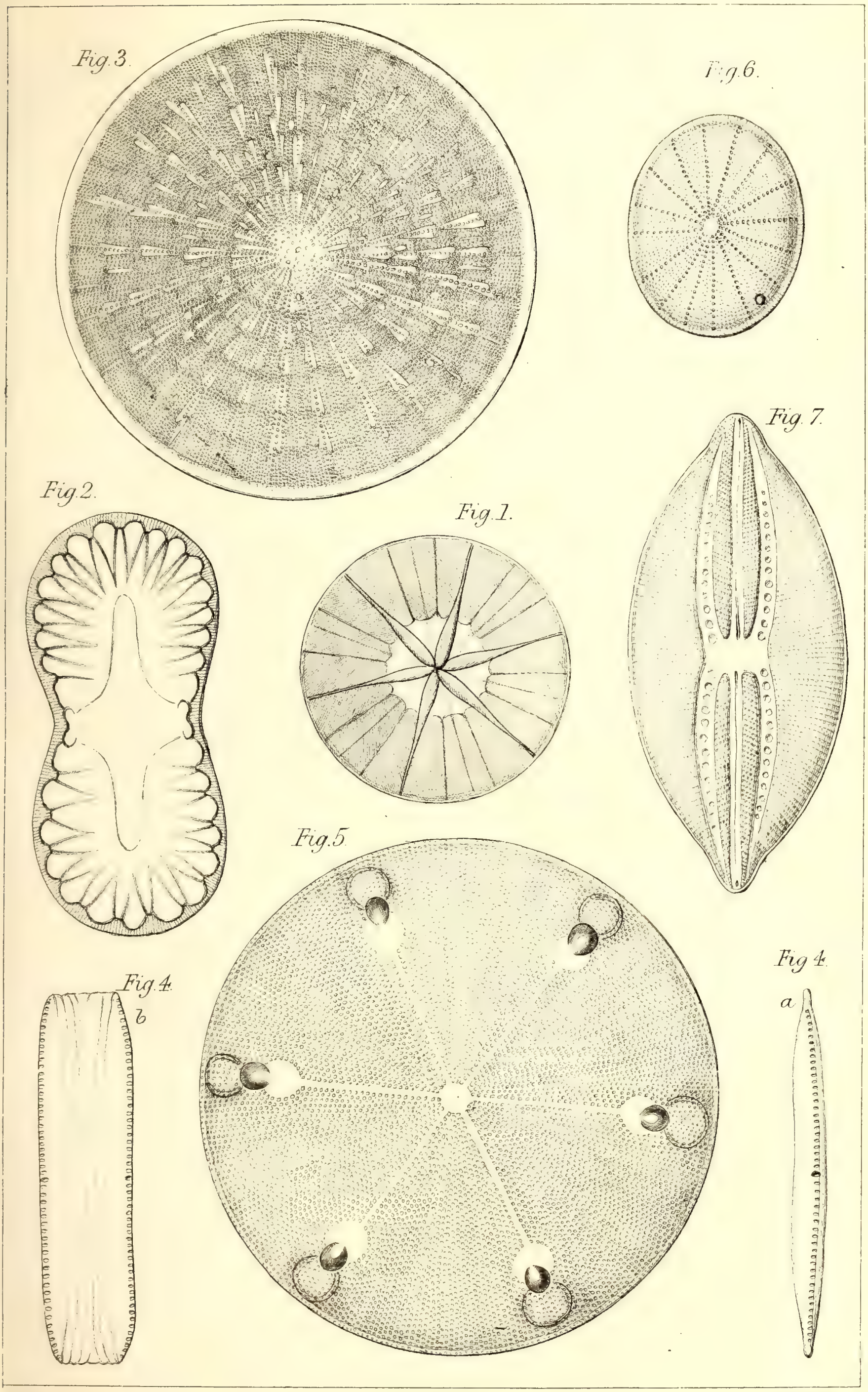
4.—*Nitzschia vitrea.*

5.—*Aulacodiscus Sollittianus.*

6.—*Eupodiscus ovalis.*

7.—*Navicula bullata.*

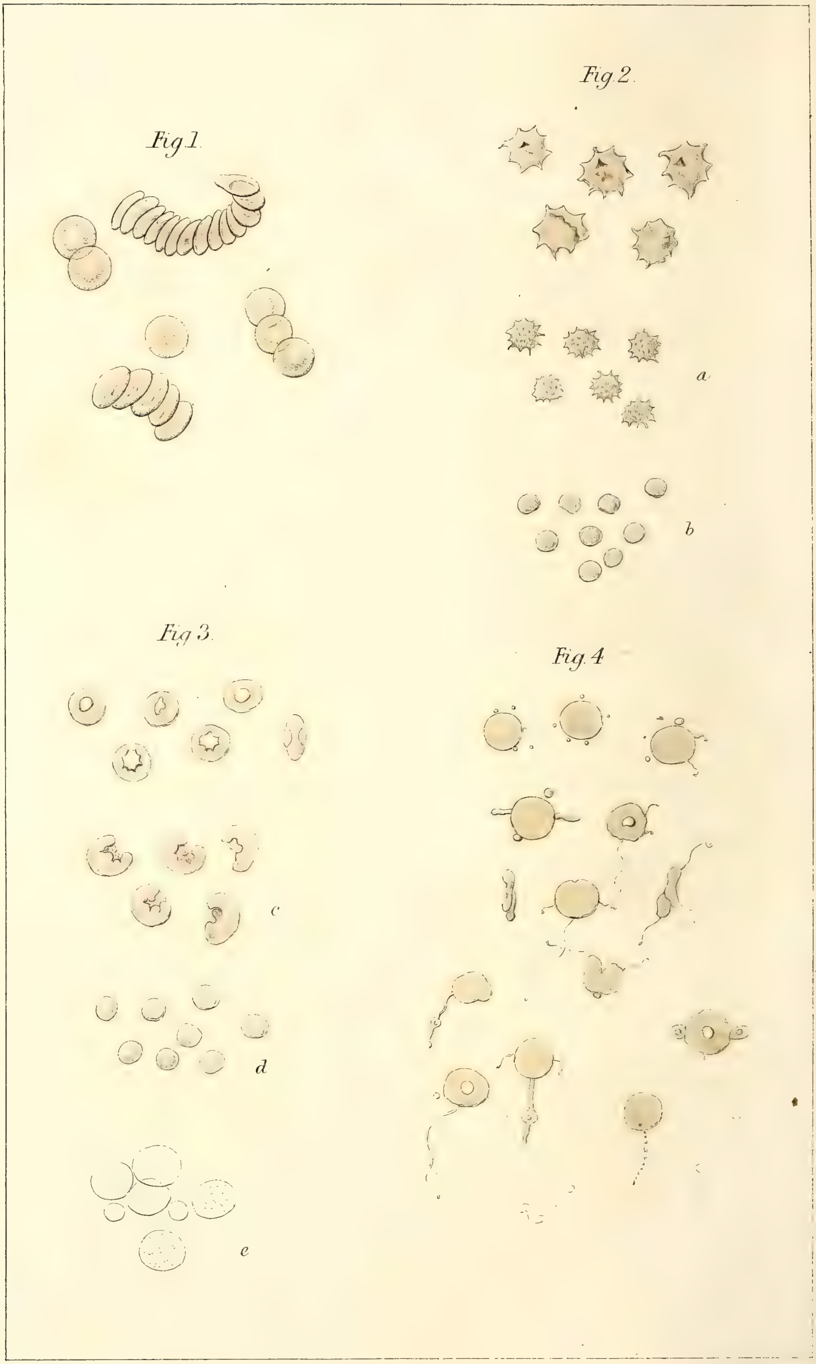
All magnified 400 diameters.



G.N. & T.W. del. T.W. sc.

All 400 X

W. West imp.



W.A. del. Tuffen West sc.

DESCRIPTION OF PLATE III,

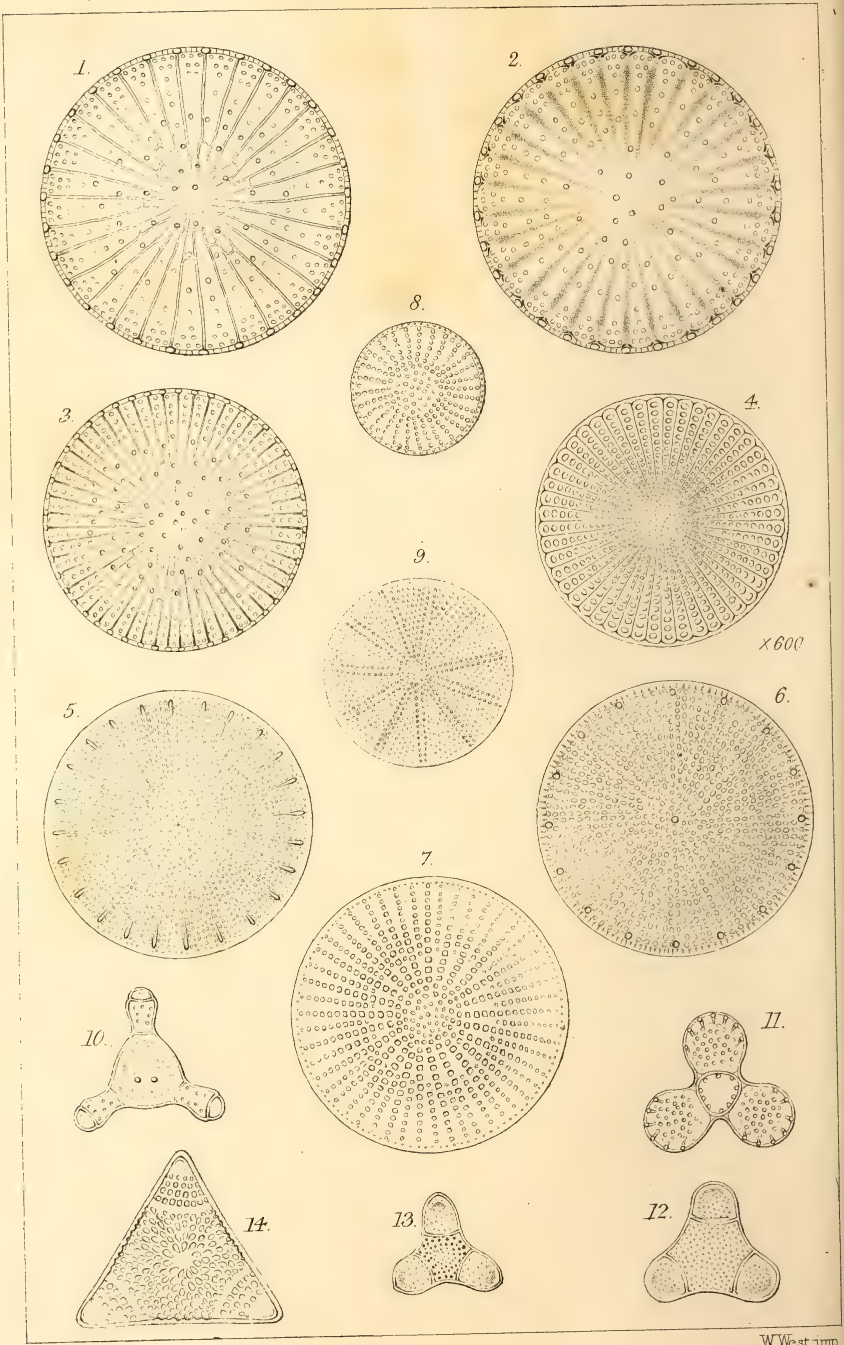
Illustrating Mr. Addison's paper on Changes of Form in the Red Corpuscles of Human Blood.

Fig.
1.—*Natural forms* of the red corpuscles of human blood.

2.—*Alkaline forms,* produced by saline and alkaline liquids.

3.—*Acid forms,* produced by the action of weak acid liquids.

4.—*Tailed forms,* produced by Sherry wine, &c.



R.K. Greville del. T. West sc.

W. West imp.

DESCRIPTION OF PLATE IV,

Illustrating Dr. Greville's paper on New Diatoms, Series I.

Fig.

1.—*Stictodiscus Buryanus*, focused for the radiating lines.

2.—The same, focused to show the plicate character of the disc.

3.—*S. Johnsonianus*.

4.—*S. insignis*, × 600.

5.—*Coscinodiscus armatus*.

6.—*C. tuberculatus*.

7.—*C. biradiatus*.

8.—*C. elegantulus*.

9.—*C. Barbadensis*.

10.—*Triceratium capitatum*.

11.—*T. Westianum*.

12.—*T. Barbadense*.

13.—*T. nitidum*.

14.—*T. cellulosum*.

All the figures are × 400, except fig. 4, which is × 600 diameters.

The Barbadoes species are described from a fine series of slides supplied by Mr. J. T. Norman.

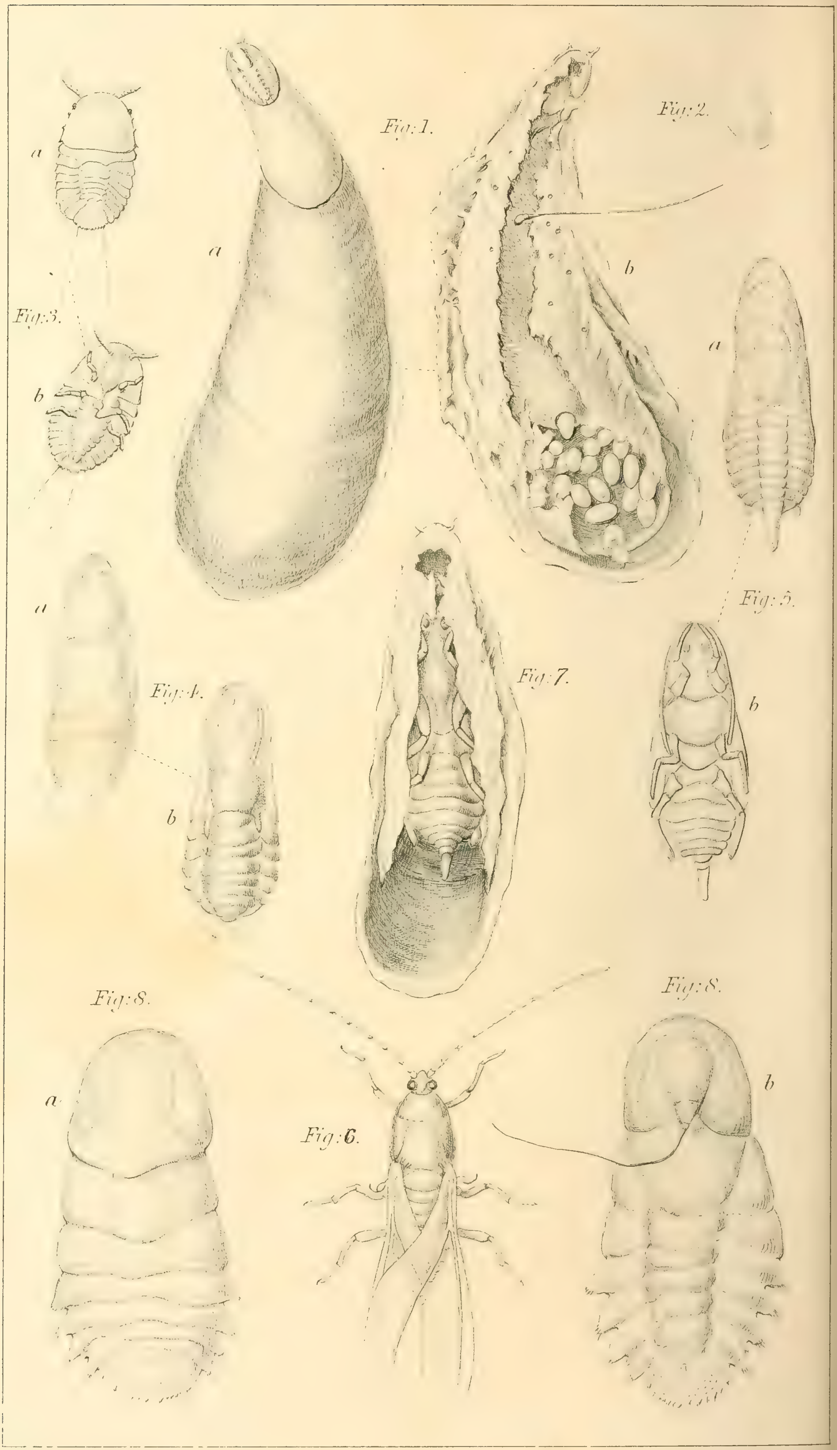


Fig:1.
a
b
Fig:2.
a
b
Fig:3.
a
b
Fig:4.
a
b
Fig:5.
a
b
Fig:6.
Fig:7.
Fig:8.
a
Fig:8.
b

DESCRIPTION OF PLATE V,

Illustrating Richard Beck's paper on the Metamorphosis of a Coccus found upon Oranges.

Fig.

1.—Female.

2.—Egg taken from one of the above.

3.—Young Coccus shortly after breaking from the egg.

4.—Male insect at the earliest period at which any traces of sexual characters can be distinguished.

5.—A male insect further advanced.

6.— „ „ mature.

7.—Shell of a male Coccus, with indications of its formation at three distinct periods,—the larval covering, the pupal covering, with a subsequent addition for the protection of the wings of the imago.

8.—Mature female removed from the shell.

In all the figures where letters are employed, *a* represents the upper, *b* the lower surface.

TRANSACTIONS OF MICROSCOPICAL SOCIETY.

PLATE VI,

Illustrating Dr. Guy's paper on the Crystals of Arsenious Acid, showing the sublimates as they appear by the monocular and binocular microscope by transmitted and reflected light.

Fig. 1.

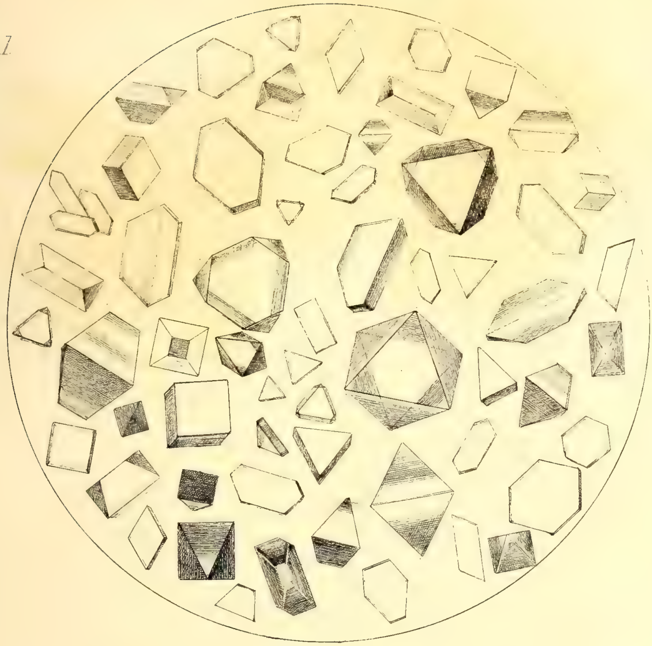
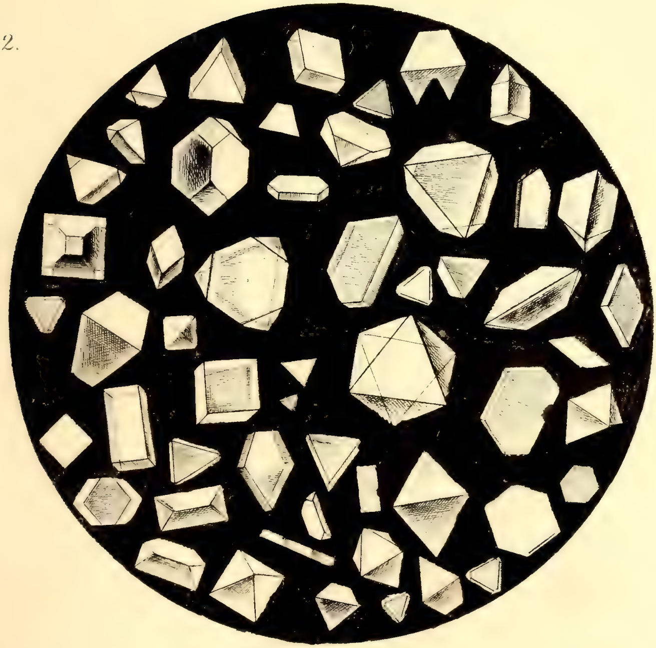


Fig. 2.



Tuffen West ad nat. sc.

W. West imp.

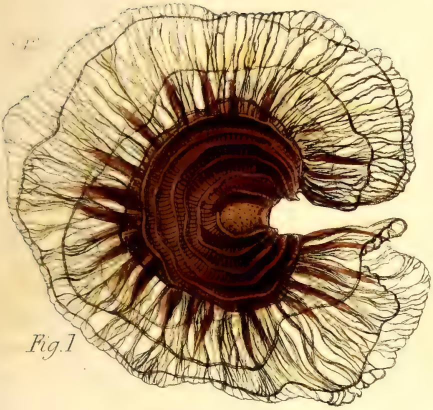
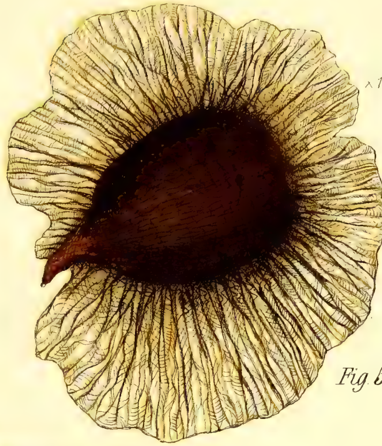


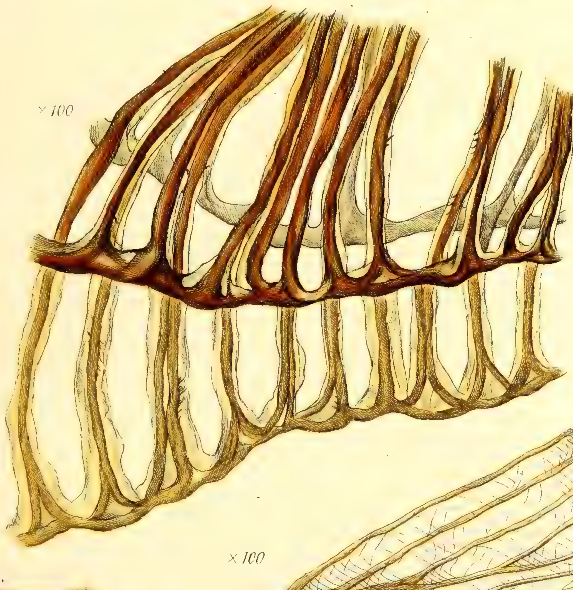
Fig. 1



× 12

Fig. 5

Fig. 2



× 100

Fig. 3

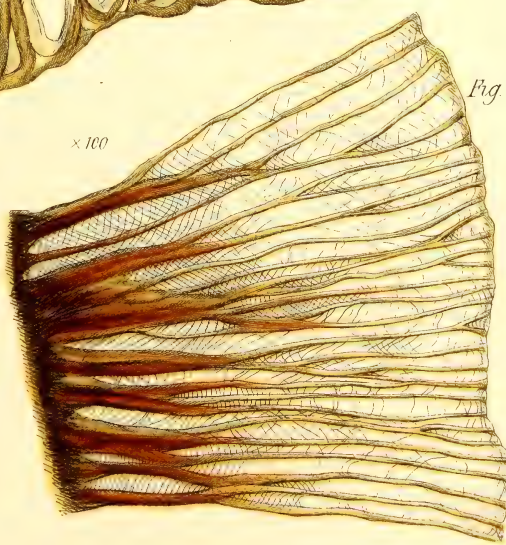


Fig. 6

× 100

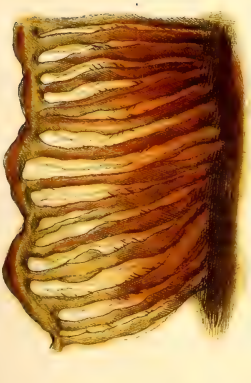
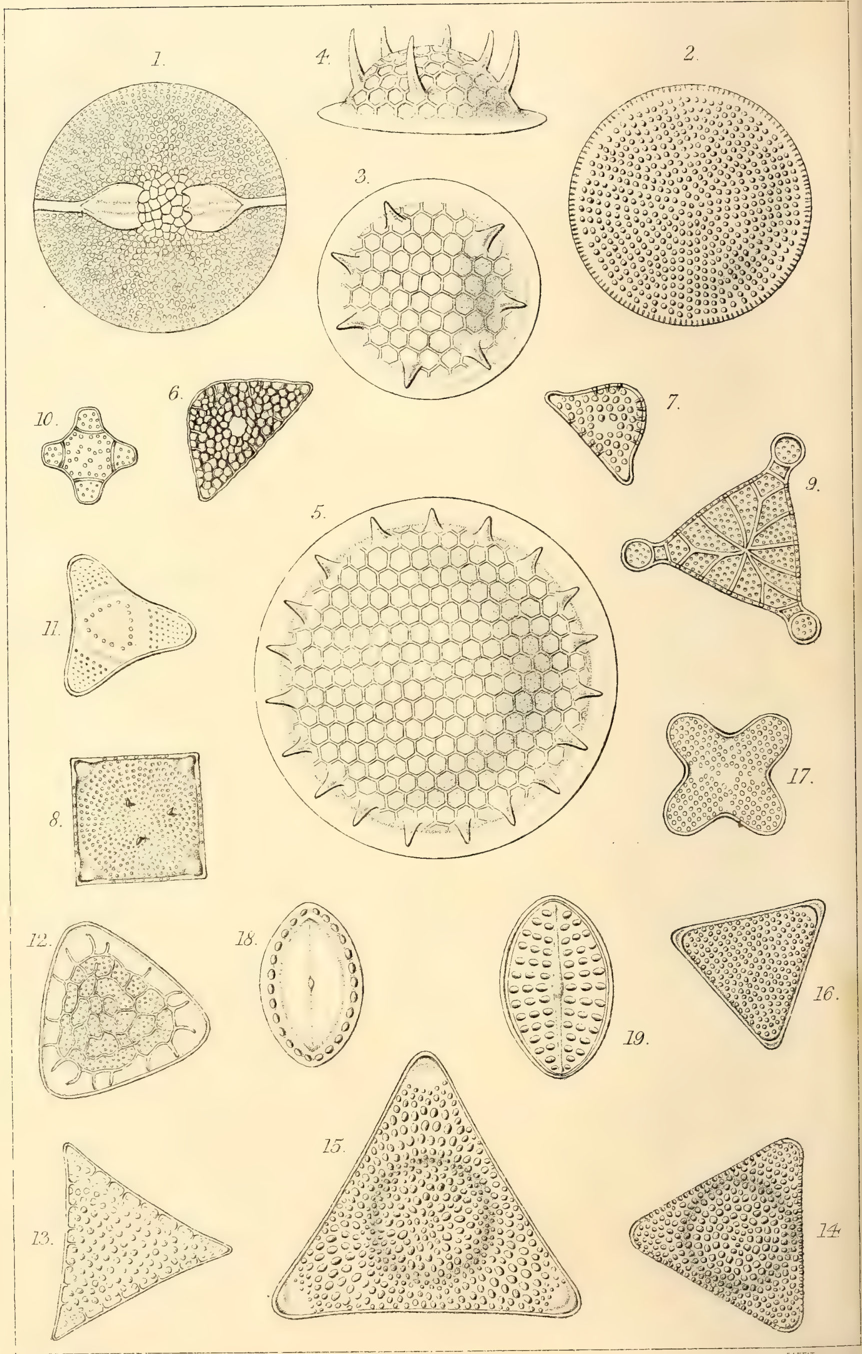


Fig. 4

× 100

H. J. Slack ad nat. del. Tuffen West sc.

W West imp. chr



R.K.G. del. Tuffen West sc.

W. West imp.

DESCRIPTION OF PLATE VIII,

Illustrating Dr. Greville's paper on New Diatoms, Series II.

Fig.

1.—*Rylandsia biradiata*, × 600.

2.—*Coscinodiscus symmetricus.*

3—5.—*Creswellia superba.*

6, 7.—*Euodia Barbadensis.*

8.—*Triceratium cornutum.*

9.—*T. productum.*

10.—*T. inconspicuum*, × 800.

11.—*T. delicatum*, × 600

12.—*T. labyrinthæum.*

13.—*T. areolatum.*

14.—*T. tessellatum.*

15.—*T. robustum.*

16.—*T. Browneanum.*

17.—*T.* (?) *blanditum.*

18.—*Cocconeis Grantiana*, × 800.

19.—*C. granulifera*, × 600.

All the figures are × 400 except where the contrary is mentioned.

DESCRIPTION OF PLATE IX,

Illustrating Dr. Greville's paper on New Diatoms, Series III.

Fig.

1.—*Brightwellia elaborata.*

2, 3.—*Triceratium notabilis.*

4.—*T. microcephalum.*

5.—*T. insignis.*

6.—*T. rotundatum.*

7.—*T. amœnum.*

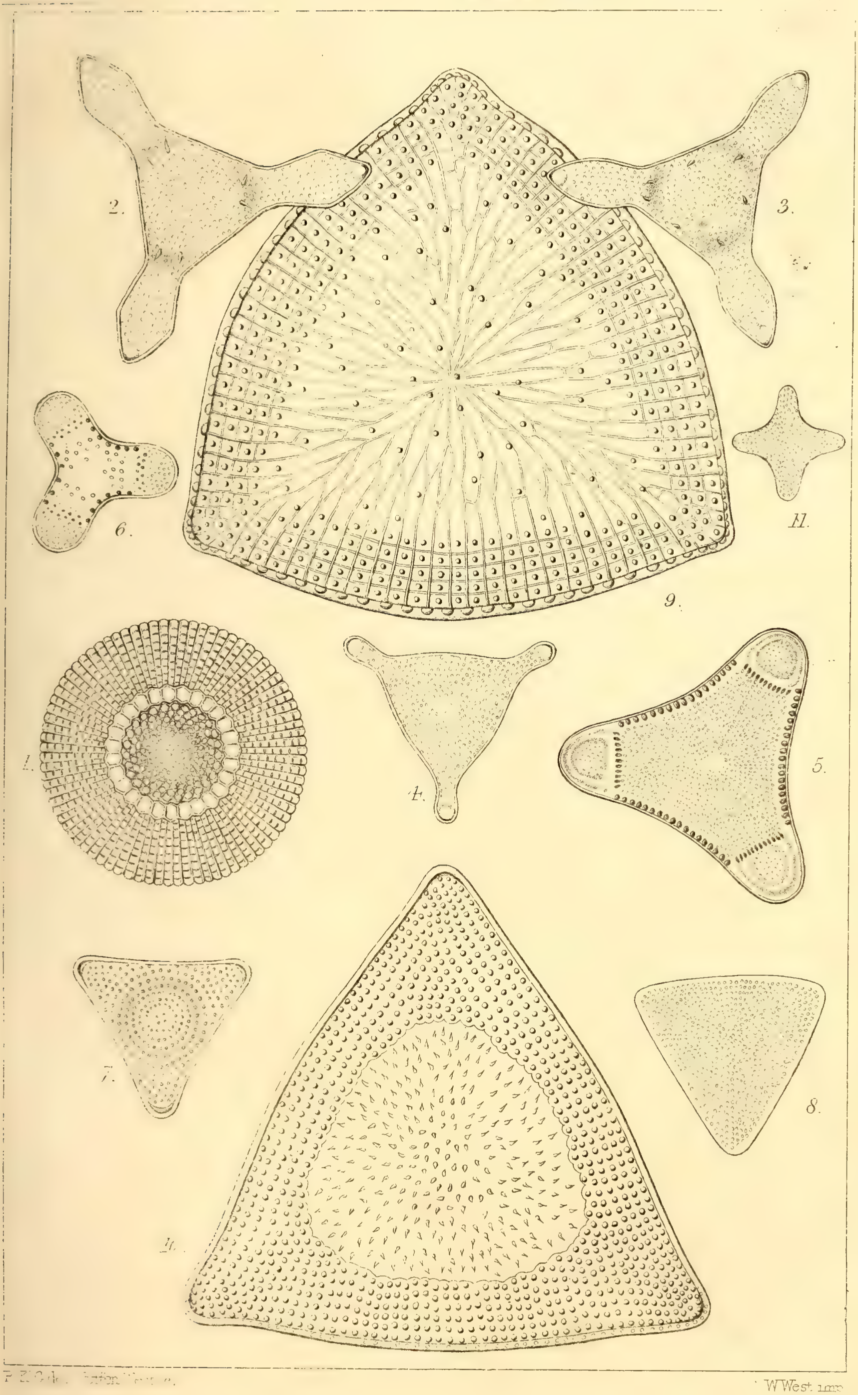
8.—*T. obscurum.*

9.—*T. Harrisonianum.*

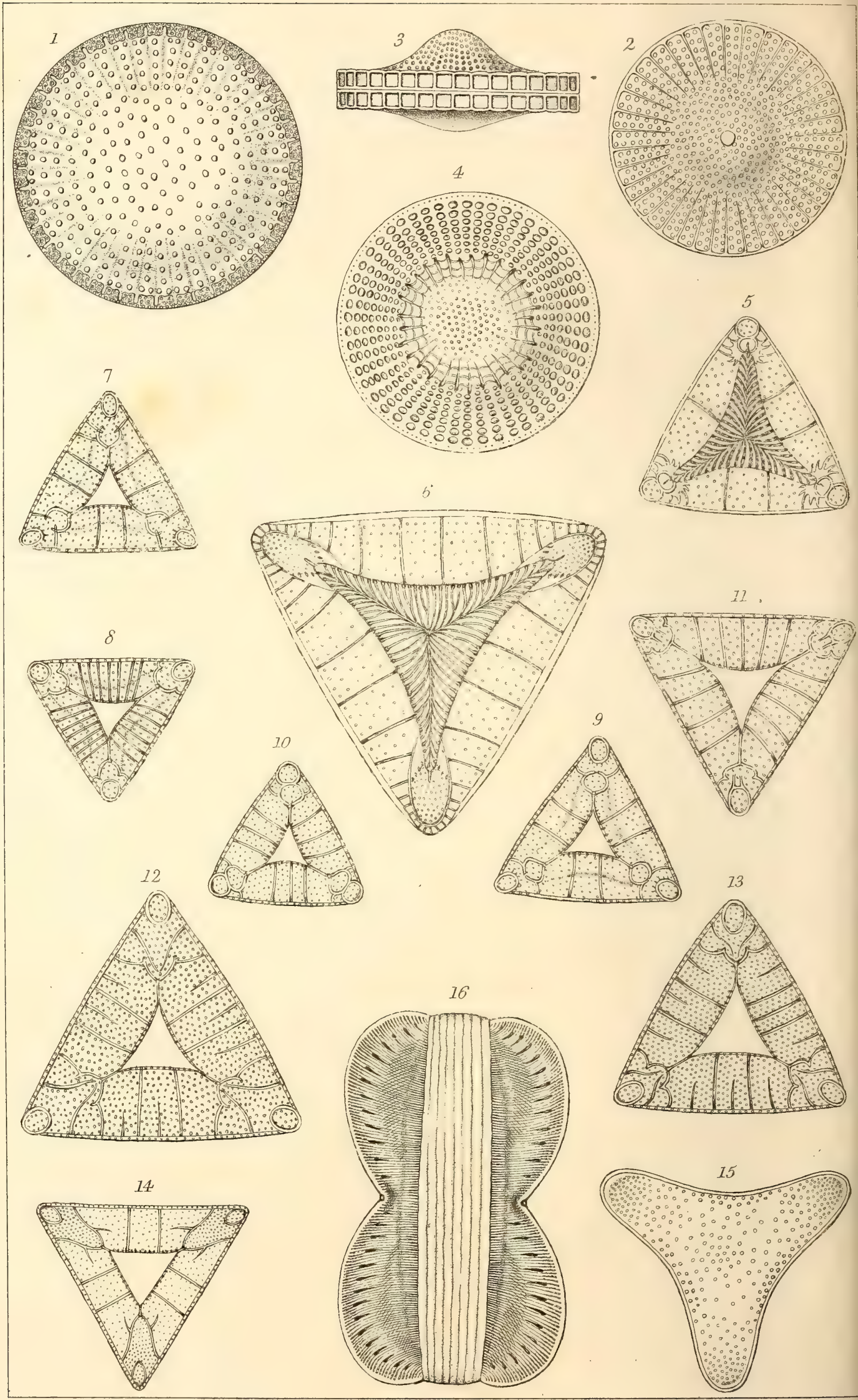
10.—*T. giganteum.*

11.—*Amphitetras minuta.*

All the figures are × 400 diameters.



W West imp.



R. K. G. del. Tuffen West, sc.

W. West, imp.

DESCRIPTION OF PLATE X,

Illustrating Dr. Greville's paper on New Diatoms, Series IV.

Fig.

1.—*Stictodiscus Californicus.*

2, 3.—*S. Kittonianus*, × 600.

4.—*Coscinodiscus patellæformis.*

5.—*Triceratium marginatum.*

6.—*T. pulcherrimum.*

7—9.—*T. Abercrombieanum.*

10.—*T. inopinatum.*

11.—*T. approximatum.*

12, 13.—*T. gratiosum.*

14.—*T. variegatum.*

15.—*T. nebulosum.*

16.—*Amphiprora conspicua.*

All the figures except 2 and 3 are × 400.

Errata in Series III.—For *Triceratium notabilis* and *T. insignis*, read *T. notabile* and *T. insigne.*

INDEX TO TRANSACTIONS.

VOLUME IX.

TRANSACTIONS

OF THE

MICROSCOPICAL SOCIETY

OF

LONDON.

NEW SERIES.

VOLUME X.

LONDON:
JOHN CHURCHILL, NEW BURLINGTON STREET.
1862.

TRANSACTIONS.

On the Circulation *in the* Tadpole.

By W. U. Whitney.

(Read June 13th, 1861.)

I have been surprised at the comparatively small number among the many who, in the present day, devote a good deal of time to the microscope, who have examined the tadpole. But I am sure that not one among those who have done so will easily forget the sense of surprise and delight felt on first looking through the transparent cabinet of this little creature's curiosities. He reveals to us, through the eye of the microscope, the greater part of his entire mechanism in living and liveliest operation, the contemplation of which never fails to excite equal astonishment and pleasure.

I had often examined the tadpole under the *single* microscope, but on looking at him under the binocular I was astonished at the additional *grasp*, as it were, of vision—a power of penetration as well as distinctness—given by this instrument; and felt convinced that, with this great addition to our means, we might obtain a more complete view of the organism, and of the circulation especially, than had yet been attained. In conjunction with my friend, Mr. Fitzgerald, and with his binocular microscope, I began the series of observations which have produced the accompanying diagrams, wherein the complete circle of the circulation is represented. As in the best English standard work on comparative physiology (I mean Dr. Carpenter's)—a work enriched from foreign as well as native sources—there is no such complete representation, we have presumed that the binocular microscope has enabled us to obtain, for the first time, a clear and comprehensive view of the tadpole's vascular system.

Placing the tadpole on his back, we look, as through a pane of glass, into the chamber of the chest. Before us is the beating heart, a bulbous-looking cavity, formed of the most delicate, transparent tissues, through which are seen the globules of the blood, perpetually, but alternately, entering by one orifice and leaving it by another. The heart appears to be slung, as it were, between two arms or branches, extending right and left. From these trunks the main arteries arise. The heart is enclosed within an envelope or pericardium. This pericardium is, perhaps, the most delicate and is, certainly, the most elegant beauty in the creature's organism. Its extreme fineness makes it often elude the eye under the single microscope, but under the binocular its form is distinctly revealed. Then it is seen as a canopy or tent, enclosing the heart, but of such extreme tenuity that its *folds* are really the means by which its existence is recognised.

Passing along the course of the great blood-vessels to the right and left of the heart, the eye is arrested by a large, oval body, of a more complicated structure and dazzling appearance. This is the lung, which, in the tadpole, is a cavity formed of most delicate, transparent tissue, traversed by certain arteries, and lined by a crimson network of blood-vessels, the interlacing of which, with their rapid currents and dancing globules, form one of the most beautiful and dazzling exhibitions of vitality.

The tadpole is hatched with respiratory and circulating organs that resemble those of the fish. It lives in the water, breathes oxygen from the air contained in the water, and during the early period of its existence respires exclusively by gills. Our inquiries do not apply to this the earliest stage of tadpole life, but to the *middle* and *later* periods, the stage of *transition* between the fish and the reptile, when, as Dr. Carpenter expresses it, "there is a kind of balancing between the organs which are disappearing and those which are being evolved."

It will be remembered that in the fish the heart has two cavities, an auricle and ventricle; that the blood, returned by the veins of the body to the auricle, passes into the ventricle, and is then transmitted to the gills, where, being exposed to the air contained in the water, it becomes deprived of carbonic acid, aerated, and rendered fit for re-circulation through the system. In the reptile we find a modification of plan coincident with the lower tone of vitality which distinguishes these cold-blooded creatures. Their heart has three cavities, two auricles and one ventricle; and by this contrivance there is a perpetual mixture in the heart of the impure carbonized blood which has already circulated through the body, and flows into the ventricle from the *right* auricle, with the pure, aerated blood returned from the lungs, and which also flows at the same instant into the ventricle from the *left* auricle. Thus the habitual circulation of this "cold-blooded" mixture is the cause of the low tone of vitality that distinguishes the perfect reptile.

We now arrive at the consideration of the tadpole, who, during the middle and latter stages of its metamorphosis, assumes a condition which is neither that of fish or reptile, but something which differs considerably from both.

For the purpose of observation the tadpole must, of course, be selected during the period in which the skin is perfectly transparent. The first examinations revealed plainly enough the appearances already described of the form and situation of the heart, and the three great arterial trunks proceeding (right and left) from it. The course and destination of these were not so easily arrived at. Many observations were required, on tadpoles of various sizes and carefully prepared, to arrive at what I believe to be the true anatomical and physiological arrangement of these vessels. First, all these are closely connected with the corresponding lung. The upper one (the *cephalic*) runs along the upper edge of the lung, and gives off, in its course, a branch which ascends to the mouth, and is mainly distributed to the thick-fringed lip which surrounds the mouth, and is evidently an organ of sense, playing the part of judge and sentinel to this important entrance. It is profusely supplied with blood by this artery, and the blood is returned by a corresponding vein. We may call these the *labial* artery and vein. The cephalic artery continues its course around the lung (forming, to all appearance, the *edge* of that organ), until it suddenly curves upwards and backwards, and reaches the upper surface of the head, where it dips between the eye and the brain, towards which it is evidently travelling. We may now call it the cerebral artery.

Dr. Carpenter speaks of the second main trunk as contributing with the third to form the great systemic *aorta,* which descends into the abdomen. The evidence we obtained appears to be at issue with this statement. To us the microscope revealed the course and distribution of this artery *through the lung,* freely communicating, by a network of vessels, with the upper or cephalic branch, and with the lower one, which I am next to describe. This *middle* one, therefore, would seem to be the true *pulmonary* artery. The third main trunk (which we have been at great pains to trace) clearly enters the lung, distributes branches, but *continues its course as a large trunk,* bending downwards to the lower surface or floor of the lung, whence it emerges, curving towards the spine, and becomes, as I shall presently show, the great *abdominal aorta*. If these statements are correct, they exhibit a different vascular arrangement to that which has hitherto been represented, and they have an important bearing upon certain *physiological* points presently to be mentioned.

I will now speak of the means by which we were enabled to trace the existence and course of blood-vessels ordinarily *invisible*. It would be a mistake to suppose that you can make out distinctly, in the average of tadpoles taken, without preparation, and placed under the glass, the plan of the blood-vessels, even as far as I have yet described them. The great obstacle is the large coil of intestines, usually distended with dark-coloured food, undergoing digestion and travelling along the bowels. This, of course, effectually screens every thing behind it from the eye of the observer. Moreover, by distension the bowels stretch upwards to the chest, reaching the apex of the heart, and often concealing a part of the lungs. To empty the bowels, therefore, was the great desideratum. I immersed tadpoles in solutions of many of the known aperient drugs—Epsom salts, colocynth, aloes, elaterium, &c., but no purgative effect was produced. But as the contents of the bowels are, in the natural state, perpetually passing away, I thought that by giving them an opportunity of clearing themselves, and at the same time preventing an accumulation of fresh matter by putting the tadpoles upon low diet, we should extend our field of vision. This experiment succeeded. The tadpoles lived on plain water for some days; much of the intestinal contents passed away, the canal became comparatively, though not entirely, empty, and the bowels, shrinking in proportion, occupied a smaller space.

Figure 1 (Pl. I) exhibits what we see ordinarily when a tadpole is looked at—heart, the main arterial trunks, and the greater part of both lungs. But under the influence of low diet we gain a much clearer and more extended view of the vascular system. Water diet, of course, impoverishes the blood, which is rendered paler, as well as reduced in quantity. This effect upon the lungs increases their transparency, and by diminishing the quantity and redness of the blood in the minute vessels, lessens the dazzling, dancing movement of red globules, which, most beautiful to look at, is yet perplexing to the eye in its endeavour to catch distinctly and trace the course of the three large arteries which, I have said, traverse these organs. But in proportion as the *minute* branches and their contents are *less* conspicuous, the large trunks become traceable; and we have repeatedly been able to follow their course as they have lain naked and unencumbered beneath the eye (see figures). The bearing of this in a physiological point of view I shall reserve till we have completed the circle of the vascular system.

Figure 2 exhibits the more extended view of the vessels obtained under the influence of low diet. Here are vessels revealed which, till now, were invisible. But we will continue our course along the arteries. The *third* trunk, traversing the lung, is now seen to emerge from its lower edge or floor, and descends into the abdomen. There could be no doubt that this contributed to form the great abdominal aorta, conveying the blood which supplies the bowels and all the abdominal organs. Still it was partially hidden. We had not yet *seen* the vessel on each side descend and unite with its fellow to form the abdominal trunk. But this desideratum was at last vouchsafed to us in a most unexpected manner. It happened that on one occasion a small, black-looking little fellow was put under the microscope. He was taken from a jar of fresh tadpoles who had been regaling upon green weeds. To all appearance opaque, he proved, to our astonishment, transparent from head to tail! He was an animated *case,* and nothing more. His heart was beating and his blood circulating, but the latter was quite *colourless,* not a single red globule was visible anywhere. The creature was a mass of *outlines* merely. The globules chased one another like globules of water, the heart was a colourless globe, the lungs were two transparent ovals, and the bowels a colourless, empty, transparent coil. Our animated *case,* however, proved to be "a case in point." That which we had long been searching for was now before us. Through the empty coil we saw the artery on each side descending from the lungs, converging to the spine, meeting its fellow, and with it uniting to form the abdominal aorta (fig. 3). After the aorta has supplied the abdominal viscera, we find a prolongation, or *caudal* artery, descending to the tail, the all-important organ of locomotion in the tadpole. This artery, entering the root of the tail, is imbedded deeply in the flesh, whence it emerges, and then continues its course, closely accompanied by the vein, to within a short distance of the tail's extremity, where, being reduced to a state of extreme fineness, it terminates in a capillary loop, which is composed of the end of the artery and the beginning of the vein. The artery, in its course, gives off branches continually to supply the neighbouring tissue. You may often observe that the blood-current in the tail, even in the main artery or vein, is sluggish or even still. This occurs independently of the heart, which may continue to beat as usual; and it happens, because the circulation in the tail depends very much on the motion of the organ. When this is suspended (as in confining the tadpole under the microscope), the blood moves sluggishly, or stops, till the tail regains its freedom and motion, when the activity of the current is restored. This principle is thus alluded to by Dr. Grant:—"It is the restless activity of the worm and of the insect that makes every fibre of their body, as it were, a heart to propel their blood and circulate their fluids, while the slow-creeping snail that feeds upon the turf has a heart as complicated as that of the red-blooded, vertebrated fish, that bounds with such velocity through the deep. It is because the fish is muscular and active in every point that it requires no more heart than a snail to keep up the necessary movements of its blood."

Having arrived at the end of the arterial system, which conveys the blood from the heart to the extremities, we will now trace its return by the veins back again to the heart.

The caudal vein runs near to the artery during the greater part of its course, with its stream, of course, *towards* the heart. This stream is swollen by perpetual tributaries flowing into it at all points of its course, from vessels so numerous that their loops form a network which covers the entire surface of the tail. As the vein approaches the root of the tail it lies superficial to the artery, and diverges from it at the point of entering the abdomen. Here it approaches the kidney, sends off a branch which encloses that organ on the one side, while the main trunk continues its course on the other, receiving tributaries from the kidney as it passes. By this time this vein has become the chief river of venous blood, the *vena cava inferior*. Passing upwards behind a coil of intestine, it approaches the liver, and runs in a curved course along the margin of that organ, where it receives the large residue of the blood from which the *bile* has been secreted. This blood is seen to enter the vena cava by numerous fine channels, which converge towards the great vein as it passes in close proximity to the organ (figs. 2, 3). Beyond the liver the *vena cava* continues its course upwards and inwards to its terminus in the *sinus venosus* or rudimentary auricle of the heart. This terminus is the junction of not less than six distinct venous trunks, incessantly pouring their blood into the heart. Figure 2 illustrates that the junction of these venous trunks, and, in part, the vessels themselves were revealed under the influence of the low-diet system

We have already traced the lower *vena cava* to the *sinus venosus.* Let us now return to the head, where we left the cephalic arteries to supply the brain, lips, &c. The circulation in the fringed lips forms a most complicated network of vessels, out of which proceeds a vein corresponding to the artery already traced. This descends in a direct course till it joins the principal vein of the head, which corresponds to our own *jugular.* This latter, formed by the union of smaller ones converging to it from all parts of the head, descends in front of the large transverse muscles, passes downwards in front of the lung close to its inner edge, and continuing to descend in a direct course, *seems* to be making its way into the abdomen. But the abstinent system, by removing the screen of loaded bowel, revealed the subsequent course of this vessel. The vein, having reached the lower edge of the lung and arrived at the very margin of the abdomen, turns suddenly at *a right angle* and runs straight to the sinus venosus. We observe that at the point of the angle this vein receives into it the current of another large one, running upwards from the abdomen to meet it. Herein is the probable explanation of this eccentric course (figs. 2, 3, letter T). The union of this jugular vein from above with the abdominal vein from below forms *the upper vena cava.* We have two more large abdominal veins, which meet close together, and pour their blood into the sinus venosus, between the lower vena cava on one side and the upper vena on the other (U). We have detected distinctly on the *right* side *a venous trunk,* returning blood from the lung, and emptying itself into the auricle or sinus (V). This is the *pulmonary vein,* bringing the *aerated* blood from the lung to the heart; but observe that the proportion of *aerated* blood thus contributed is very small compared with the quantity of *venous* blood poured into the same cavity at the same moment from the *five* other sources I have described. There is doubtless a left pulmonary vein, corresponding to the one on the right side, but as we have not yet been fortunate enough to see it, I have not figured it.

Thus we have traced the blood through its main channels and completed the circle of its course. But the special point in relation to the anatomy and physiology of the tadpole, as a creature distinct from the fish on one hand and the reptile on the other, yet remains to be mentioned. The *three* large arteries which arise from the heart become (according to the evidence we have obtained, *the cephalic, pulmonary,* and *aortic* trunks. Herein we differ from the received view of these arterial arrangements. The first trunk, according to Dr. Carpenter (and as we have also observed) is devoted to the head; but Dr. Carpenter does not mention any connexion between this vessel and the lung. Now, this cephalic artery, as it travels over and rests upon the upper surface of the lung, *receives into it small branches from the subdivisions of the pulmonary artery,* so that there is a direct communication between these two vessels. The second and third trunks, according to the same authority, form the aorta, the current flowing continuously from the heart into the abdomen; while a fourth trunk is mentioned by Dr. Carpenter as the pulmonary artery, devoted exclusively to the lungs. But our own observations have convinced us that it is the *second* trunk which enters and is distributed through the lung as the true pulmonary artery, while the *third* trunk *also enters* and passes through the lung, *inosculating, in its course, with branches of the pulmonary artery,* and then emerges from the floor of the lung to enter the abdomen, and with its fellow form the aorta or great systemic trunk. With regard to the *fourth* vessel, which Dr. Carpenter calls the *pulmonary,* we have never been able to discover such a one. Now, according to Dr. Carpenter's view, it is clear that the blood in the cephalic arteries, and the blood descending to the aortic trunk in the abdomen, is the mixed arterial and venous blood expelled from the heart, in short, the blood of a reptile. But the habitudes of the tadpole are *not* those of the reptile. He exhibits all the activity and liveliness of the fish *long after the gills* (the characteristics of his fish life) *are supplanted* by the developing lungs. *Activity* characterises every function in the tadpole at this period. In this respect he presents a contrast to the frog, which cannot fail to strike the most careless observer. The functions of nutrition, growth, development, and locomotion, which constitute the great business of his life, are all habitually and vigorously performing. For these functions, and for this activity, a constant supply of pure, aerated blood is known to be essential. On the other hand the circulation of mixed venous and arterial blood in the frog is consistent with the lethargy, inertness, coldness, low vitality of the creature. Dr. Carpenter observes, "the correspondence between the *general vital energy* in any individual system, and *the activity of respiration,* must be evident to the observer;" and quotes for example "the energy of respiration in the active and rapacious eagle as compared with the timid and indolent tortoise." I think we may paraphrase this passage by comparing "the active and rapacious tadpole" with the timid and indolent frog." The activity of the tadpole is unquestionable. As for his rapacity, I know him to be a cannibal. A large tadpole, and especially if he be hungry, will kill and devour his smaller brethren; while the body of a dead tadpole put into a jar of living ones is attacked in a moment, and greedily consumed as a *bonne bouche* of the highest order. These ferocious qualities are not found in the frog. Again, Dr. Carpenter observes, "The development of the *locomotive powers*, which may be regarded as an indication of the general activity of the organic functions, will be found *peculiarly* connected with that of respiration." Now, in the tadpole we have the development, first, of the tail, an active and vigorous organ of locomotion, and which is often large enough to make a winding sheet for the whole body; and, secondly, the development of the four extremities, the locomotives of the future frog, which business is completed during the tadpole state.

Thus there seems to be plenty of evidence that *some provision* exists in the tadpole for a much higher aeration of the blood than the mere reptile arrangement will permit. And I submit that if we have been able to trace *each* of the three great arterial trunks into immediate connexion with the lungs themselves—the *cephalic* running over, or rather forming, the upper edge of the lung, and directly receiving blood from branches of the pulmonary artery; the *pulmonary*, distributed to the lung itself; and the *aortic*, also penetrating the chamber of the lung to inosculate with, and receive blood from, the pulmonary—then we have discovered this provision, and have found an adequate explanation for all those active vital phenomena in the tadpole which appear to indicate a very complete aeration of the blood.

On a PORTABLE REVOLVING TABLE.
By JOHN BURTON, Esq.

(Read Oct. 9th, 1861.)

A COMMUNICATION of Mr. Jansen in the Journal for July suggested to me the desirableness of laying before the Society a portable revolving table which I had recently constructed for my own use.

Where only one microscope is used, an apparatus to move upon an ordinary table has the advantage of enabling the exhibitor to have various things lying at hand, while the microscope is being passed round to others.

In constructing this my object was to have a table efficient, at the same time small and light, one which might conveniently accompany the microscope even on visits into the country. Care was taken to have the space needed for a first-class instrument, and lamp, with bull's-eye and side condenser; securing this, there is space for everything else.

The upper part is in five sections, tapering from $3\frac{3}{4}$ inches to a point, of deal $\frac{1}{4}$ inch thick, made strong by having American leather-cloth glued on the upper and coloured cotton on the under surface, both being arranged to allow the parts to fold up like a fan. This rests on a triangular frame of 19 inches, made of light, tough wood, $\frac{3}{4}$ inch deep by $\frac{1}{2}$ inch, with one bar across the middle. This bar is joined to the sides by two small pins at each end. The sides are united by a joint similar to that of a carpenter's rule, but made of simple plates of brass, one above, one underneath, as shown in Diagram 2. In the under one is a *hole* for the *pivot,* on which the table rests and revolves. The other angles are mortised, and held together by one of the two wires which give support to wheel-rollers. These wheels (about $1\frac{1}{4}$ inch diameter) are somewhat tapered, to move more smoothly in a circle, and are covered with cloth. The *pivot,* a small wire, is fixed in a turned base. This being placed in the middle of a round table, or near the end of a dining table, and the pivot-hole passed over, the whole is moved easily round, without damage to wood-polish or cloth, and its circular action preventing its running off the table.

Diagram 1 shows the table as in use.

1.

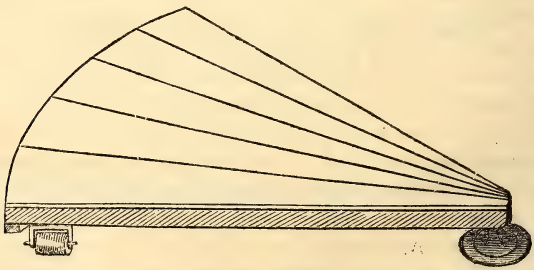
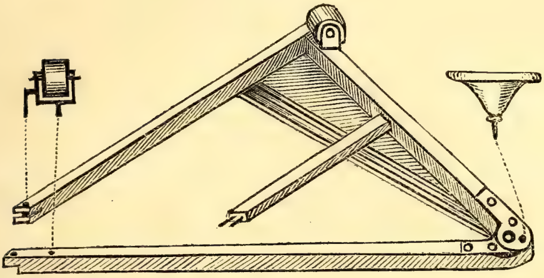


Diagram 2 the table turned over, the "upper part" folded

2.



as a fan; one wheel taken out, and its corner disjointed; the middle bar, with its connecting wires. The dotted lines mark the holes to which each wire of the wheel and centre pivot belongs.

A Description of the Universal Achromatic Microscope, *as contrived and manufactured by* Smith, Beck, and Beck.

(Read Oct. 9th, 1861.)

The word cheap, when applied to the achromatic microscope, by no means loses its varied and comprehensive meaning. As manufacturers, we are not unfrequently told by the gentleman who has paid his hundred guineas for his instrument that he does not consider it expensive, but cheap, compared with the instruction and amusement it affords, or, indeed, as nothing, when contrasted with an indulgence in many other tastes; whereas, on the other hand, we receive a letter from an inquirer for a cheap microscope, in which, after stating its numerous qualifications, we are told we must on no account exceed the sum of 10*s.* 6*d.*

Now, disregarding these extremes as well as "the happy medium" (for our price is much nearer the smaller sum), we still claim the title of cheap for the microscope which is represented in Plates V and VI.

At first sight, the instrument undoubtedly appears one-sided, and to those who are inclined to form an opinion as to its deformity, we must confess that, after a most careful consideration of the whole as well as each individual part, we have in no instance made a sacrifice of efficiency for the sake of appearance; but with this expression of our motive, we would also ask the casual observer to withhold his judgment until the working qualities and the price of the instrument are also before him.

The foundation of the stand is a large, circular base (A), and near its circumference, on the left-hand side, is a strong pillar (B); at its top is the axis upon which the remainder of the instrument turns, and with so equal a balance as never to require more than a slight screwing down of the small, milled head (C) to secure any particular position.

On the same centre as the axis is a large, milled head (D), by which a quick motion is given to the body (E), and depending from the smaller part of the same milled head is a lever (F); this of itself hangs free, but when held at the end and pressed sideways, either nearer or further from the pillar, it obtains a gripe upon the milled head (D), which can then be turned so slowly as to constitute a very good slow motion.*

The quick-motion milled head and the slow-motion lever are always in the same position, and do not alter with any inclination of the body they are also so low down; that in using them, the hands are very little raised from the table; this latter advantage also applies to the stage (H) which is screwed on at the lower end of the limb (G) at less than four inches from the bottom of the stand.

On the top of the stage is a double spring (I), branching right and left over a brass plate (K). On this there is a ledge (L) for the object to rest upon, and in continuation, on the right-hand side the plate, is bent over, so that it may be firmly grasped by the fore and middle figures underneath and by the thumb above. By this arrangement the object can be moved freely in every direction, and will retain its position after the hand is withdrawn. If necessary, the short spring (M) may be used when the object has to be held firmly on the plate. The small pin (N) is for holding the forceps (O).

Beneath the stage is a cylindrical fitting P, for all the apparatus required in that position. The diaphragm (Q) is, however, made a fixture to the mirror-stem (R), except that it will turn away entirely on the left side when necessary; it is provided with one small aperture (X) for the lower powers, and this can be closed, or otherwise by a small shutter (Y).

A concave mirror (S) swings in a rotating semicircle (T), which

* Mr. Brookes was, we believe, the first to recommend this kind of slow motion, and the chain motion; and the chain movement, which we have also adopted, has hitherto been chiefly confined to Mr. Lobb's instruments.

is attached to an outside sliding or tube, the inner tube being screwed beneath the stage, and almost opposite a side condenser (U) is fixed for the illumination of opaque objects; it is provided with ball-and-socket joints, which afford any necessary movement, and also the means of turning it out of the way when not in use.

The object-glasses are two in number, one inch, and a quarter inch focus, and of the respective apertures of 20 and 75 degrees; these, when combined with the two eyepieces give the four linear powers of 60, 90, 240, 360; the higher power has no adjustment for variations in the thin glass or other media when interposed between its front lens and the object, but it is corrected for a piece of glass ·008 thick, and for objects covered with glass of such measurement its definition will be best.

The eye-pieces are small in diameter, but are of a construction (we believe introduced by Kelner) which gives a flat, and for their size a large, field of view. Their chief fault will, we believe, prove a general advantage; any dust or moisture upon the field-lens is so annoyingly apparent, from its being in the focus of the eye-lens, that those who use this form will be compelled to wipe the lenses frequently; and not only this, but they will soon learn the necessity for the constant examination and the occasional cleaning of every surface of glass that they have about their microscopes.

With merely enumerating a pair of forceps (O), a small pair of pliers (V), a glass plate, with a ledge (W), and an upright mahogany case, we sum up the achromatic microscope we shall supply for five guineas.

Although, up to this point, the instrument may be considered as complete and probably sufficient for many observers, yet we are quite sure, if any one who possessed such a stand were to find that, as his interest in microscopic research increased, he were unable to make additions to the power and to the capabilities of his instrument, the investment even of five guineas would become a source of regret or a check, perhaps to his enterprise, whilst no credit would be due to the manufacturer. We hope, however, to obtain the most opposite results from the following additions, which can be made to those parts we have already described.

In the first place a lower, an intermediate, or a higher magnifying power than those mentioned may be obtained by the addition of a 2 in., $\frac{1}{2}$ in., or $\frac{1}{8}$ in., the respective angles of aperture of which are 9, 45, and 85 degrees, and their magnifying powers with the two eyepieces mentioned 30, 45, 120, 180, 480, and 720; besides these, a third eyepiece may be added, which will as nearly as possible double the power of the first.

That which we believe our customers will first selves of is a body as shown in Pl. VI, fig. 1; this is so combined as that three object-glasses and three eyepieces shall be attached to it. Only one of each of these can be central with the axis of the body at the same time; but any of the others can be brought into their proper position by pressing in the rounded head of a pin, (B), when either of the discs, (C), can be turned in the required direction, and will be stopped again by the pin, (B), springing out.

This will be a great advantage to those who are deterred from making a casual use of the microscope by the trouble first of all, of putting the instrument up, and, secondly, the delays which are caused by the necessary changes; whilst it will considerably assist in the investigation of objects which are undergoing a change, either in their position or their structure, and when a great range of power is required with the least delay possible. As a luxury, it will apply to every use of the microscope.

These remarks apply more especially to the change of the object-glasses; in some cases the eyepieces are to a slight extent in the way, as in using a camera lucida, whilst they are always more or less likely to be condensers of the breath; and as their change can be made rapidly, we have for these reasons, combined with a complicated structure that was involved, omitted them in the binocular edition. (Fig. 2.)

From the very first glance through Mr. Wenham's last binocular arrangement we have always been convinced, not only that this improvement was essential, but also that it must become universal. We have no cause, more than any other opticians, to urge the necessity of stereoscopic vision in nearly if not all microscopic investigations; and by bringing before you this evening a plan by which we hope to reduce the price considerably, we cast in but a very small mite compared with the liberality of the inventor, who, refusing the least emolument, has presented you with his scheme unpatented.

Pl. VI, fig. 2, shows the double body, and it possesses the following advantages:—the object-glasses are mounted on a rotating disc, as already described; an adjustment for different distances between the eyes is made by sliding the draw tubes (E) up or down, the milled head (F) clamping them in any required position. The reflecting prism is placed close behind the back lens of each object-glass, and with this arrangement the field of view is not cut off when the objects are viewed as transparent with the highest power. If the single body only be required, the prism can be pushed back by the small, milled head (G); or when this is unscrewed, it can be taken out altogether, for the purpose of being wiped.

We may here mention that the manufacture of this instrument is so arranged as that the change from the square body (Pl. V) to the binocular or other body (Pl. VI) can be made by any one, and with great facility; so that to add these, or any other parts which are alluded to in this paper, it will not be necessary for the microscope to go into the hands of the manufacturers, or of any skilled workman.

As to the necessity for the next addition, there may be different opinions. We have not previously stated that the spring (Pl. V) which holds down the stage-plate (K) can be removed by unscrewing; after this is done the stage is perfectly clear, and any large object, or a small saucer or dish, can be placed upon it. It will also then receive what is commonly called a stage with actions (Pl. VI, fig. 3); this is contrived so to fit on as to admit of its being turned round as a whole, and consequently always central with the body; or, in other words, during the rotation the object will not move out of the field of view; the amount of movement at right angles is half an inch each way, and is effected by means of the milled heads (I, K); the object can be moved to and fro on the ledge (L) which also slides up and down, and a small spring can be turned to clamp the object when necessary.

The following extra pieces of apparatus can also be added; but as they require no description here, we merely enumerate them to give some idea of the capability of this form of stand:

Polarizing apparatus, consisting of two Nicol's prisms and plate of selenite.

Wenham's parabolic reflector, for dark field illumination.

A dark well; and Lieberkuhn's to the 1-inch and $\frac{1}{2}$-inch object-glasses, for additional opaque illumination.

Wollaston's camera lucida, by which, with the aid of a stage micrometer, any drawing or measurement can be made.

A small live box, and a glass trough.

At the conclusion of this description (for the length of which we must apologise), whilst not contending for one moment that the performance of this microscope will equal that of our first-class instruments, we are sure it will most satisfactorily exhibit nine tenths of the microscopic researches already recorded, and we as confidently predict its efficiency for a larger proportion of those observations which have yet to be made in that immense field of nature still unexplored.

On a Coccus *upon a* Rosebush.
By Richard Beck.

(Read Nov. 13th, 1861.)

In a note appended to my former paper on a coccus found upon oranges, and published in the 'Microscopical Journal' for July, 1861, I mentioned that the same insect was very numerous in our own gardens, and at that time my attention was directed to a plant of Cotoneaster against a south wall, which in many parts was literally covered with a female coccus of the same species as that already alluded to (Pl. IV, fig. 1).

The search for any males seemed, however, quite hopeless, when Mr. Cooke, the optician, of York, having written to me for some of the large garden spiders which he says are not to be found in his neighbourhood, I was hunting on a north wall, and could not but notice a *Coccus* in great abundance on the older stems of a rosebush, both the male and female insects being visible to the naked eye (fig. 2). For many reasons I for some time believed this to be a species entirely different from that on the orange; the external appearance of all the shields was very different, and when these were turned over the females were so much larger at the head as to be quite different in shape, and of a much darker colour (fig. 3). The eggs, also of a darker colour, were laid in a more or less circular position, and most of the males contained a fly entirely different from that I had previously described.

But these were the only differences, and ultimately, after a very careful examination, I traced both males and females, the former more especially, through exactly the same metaphorsoses as I have described in my former paper.

The small fly I have alluded to as being present in some of the male shields, and, as I found afterwards, in those of the female also is a species of ichneumon (fig. 4), but its presence alters the external character of the *Coccus* very little, a slight enlargement in the males only being visible (fig. 5).

Beneath the shields there are, however, considerable differences; in the female *Coccus* the mere fact of a fly being developed is sufficient to indicate an unnatural state, and whereas the male *Coccus*, when in its pupa state, undergoes considerable changes in its form, the smooth, hard shell in which the ichneumon fly is developed is invariably uniform; this shell is left behind when the imago escapes, in the male coccus one or other extremity being removed (fig. 6), but in the female a clean, round hole is made through both shell and shield (fig. 7).

From the examination of some skins of Aphides, from which the ichneumon flies have escaped, I believe that in making the hole this portion of the shield is not destroyed, but a piece is cut out which has very much the appearance of the cover of a "man-hole" to a boiler.

The external features of the ichneumon are also of a much higher class than those of the *Coccus*. The head is perfect in all its parts; there are four wings; the eyes are compound; the extremity of each leg is provided with a beautiful, trumpet-shaped sucker, and the ovipositor is capable of being protruded or otherwise.

To sum up these few and very short remarks, I venture to repeat the two facts which I consider of most interest—first, that the male of this *Coccus* may under some circumstances be detected in our own gardens; second, that the same species may differ very considerably, more especially on the exterior of the shield, according to the climate, its position, or the nature of its food.

On the VISCID LINES *in a* SPIDER'S WEB.
By RICHARD BECK.

(Read Nov. 13th, 1861.)

As I have, although very casually, alluded in this paper to the large garden spiders, I may, perhaps, be allowed to mention a fact connected with them which came under my notice about the same time.

It is well known that in all the geometric spider webs the concentric lines, with the exception of those in the very centre, are most beautifully dotted with a viscid substance, to aid in the capture of insects. Mr. Blackwall has, I believe, computed that there are more than 100,000 of these gummy drops in a web which is made in about half an hour; it has always, therefore, been a puzzle in my own mind how this part of the process was effected, and as I had been unable to find any one who could give me a satisfactory explanation, I thought I would carefully watch a spider during the operation, when, with only a pocket lens, I could distinctly see that the viscid lines, as first drawn from the abdomen were not dotted.

On a careful examination with a microscope, which I took into the garden, the thread at first appeared only slightly thicker than an ungummed line, but after a very short time undulations appeared, and subsequently, at the most regular distances, the viscid matter formed into alternating large and small globules.

The whole process is such a beautiful illustration of molecular attraction, which Mr. Rainey has been so patiently and profoundly working out with regard to the highest organic structures, that I thought this simple example might interest some of our members. The cold weather has, of course, driven away these spiders till next autumn, at least, but the same result can easily be obtained artificially.

DESCRIPTIONS *of* NEW *and* RARE DIATOMS. SERIES V.

By R. K. GREVILLE, LL.D., F.R.S.E., &c.

(Read Dec. 11th, 1861.)

HAVING recently been presented by my friend, Dr. Macrae, Presidency Surgeon, Calcutta, with a considerable series of slides of diatoms collected in Ceylon and on other parts of the Indian coast, I hasten to lay before the Society a notice of some of the more interesting species contained in them. I have not, however, exhausted the materials so kindly placed in my hands, and must reserve a description of other novelties, as well as any general observations I may have to make on the entire collection, for a future communication. Dr. Macrae has returned to India with the intention of taking every opportunity of prosecuting his diatomical researches, and we may confidently anticipate many interesting discoveries in a field comparatively unexplored.

SURIRELLA.

Surirella fastuosa, Ehr.—Elliptic, with rounded ends, and rather distant costæ, dilated towards the margin; median space more or less lanceolate, enclosed within a line of extremely short transverse striæ. Length ·0025 to ·0074″. (Pl. III, fig. 1.)

No correct representation of this fine species having hitherto been published, I have been induced to figure a frustule of extraordinary dimensions found by Dr. Macrae in Ceylon. When Professor Smith wrote the first volume of his 'Synopsis of the British Diatomaceæ,' it was considered so rare that some of the slides distributed by him contained only a solitary carefully marked specimen. The figure engraved in the synopsis is incorrect in outline and deficient in details. Doubtless, however, examples must have occurred to the author of an ovate form, and such a one must have been placed before the engraver; but Mr. Ralfs remarks ('Pritch. Inf.'), "we have never seen it ovate as described by Professor Smith;" and I may add my own testimony to the same effect, after having examined a multitude of frustules. The ordinary form is unquestionably elliptic, with rounded ends, as stated by Ralfs, occasionally tending to orbicular, as in the specimen now figured. An error seems also to have been entertained with regard to the structure of the centre of the disc. Smith does not refer to any striation whatever of what he calls the median line, and the figure in the synopsis has the centre wholly blank. On the other hand, the median space is described in 'Pritchard's Infusoria' as transversely striated, a character I have been unable to perceive. After making the drawing of the gigantic individual received from Dr. Macrae, I examined an extensive series of frustules from British stations, relative to the structure of this part, as well as a slide from Professor Smith himself, and find them all to agree in essential points. It will be seen, by consulting my figure, that the median space is enclosed by a narrow line of exceedingly short striæ, within which the costæ are continued towards a sort of indefinite median line, indicated by the termination of the costæ rather than by any genuine line. The normal shape of the median space is correctly described by Mr. Ralfs as lanceolate; but it varies exceedingly, and I have seen frustules in the same slide exhibiting every gradation from a strictly linear to a broadly lanceolate median space. In the former case the narrow, striated lines become parallel, and no room is found for any continuation of the costæ. In no instance, however, so far as I have seen, do the striæ really cross the median space. In proportion as the striated lines expand, continuations of the costæ are introduced, at first with great irregularity, being short, often pointing in different directions, frequently passing across the middle, and scarcely appearing to be connected with the costæ at all. As the median space increases, they become more regular, and in largely developed frustules, as in the figure now given, there can be no doubt about their true nature. Besides the proper continuations, there are sometimes short, supplementary ones, which do not answer to any of those exterior to the median space, as well as lines of puncta (see the figure) which must be regarded as abortive supplementary costæ.

The late Professor Gregory had observed, as he believed, intermediate states between this species and *S. lata*. Such specimens have not occurred to myself. I may mention, however, that the structure of the middle portion of the disc is very similar in both species. Nothing definite is conveyed by the figure of *S. lata* in Smith's synopsis with reference to this part. The median space in that species, as well as in *S. fastuosa*, is not itself striated, but is bounded on each side by a line of exceedingly short striæ, which apparently form a narrow ridge. A difference, however, exists in the shape of the median space; the normal form of that of *S. lata* being linear, or, at least, having parallel sides, while that of *S. fastuosa* is lanceolate. And although in the latter it not unfrequently becomes linear, I have never seen it expand into lanceolate in the former. In both species, when the median space is narrow, there are no central continuations of the costæ, but when the space is broad these occur in *S. lata* as well as in *S. fastuosa*.

Surirella Macraeana, n. sp., Grev.—Oblong, constricted in the middle, with broadly rounded ends and narrow median area, enclosed within two lines of punctiform striæ; costæ distant, externally dilated, the dilated portion transversely punctate. Length ·0072″. (Pl. II, fig. 1.)

Hab. Ceylon, Dr. Macrae.

A very remarkable diatom, distinguished pre-eminently by having the dilated portion of the costæ coarsely punctate. At first sight they appear to be transversely barred, but careful adjustment brings out the transverse puncta. The general outline of the frustule resembles that of *S. lata*, as figured in the 'Synopsis of the British Diatomaceæ.' The lines which enclose the narrow median space are composed of what should be considered normally striæ, but these are exceedingly short, and often nothing more than puncta.

CAMPYLODISCUS.

Campylodiscus biangulatus, n. sp., Grev.—Disc nearly circular, with a broadly linear, smooth, median space, extending at each end nearly to the margin; surface waved so as to produce an angular, converging line between the median space and the margin, and again bent back near the margin at each end; costæ rather distant, 4 in ·001″. Diameter ·0036″. (Pl. III, fig. 2.)

Hab. Ceylon, Dr. Macrae.

This species belongs to the second section of Ralfs' first division ('Pritch. Infus.,' 1861), and is clearly different from any one there described. In the remarkable undulation of the surface of the disc, it is nearly allied to Gregory's *C. angularis.* By the first bending, a line or ridge is produced on each side, which extends in a curve from one end of the median space to the other. The second bending of the disc becomes most evident towards the ends, where the edge is bent back as in *C. angularis.* The costæ are given off from the median line at right angles, throughout its whole length, and the latter is remarkably clearly defined. In all the specimens I have seen there is a tendency in a number of the central costæ to become forked at the margin, but as the apices again unite, it would be more correct to say that they formed little loops. The whole frustule has a very diaphanous and brilliant appearance, with the markings sharply defined.

DICTYOPYXIS (*Ehr.*), *Grev.*

Frustules two-valved, cellulose, cohering by simple, more or less convex, junction-surfaces, into a filament. Valves cup-like, destitute of any silicious connecting band.

In consequence of the discovery by the Rev. R. Cresswell of the diatom which now bears the name of *Creswellia turris,* Professor Walker-Arnott and myself were enabled to define with some precision a little group of *Pyxidiculæ,* which Ehrenberg had partially indicated, but, from want of perfect materials, had left in great obscurity. Of his genus *Stephanopyxis,* no two of the four species referred to it appear certainly to agree generically with each other; and as his character was drawn up in ignorance of the perfect state of any of them, and as, besides, it was not known which of them was to be regarded as the type, we adopted what seemed, under the circumstances, to be the most satisfactory course, and constituted the genus *Creswellia* upon good and perfect specimens. Three other species have been subsequently added by myself, and my friend, Mr. Ralfs (who sustains Ehrenberg's name), mentions under *Stephanopyxis diadema* ('Prit. Infus.,' 4th edit., p. 826) that he has seen two frustules connected by the coronal spines. It consequently, without doubt, belongs to the same group.

Whether, therefore, Ehrenberg's genus, or *Creswellia,* as proposed by Professor Walker-Arnott and myself, be preferred, one portion of the *Pyxidiculæ* may be regarded as satisfactorily disposed of.

Two other genera of *Pyxidiculæ—Pyxidicula* and *Dictyopyxis* of Ehrenberg—still remain in a very confused state. Indeed, it is probable that the perfect condition of most of the species is unknown. Mr. Ralfs considered it desirable to retain *Dictyopyxis* as a sub-genus or section of *Pyxidicula,* until some of the species were better known. His generic character for the whole is, "frustules simple or binately conjoined, free or adnate, bivalved; central portion obsolete; valves very convex." The two sections being—1. Frustules smooth, or minutely punctate (*Pyxidicula*). 2. Frustules cellulose (*Dictyopyxis*). While recently engaged in the examination of Dr. Macrae's slides, I was so fortunate as to find two examples of a *Dictyopyxis* with the frustules connected, and consequently I have it in my power to offer a more definite character of that genus, which will now be placed in as satisfactory a position as *Creswellia.*

It remains to be seen, however, how many of the diatoms at present referred to it will exhibit the same structure.

Dictyopyxis brevis, n. sp., Grev.—Valves equal, cylindrical, much shorter than they are broad; junction-surfaces somewhat convex; cellules hexagonal, very small, 10 in ·001″. (Pl. II, fig. 2.)

Hab. Andaman Islands. Ceylon, Dr. Macrae.

This species appears to differ very decidedly from those already described. It is remarkable for the shortness of the frustules; so that if one of the valves alone be taken, the length is scarcely more than half the breadth. The cellules, small as they are, are exquisitely regular and hexagonal. The frustules are connected in the same manner as in *Orthosira marina;* only as the junction-surfaces are somewhat convex instead of plane, they occupy less space. Side views of the valve are frequent.

EUPODISCUS.

Eupodiscus Jonesianus, n. sp., Grev.—Disc pale, with closely radiating lines of minute puncta; processes oblong, submarginal. Breadth ·0064″. (Pl. II, fig. 3.)

Hab. Guano; locality unknown; Dr. Macrae.

A species remarkable for its minute structure, presenting in this respect the greatest possible contrast to *E. Argus* and *E. Rogersii.* *E. radiatus* of Bailey is, indeed, intermediate, but still very far removed from this very minutely punctate diatom. The processes are quite conspicuous, and situated very close to the margin. The puncta in the centre of the disc are rather larger than the rest, but soon become minute and cover the whole surface with crowded, somewhat wavy lines, the wavy appearance being caused by the frequent dichotomous division of the lines of puncta. Immediately within the margin, and at short intervals, are a series of faint, inconspicuous, radiating lines, not longer than the processes themselves, which appear dark or light, according as they are focussed. They seem to be produced by a slight separation of the lines of puncta, the intervening part being somewhat thickened and prominent.

AULACODISCUS.

Aulacodiscus Macraeanus, n. sp., Grev.—Processes cylindrical-oblong, terminating inflated portions of the disc, which are rough, with large, raised points; smaller apiculi are numerously scattered over every other part of the surface except the spaces which alternate with those connected with the processes. Diameter ·0054″. (Pl. II, fig. 4.)

Hab. Ceylon; rare; Dr. Macrae.

A slendid species, so like *A. Petersii* in general appearance that any diatomist might be excused for passing over it as such in a cursory examination. There are, nevertheless, very material differences. In the first place, the processes are not orbicular, as in *A. Petersii,* but cylindrical-oblong. In the last-named species they are much nearer the margin, and the inflations vastly more prominent and elongated. Then there is a great difference in the margin itself. There is, indeed, what may, in general appearance, be called a double margin in both; the inner one being a continuation of the disc-surface, and striated, and an outer, narrow ring, which in *A. Petersii* has a hazy, punctate character at the extreme edge, arising probably from an undulation in the silicious structure. Mr. Tuffen West has represented this in his figure of Mr. Shadbolt's *Eupodiscus crucifer* ('Mic. Trans.,' vol. ii, pl. i, fig. 12), which is admitted to be identical with *A. Petersii.* In *A. Macraeanus* this feature is wholly wanting. Then, again, a careful examination of a series of *A. Petersii* shows that the raised points on the surface of the disc are confined to the inflations, and "less conspicuously along the connecting furrows and about the umbilicus." So far, however, is this from being the case in *A. Macraeanus,* there is no part uncovered by these apiculi, except the roundish intervals between the process-bearing spaces, and they are particularly numerous, as will be seen by referring to the figure, all round the margin.

In the above remarks I have referred only to *A. Petersii* as occurring in South Africa. Australian specimens I have never seen, but through the kindness of Professor Walker-Arnott I possess a disc of the so-called New Zealand variety of which Mr. Ralfs remarks ('Pritch. Infus.,' p. 843) that specimens from that quarter "have the granules and markings more distinct and the inflations smaller, less definite, and further from the margin." It unfortunately happens that the disc in question has the concave surface uppermost, so that I cannot obtain a clear view of the processes. Their position, however, agrees with my proposed new species, so does the margin; and the surface, as far as I can see it, is covered with raised points, as in my Ceylon specimens. I gladly appropriate Dr. Macrae's name to this diatom, as, perhaps, the finest and most interesting thing in the collection he has kindly placed in my cabinet.

Aulacodiscus Jonesianus, n. sp., Grev.—Disc very large, somewhat lurid, with minute radiating granules, and a marginal belt of minute scattered apiculi; processes small, oblong, submarginal, the connecting furrows inconspicuous. Diameter ·0110″. (Pl. II, fig. 5.)

Hab. Guano; locality unknown; Dr. Macrae.

A very fine and large species. The surface is filled up with minute granules, which at first sight seem all equal in size, but on a careful inspection are found to diminish insensibly towards the circumference. At the margin they become rapidly smaller, being about 15 in ·001″. There is no perceptible umbilicus, and the furrows are so inconspicuous that they are scarcely to be perceived, except by commencing at the processes and directing the eye along the two series of granules of which they are composed. Near the processes the two series of granules slightly diverge, and then leave a small, subtriangular, hyaline space. The processes are situated at less than their own length from the margin. Minute apiculi, similar to those which occur in *A. Petersii* and *scaber,* are in this species confined to a marginal space equal to about a fourth of the radius.

I have much pleasure in dedicating this noble diatom to Professor Jones, of the Calcutta University, who is associated with Dr. Macrae in the investigation of Indian Diatomaceæ.

AULISCUS.

Auliscus Peruvianus (Kitton), Grev.—Valve orbicular, with close, radiating lines of fine puncta, some of them curved and converging towards two small, flat, circular, submarginal processes, each of which is surrounded by a circlet of minute apiculi; the margin is furnished with a close row of larger apiculi. Diameter ·0039″. (Pl. II, fig. 6.)

Hab. Peruvian guano, Dr. Macrae.

The genus of this diatom is considered doubtful by my friend, Mr. Ralfs, who remarks ('Pritch. Infus.,' p. 938) that it has some resemblance to an *Auliscus,* but that the puncta are not in flexuose lines. Fine specimens, however, which have come under my own observation, really confirm Mr. Ralfs' first impression, having the centre connected with the processes by a rather narrow band of curved lines, not very conspicuous certainly, on account of the fine puncta. These curved or converging lines, taken in connexion with the imperforate, discoid processes, lead me to follow out Mr. Ralfs' indication, and to refer it without question to *Auliscus.* The species is well marked by the numerous marginal apiculi and circlet of minute ones which surround the processes. A few inconspicuous tubercles or apiculi are also scattered over the surface of the disc, which in a favorable light appear as diaphanous points.

BIDDULPHIA.

Biddulphia pulchella, Gray.—(Pl. III, figs. 3, 4.)

In a gathering obtained by Dr. Macrae at Point de Galle, Ceylon, *Biddulphia pulchella* occurs in the greatest abundance, and in every stage of development. No better opportunity could be afforded for studying the species, and the propriety is at once perceived of uniting the *B. trilocularis, quinquelocularis,* and *septemlocularis* of Kützing, as was done by the late Professor Smith. In the above-mentioned gathering, however, certain frustules sparingly present themselves, which differ so considerably from the ordinary state of the species that I have considered them deserving of illustration. They are trilocular, but will not be confounded with the usual trilocular state which is most characteristically figured in Smith's 'Synopsis' (pl. xliv, fig. 321). The latter, I need scarcely observe, constitutes the most simple form of the diatom, and is smaller than the quinquelocular or septemlocular frustules.

In the figure above referred to, the side view of the valve is only ·0028″ in length, and I have seen it still smaller. In the trilocular form, however, under consideration, the length of the valve extends from ·0045″ to ·0088″, the latter measurement being greatly beyond any recorded specimens of even the septemlocular valve. A very noticeable character invariably accompanies this condition of the species, in the different position of the spines and arrangement of the cellules in the central elevation of the valve. In the valve, as hitherto known, the cellulation of the middle elevation radiates from the centre, where two or three small spines are placed, as is accurately represented in Smith's 'Synopsis.' In the valves before us, on the contrary, the cellules do not radiate from the centre; for a transverse line crosses the elevation on which the spines, sometimes in a row, sometimes at each extremity, are placed, and the cellules are given off at right angles to this line, except at each end of it, where they radiate, as from a centre, towards the margin. In one of my figures it will be seen that there are six spines in a row, while in the larger valve the spines only occupy each extremity of the transverse line. It is true that in fully developed states of the species, as in large examples of quinquelocular and septemlocular individuals, there is sometimes seen a somewhat oval centre of radiation, but this is evidently only a slight deviation from the normal disposition, and quite different from the transverse line invariably present in the valves now figured (figs. 3, 4). The slight deviation above mentioned takes place, as I have remarked, (and that only rarely), in large, fully developed frustules; but in the case now before us the more important deviation occurs in trilocular frustules. Some difference also appears to exist in the outline of the side view of the valve, the ends being somewhat sharper, and consequently rendering the form more decidedly elliptical. The divisions in the front view, again, are more turgid, and the middle elevation more prominent.

When frustules are observed considerably larger than the average size of the species to which they belong, they are generally pronounced to be sporangial. No conjugation has been observed in the *Biddulphiæ*, but it has been assumed that something analogous to it must take place; and, according to one of our most acute and original observers, Mr. Thwaites, "the two kinds of endochrome may be developed at the opposite ends of one frustule as easily as in two contiguous frustules, and give rise to the same phenomena as ordinary conjugation." However this may be, we do not as yet know anything about the production of sporangial frustules in this group. Were we to assume that the frustules which have given rise to these remarks are indeed sporangial, it would not account for the deviation from the usual characters I have pointed out. It would certainly be a remarkable circumstance, that, if sporangial, none should appear but in the least developed form of the species. Although I have examined a considerable number of individuals like the smaller of the two valves I have figured, I have not seen any of a size intermediate between them and the larger one, which is so enormous that it might well give rise to some suspicion of error in measurement.

TRICERATIUM.

Triceratium convexum, n. sp., Grev.—Valve with very convex sides, narrow, obtuse, angles, and small pseudo-nodules; granules faint and minute, in radiating lines, 16 in ·001″. (Pl. III, fig. 6.)

Hab. Ceylon, Dr. Macrae.

I am quite aware that the *Triceratium* I have just defined will, at a hasty glance, be regarded as occupying a rather ambiguous position. I myself thought that it was *T. orbiculatum* of Shadbolt; but the precise statement of that observer, that his species exhibited a "structure similar to that of *Coscinodiscus radiatus*," only less regularly hexagonal, and that the reticulations were "largest at the centre, and diminished in size gradually towards the margin of the valve," led me to hesitate; for in my present species the puncta are so minute that they could never be termed "reticulations." And, more than that, they gradually increase in size from the centre to the margin, exactly opposite to the rule in *T. orbiculatum*. Then, again, the lines of puncta in the present species, minute though they be, are distinctly radiating; whereas in *T. orbiculatum* they are represented as following no order. And Mr. Tuffen West, who engraved the figure from nature ('Mic. Trans.,' vol. ii, pl. i, fig. 6), could never have committed such an error had they been decidedly radiating. However closely, therefore, the two diatoms resemble each other in general aspect, they cannot be united. While upon this subject I may be allowed to express my conviction that *T. orbiculatum* of Shadbolt and the diatom published under the same name by Mr. Brightwell are really distinct. The difference in the shape of the valves is considerable. In *T. orbiculatum* the puncta, as we have seen, do not radiate. The pseudo-nodules, judging from the figures, are dissimilar, and the remarkable bristle which accompanies each pseudo-nodule in Mr. Brightwell's specimens serves still more decidedly to separate them. Mr. Ralfs, in his remarks under *T. orbiculatum* ('Pritch. Inf.,' 1861, p. 853), is evidently under the same impression. I beg to suggest that while the original name be retained for Mr. Shadbolt's species, the other may be named *T. Shadboltianum*, Mr. Brightwell having a species already dedicated to him. The following characters will serve to distinguish them:

T. orbiculatum, Shadb.—Valve with very convex sides, obtuse angles, and conspicuous pseudo-nodules; cellulation minute, decreasing in size from the centre to the margin. (Shadbolt, 'Mic. Trans.,' vol. ii, p. 15, pl. i, fig. 6.) *T. Shadboltianum*, Grev.—Valve with nearly straight sides and obtuse angles, each with a prominent, circular pseudo-nodule, accompanied by a spine; puncta minute, radiating. *T. orbiculatum*, Brightw.—'Mic. Journ.,' vol. iv, pl. xvii, fig. 20. Ralfs ('Pritch. Inf.,' 1861, p. 853), in part.

Triceratium Thwaitesianum, n. sp., Grev.—Large, valve with straight sides, rounded angles, and rather large pseudo-nodules; surface filled with large, irregularly hexagonal cellules, about 5 in ·001″, commencing, but not radiating, from the centre, and becoming smaller towards the angles, where they suddenly pass into inconspicuous puncta. Distance between the angles ·0050″. (Pl. III, fig. 5.)

Hab. Cape of Good Hope, Dr. Macrae.

An exceedingly distinct species, not so regular in its reticulation as *T. favus* and its allies, and peculiar in having the centre indicated by the arrangement of the cellules, not very evident to a careless observer, but quite distinct when the eye is directed towards it. The central cellules are very slightly elongated, but there is no distinct radiation. The angles appear to be produced into large, conical processes; I have not, however, seen the front view.

AMPHITETRAS.

Amphitetras radiata, n. sp., Grev.—Valve with slightly concave sides and broadly rounded angles; the centre composed of a nucleus of large cellules, the rest of the surface covered with a network of radiating quadrate cellules, and a circle of dark, radiating, thickened lines anastomosing and terminating near the margin. Diameter ·0058″. (Pl. III, fig. 7.)

Hab. Peruvian (?) guano, Dr. Macrae.

In the absence of positive evidence, it is highly probable that this magnificent species occurs in guano from some part of the Peruvian coast, for in the slide of selected diatoms, in which two specimens are preserved, the other species are *Aulacodiscus Comberi, A. scaber,* and *Auliscus Peruvianus.*

The centre is composed of a compact group of large cellules, from which radiate rows of smaller, more or less quadrate cellules, constituting a beautiful network. Many of the straight longitudinal lines of separation are thickened and opaque, as in *A. ornata,* becoming attenuated as they approach the margin, and anastomosing with each other by terminating cross lines. The species differs from *A. ornata* in various points, but conspicuously in the arrangement of the dark lines of ornamentation. In that diatom there is a more or less defined circle at some distance from the centre, and the radiating lines invariably constitute four distinct groups, directed towards the respective angles of the valve. In *A. radiata* the radiating lines point equally in all directions, producing the effect of a sort of halo.

Amphitetras punctata, n. sp., Grev.—Lateral view, with concave margins and rather narrow, rounded angles; surface covered with very minute puncta, which form converging lines towards each angle; marginal striæ coarse, 20 in ·001″. Breadth between the angles ·0024″. (Pl. III, fig. 8.)

Hab. Ceylon, very rare, Dr. Macrae.

A pale species, with the margins somewhat folded, as in *A. ornata,* and causing the angles to appear narrower than they would otherwise be. A small cluster of puncta occupies the centre, and then a series of radiating lines of smaller puncta converge towards each angle, becoming more and more minute as they fill up the angle itself. The striæ of the folded margins are strong and coarse.

TRANSACTIONS.

Some Account of the Martin Microscope, *purchased for the* Society *at the Sale of the late* Professor Quekett's *Effects.* By John Williams, F.S.A., &c., Assistant Secretary.

(Read January 8th, 1862.)

The Microscopical Society has recently become possessed of the curious microscope said to have been made for his Majesty King George III by the once celebrated Benjamin Martin. This instrument was purchased for the Society, with two other specimens of antique microscopes, at the sale of the effects of the late Professor Quekett, by whom it was much valued as a splendid example of an early microscope. For two or three weeks past it has been in my custody, and as I am greatly interested in everything relating to antiquity, whether in reference to early scientific instruments or other matters, I could not resist the temptation of thoroughly investigating it; and as there appear to be many curious and now almost, if not entirely, forgotten contrivances for various purposes attached to it, I have requested permission of the Council to lay the result of my examination before you, in the hope that it may afford you not only some amusement, but also give you some idea of the apparatus belonging to, and the qualities of, that which was considered as a superlatively fine instrument at the time it was constructed, about a century ago.

Before I proceed to the description of this instrument, I will call your attention to a short biographical notice of the person by whom it was made. Benjamin Martin, whose name is upon the instrument before you, was born in the year 1704. I meet with no account of his parentage or of the place of his birth. He was one of the most eminent opticians and mathematicians of his day. He was the author of numerous valuable treatises on various branches of the science of his time, many of which were deservedly popular, and ran through several editions. In the library of the Royal

Astronomical Society there are nineteen of his works, and from incidental notices in these, I have been enabled to add considerably to the scanty mention of him in works on general biography. Thus, Martin does not appear to have been originally an optician, for in one of his early works on Trigonometry he dates his preface "From my school in Chichester, April 8, 1734;" and an advertisement in the same work announces that, "By the author in Chichester are taught, 1. Writing in all the common and useful hands; 2. Arithmetic," and so on, enumerating various other accomplishments taught by him, to "16. The use and construction of all the most useful mathematical instruments;" and the advertisement concludes with "N.B. Youths are boarded very reasonably by the author, Benjamin Martin." We find him here, then, as a schoolmaster in Chichester. His 'Bibliotheca Technologica' is also dated from Chichester, 1740. In this he styles himself "Teacher of the Mathematics;" and in his 'New and Compendious System of Optics, printed for James Hodges, at the Looking Glass, on London Bridge,' the following advertisement occurs:—"New-invented pocket reflecting Microscopes, with Micrometers, made and sold by Benjamin Martin, in Chichester, at the following prices, viz., those with a micrometer, at one guinea; without a micrometer, at ten shillings and sixpence." It goes on enumerating the good qualities of these microscopes, and concludes by stating that "they may be obtained by application at the British Coffee House, Finch Lane, London, or sent to any part of England by a letter to me at Chichester. Allowance will be made to those who take a quantity." It might be of some interest could we ascertain the kind of instrument here advertised for sale. By a "reflecting microscope," I presume Martin refers to one in which the light is thrown upon the object by reflection; in other words, by means of a mirror, in contradistinction to those constructed upon the principle of "Wilson's Pocket Microscope," a form which was at that time exceedingly popular, and which required holding up to the light when in use. In one of his works, Martin figures and describes an instrument which he calls a "pocket microscope," to which a micrometer is attached; and at Mr. Quekett's sale a small microscope with Martin's name upon it, answering to this description, but without a micrometer, was purchased by Mr. Roper. In all probability this is one of the same description as that referred to in the advertisement I have just quoted.

It is not unlikely he found the making and selling of microscopes more profitable than the scholastic profession, or, at any rate, more congenial to his natural bias. It does not appear when he gave up his teaching and removed to London, where it is certain he resided for many years, and established and carried on a flourishing and extensive business as an optician and globe-maker. Thus we find in his "New Elements of Optics, 1759," he states the work to be "printed for the author, and sold at his shop, the sign of the Globe and Visual Glasses, two doors below Crane Court, Fleet Street." Many of his subsequent publications are said to be "sold by the author at his house in Fleet Street," and and in one we find the number, 171. He was looked upon as one of the most eminent in the optical business, and I may adduce the instrument before us, made for the reigning monarch, as a proof of the estimation in which Benjamin Martin was held.

It is with pain I advert to the close of his career. After many years of successful application, he was compelled by the increasing infirmities of age to give up to others the superintendence of the active part of his business. Confiding in the integrity of those in whom he thought he might safely trust, he unexpectedly found himself a bankrupt, although even then he had a capital more than sufficient to pay all his debts. Overwhelmed by this unforeseen calamity, the unfortunate man, in a moment of desperation, attempted to destroy himself, and although the wound was not immediately fatal, it accelerated his death, which took place on the 9th February, 1782, in his seventy-eighth year.

I had come to the conclusion that Martin was never married, or, at least, died without issue; but on turning over the leaves of the second volume of Gill's 'Technical Repository,' 1828, purchased for the Society at the late sale, I accidentally met with the following passage:—"Messrs. Jones communicate the important fact that Mr. Lovell Martin, son of Mr. Benjamin Martin, invented the admirable engine for drawing truly the brass, plated metal, and other tubes for microscopes, telescopes, &c., which is now in such universal employment for that purpose." Hence it is certain he left at least one son, who also appears to have inherited some of his father's ingenuity. The notice which follows the above may also be interesting:—"On the achromatic microscope magnifiers.—Mr. William Jones, who is acquainted with the numerous contrivances and publications of the late celebrated Mr. Benjamin Martin, has informed the editor that this scientific optician made many trials to adapt achromatic magnifiers to microscopes, * * * but that he ultimately found he could obtain greater magnifying powers, with more light and perfect definition, by employing small single lenses, than with the compound ones. In this opinion the editor is disposed to concur." This passage is curious, inasmuch as it not only shows that Martin had attempted to produce achromatic object-glasses for microscopes, in which he appears to have failed, but also gives the opinion of the editor, who was well known as a microscopical observer, in 1828, as to the inferiority of achromatic combinations when compared with single lenses, an opinion which subsequent experience has most triumphantly refuted.

Such is the information I have been able to collect respecting the maker of this, for the time, magnificent instrument, and I will now proceed to give you the result of my examination of it. In doing this, I have first to call your attention to the stand. This consists principally of a stout bar, the greater portion of which is triangular, each side being $1\frac{1}{4}$ inch. This supports the body carrying the eye-piece, the stage, mirror, &c. The lower extremity of this bar is let into a tripod-stand, on which it turns. Just above the top of this tripod-stand, there is a strong hinge-joint in the bar, which is moved by means of a rack and pinion, and thus the observer is enabled to incline the instrument to a convenient angle. At the back of the triangular portion of the bar is a strong rack in which two pinions work. These raise or depress the stage and mirror, as may be required. At the top of the bar is a moveable cap, which carries an arm for the support of the body containing the eye-piece. This arm has a movement perpendicular to the bar, effected by means of a rack and pinion, and lateral motion is also given to it by similar means applied to the side of the head, and thus every part of an object can be subjected to inspection without difficulty, and the necessity of a moveable stage obviated.

The stage is simply a perforated plate, having ornamental scroll-work round it, in which are holes for forceps, condenser, &c., and also a clip beneath it for holding the frog-plate and other apparatus, which will be shortly described. On it the following inscription is engraved:—"B. Martin, Invt. et Fecit, London," but there is no date. This, from the workmanship, I should fix at about 1770. A spring stage of the usual construction of that period, for holding the slides containing objects, can be fitted into the central aperture, and there are also a spring stage with a condenser, disks of glass and ivory, and other apparatus which fit into the same. The mirror is large and is double, being concave on the one side and plane on the other. It has beneath it a clip, probably for a condenser, as I can see no other use for it; but as no condenser can be found among the apparatus at present belonging to the instrument, this is merely conjecture. The whole height of the instrument, from the table to the top of the eye-piece, is a little more than two feet.

The optical part of the instrument consists of the eye-piece and powers. The eye-piece is large, and is composed of three lenses, two of which are plano-convex. The middle glass of these three, or field glass, is very thick, being almost a bull's-eye. This arrangement ensures a very large field. The distance of the two upper glasses from the lower one can be increased by means of a rack and pinion, and thus a greater amount of power obtained. There are two tubes at the lower extremity of the body, into which the powers, &c., are to be screwed—an inner and an outer one. The outer can be adjusted by means of a rack and pinion. The use of this arrangement will appear as we proceed.

The powers are numerous. According to their marks, ten of them range from four inches to $\frac{1}{10}$th of an inch in focal length. These are also numbered from 1 to 10, No. 1 being the highest power. In addition to these, in one of the drawers are three higher powers, which appear to have been an after-thought. The focal lengths of these are marked respectively $\frac{1}{15}$th, $\frac{1}{20}$th, and $\frac{1}{30}$th. There are also four powers, marked $\frac{1}{10}$th, $\frac{1}{15}$th, $\frac{1}{30}$th, and $\frac{1}{40}$th, and numbered from 1 to 4. These last cannot be used with the compound body, but as single lenses only, and for their employment a small arm is provided, which fits on to the back of the instrument, and can be turned round with the head before mentioned, so as to be brought into a proper position for use. The $\frac{1}{40}$th is the smallest ground lens I have ever seen; it is scarcely larger than the aperture of its setting, which is a mere needle-hole of very small size.

There are nine Lieberkuhns of various sizes, for viewing opaque objects, belonging to this instrument. Six of these are provided with lenses suited to their focal length. These screw into the inner tube of the eye-piece; the other three are without lenses, and screw into the outer tube of the eye-piece, which, being moveable by means of the rack and pinion, the observer is thereby enabled to adapt the Lieberkuhn to the power he may be using.

I have now to describe the apparatus for various purposes connected with this instrument; and here I must express my regret that so much of it appears to be irrecoverably lost; for, from the numerous vacancies in the drawers and cases, it is evident that a number of pieces of apparatus of different kinds must be missing, and it is not improbable that many of these might have been found among the various lots of miscellaneous articles which formed part of the sale, could they have been readily recognised; but this would have required a knowledge of the instrument which possibly no one but Mr. Quekett possessed. This was also the case with some of the other instruments, various pieces of apparatus belonging to which I had the pleasure of restoring to their original position, and thus of making the lots to which they belonged, complete.

Before I proceed further, I must call your attention to the triangular box in which the apparatus is contained. This forms the original table or stand for the instrument, and a very steady and most convenient one it is; for as it runs on castors, and is in its proper place on the floor, it can be brought close up to the observer, and the instrument being inclined to a suitable angle, he is enabled to enjoy the luxury of his easy chair and his microscope at the same time, while the apparatus, being within easy reach, can be applied with great facility. It must also be remarked that from its peculiar shape, this box occupies the least possible space, and is consequently not at all in the way, as it takes up no more room than is absolutely necessary for the support of the microscope, and as it stands upon three feet it is perfectly steady.

I shall not take up your time by describing forceps and other ordinary apparatus. It may suffice to say they are of the usual form, and are applied either by insertion into the holes of the stage, or by means of the clip, as I now fix the frog-plate, which can be placed in any direction required by means of the clip. The objects are contained in six ebony slides; three of these afford accommodation for seven objects each, and the other three have three oblong apertures in each for wings of insects and other large objects. The objects are between talc, and are of the most ordinary description, one slide being filled with pieces of cloth and other textile fabrics, and another with portions of common sea-weeds, flustra, and corallines. The wings are those of the libellula, and other large insects.

We have here a piece of apparatus for viewing transparent or opaque objects. It consists of a brass, semicircular frame, with three apertures. Black and white ivory disks fit into two of these apertures, and the third evidently had originally a glass in it, and with the glazed cover formed a convenient live box. The whole fits into the stage, and can be moved on a centre in any direction.

For the viewing objects in water, this brass frame, with seven live boxes of different sizes, has been employed. The frame is applied as in the last instance, and the boxes can thus be brought in succession under the power with the greatest ease.

Here is a circular glass plate with five hollows for larger objects. It fits into the clip of the stage, and as the plate revolves on its centre, the hollows can be brought in succession under the microscope. For still larger objects this semicircular glass plate, having three similar hollows, can be applied in like manner.

There are also live boxes of large size that can be applied to the stage, but they offer nothing peculiar in their construction.

I have now to direct your attention to a rather singular arrangement, which I have never met with before, although it is possible some gentlemen present may be acquainted with it. It is a peculiar apparatus for exhibiting large opaque objects, such as minerals for instance, and as it can be used with the lower powers only, whose focus is beyond the reach of the stage in its present position, a provision has been made for its application, which is not at first sight very apparent. One portion of it consists of a ball turning in a socket, with another socket in it for receiving the other parts of the apparatus. In order to apply this we must turn the stage upside down, and thus we are enabled to lower it several inches. We can now screw the ball and socket on to the stage. Before doing this I will introduce to you these triangular forceps, the lower parts of which fit into the stage in its present inverted position. These forceps are calculated to hold objects of moderate size only. When it is required to view larger objects, the ball and socket must be screwed on to the stage, and the instrument now before you applied. It consists of two forks, as they may be called, opposed to each other, each having three points, and adjustable to any distance within the range of the instrument. An object being placed between these, the forks can be firmly secured in the required position by means of binding screws at the top of each. The lower part of this instrument being inserted into the socket in the ball, it can be readily turned in any direction, and the object examined in the most favorable position. For another class of large objects the brass pan having three opposing screws now before you is available. These enable the object to be firmly held, when the pan can be fixed into the socket in the ball, and the objects viewed in any position.

But it may be required to examine objects too large to be brought into the focus of the lower powers, even with this arrangement; Martin has even provided for this contingency. Here is a long arm to which the ordinary stage can be attached, as, by loosening a screw with a milled head, the stage can be removed from the upper bar and fixed by the same screw to the longer arm. The mirror being removed, this arm with the attached stage can be substituted for it, and the ball and socket, and other apparatus being applied as just mentioned, a pleasing view of very large objects can be readily obtained.

I must now call your attention to another peculiarity. Keeping the upper supporting bar in its present inverted position, we can apply another stage to this instrument. This is a piece of most elaborate workmanship. It consists of a frame to which a stage plate is fixed, and which is moveable in opposite directions by means of micrometer screws placed at right angles to each other. These micrometer screws are provided with divided heads. The screw in each instance is one with fifty threads to the inch, consequently each turn moves the stage $\frac{1}{50}$th of an inch. The micrometer heads are divided into twenty parts, hence every division is equal to $\frac{1}{1000}$th of an inch. It is easy to estimate by the eye a tenth part of one of these divisions should it be required, this would give the $\frac{1}{10,000}$th of an inch. There is a third micrometer on the side opposite to one of those already mentioned, this raises or depresses the stage to a similar amount. Hence it follows that as these micrometers are exactly alike, it is possible with this instrument to measure the length, breadth, and thickness of a minute object, certainly to $\frac{1}{1000}$th, and, I believe, to $\frac{1}{10000}$th of an inch. Again, by means of a milled head, the inner ring of this stage is made to turn round, and thus we have a revolving stage of very accurate construction. There are no means apparent at present of applying this instrument to the measure of objects. I believe it was effected by placing in the focus of the upper lens of the eye-piece a disk of glass with fine lines drawn upon it at right angles to each other. Now, one end of the object to be measured, having been brought into the right position, and into contact with one of the lines on the glass by means of the revolving part of the stage, the micrometer screw was turned until the object had passed under the line, so as to bring the opposite end into contact with it, when the number of turns and parts of a turn gave the measure in thousandths of an inch. The breadth was measured in a similar manner. In measuring the thickness of an object the upper edge was possibly brought accurately into focus. The corresponding micrometer screw being now turned until the under edge was in like manner brought into focus, the measure of thickness would be read off as in the former instances. This piece of apparatus appears to me to deserve particular attention, as it is extremely ingenious, and might possibly give a useful hint to microscope-makers now at the present time.

But the body of the instrument can also be inclined, so as to be at right angles with the triangular bar, and, when in this position, another piece of apparatus can be applied to it, consisting of a frame carrying a bar for supporting a stage or pair of forceps, adjustable by means of a rack and pinion. Two stages of different sizes, and a pair of forceps, fit into it. It has also two motions besides that given by the rack and pinion just mentioned, one upon itself, in a horizontal direction, the other perpendicular to this, by means of a small rack and pinion at the side. This arrangement is evidently intended for viewing objects by direct light. A reflecting mirror can also be applied to it, and it is possible to produce very oblique illumination by means of the motions I have described.

Another piece of apparatus remains to be noticed. It consists of a tube, at the bottom of which is a concave speculum. There is an opening at the side of this tube, and also the means of applying a pair of hand forceps which can be brought into the focus of the speculum by means of a rack and pinion. Upon taking away that portion of the body which carries the powers, and screwing this on in its place, we have the instrument described by Martin in his optical works as the catadioptric microscope. In this instrument, the object being strongly illuminated through the opening at the side, the image is reflected by the speculum to the upper part of the tube, where it is viewed by means of the eye-piece. I found it very difficult to manage, and, although the image of the object was clear and tolerably distinct, its performance was not to me satisfactory; but this may have been occasioned by want of experience in the proper mode of managing the instrument.

There are several other pieces of apparatus in the drawers and boxes, the use of which does not appear, and some of these I believe not to belong to the instrument, as they cannot be applied to any part of it, as far as I can at present judge.

I have thus endeavoured to give you some idea of the construction and appliances of this instrument, and, in conclusion, I may be expected to say something respecting its capabilities as a microscope. In doing this, I must premise that it would hardly be fair to attempt a comparision between it—although, undoubtedly, one of the best instruments of its time—and the present, in every respect, vastly superior microscopes. We must therefore keep in mind, not only the immense stride that has been made within the last thirty years, in the manufacture of these instruments, but also the kind of work this particular microscope was intended to perform, and not expect it in any way to rival our present microscopes. It was evidently intended chiefly for the exhibition of coarse objects, the details of which could readily be made out with low powers. Such objects are shown tolerably satisfactorily in it. Neither must we imagine that the array of powers I have mentioned, although they do range to $\frac{1}{30}$th of an inch focal length with the compound body, will at all compare with our $\frac{1}{4}$ths, $\frac{1}{8}$ths, or $\frac{1}{16}$ths, either in definition or magnifying power. Thus, the $\frac{1}{10}$th, which ought, according to our present notions, to resolve all the ordinary tests, will not line even a common butterfly's scale, neither is the magnifying power such as might be expected from such a denomination. The higher powers, viz., the 15th, 20th, and 30th, line ordinary tests, but will not touch the more delicate—such as the fine lines on the small scales of the lepisma, or the markings on the podura, and, consequently would be entirely useless in the examination of the still more delicate diatomaceæ. I may here give the result of my examination of the three higher powers—the 15th, 20th, and 30th. The test I employed was the scale of Morpho Menelaus, which would not at the present time be considered as by any means a severe one. They were tried by candlelight.

The 15th.—Indistinct traces of lines very ill defined.

The 20th.—Lined distinctly, but the definition anything but sharp.

The 30th.—Lined distinctly but still without good definition; the amplification in all these cases being far beyond that which is necessary for bringing out the lines sharply with the present object-glasses of much lower power.

The very finely lined scales of the lepisma were tried with the 30th; very faint traces, amounting to a mere suspicion of lines, was all it would exhibit; possibly superior modes of illumination might produce better effects with these glasses. The low powers, however, define objects suited to them very fairly.

There are also grave mechanical defects in this instrument, which must be obvious to all. The supporting a long bar, carrying a considerable weight above, upon its lower extremity only, must of necessity produce unsteadiness; and the sole adjustment being by rack and pinion, is so coarse that it is only with difficulty the higher powers can be brought into focus; indeed, I have not succeeded in focussing the $\frac{1}{40}$th at all; with these high powers the unsteadiness of the instrument is painfully apparent. With all these disadvantages the instrument is certainly far superior to the ordinary microscopes of that time, both in its optical qualities and in the apparatus attached to it for the examination of objects. It is obviously not suited for the purposes to which the microscope is applied in the present day; still it was undoubtedly considered as a very superior, pleasing, and convenient instrument at the time it was constructed. The workmanship, also, is of the very best description; and although it must now be looked upon rather as a curiosity than as a useful instrument, the Society may be congratulated on having acquired so remarkable and characteristic a microscope of the olden time.

Before I conclude I must call your attention to two other old microscopes, purchased at the same sale for the Society. They were made by Culpepper, a well-known optician, who flourished, I believe, a little earlier than Martin, but of whom I have as yet been unable to find any account. The first is an early form of the compound microscope, which long kept its standing under the name of "Culpepper's Microscope," and whose pyramidal box must be familiar to all of us. The second is a fine specimen of "Wilson's Pocket Microscrope," mounted in silver, with extra apparatus, by which it may readily be converted into a compound microscope, and fixed upon a stand, with a reflecting mirror, if required. They are both curious and characteristic specimens, and well worthy of a place in the collections of thls Society.

On the ASTEROLAMPRÆ *of the* BARBADOES DEPOSIT. By R. K. GREVILLE, LLD., F.R.S.E., &c.

SOON after the publication of my monograph of the genus *Asterolampra*, nearly two years ago, my attention was directed to certain discoid forms occurring in the celebrated deposit of *Polycistineæ* and *Diatomaceæ*, in the island of Barbadoes. At the same time my friend, Mr. T. G. Rylands, sent for my inspection a disc, which he had discovered in deep-sea soundings from the Atlantic. In the course of the same year (1860), Mr. Brightwell published, under the names of *Craspedodiscus marginatus* and *semiplanus* ('Mic. Journ.,' vol. viii, p. 95), two diatoms from the Barbadoes deposit. All these, upon a careful examination, proved to belong to the same group, having a hyaline area, traversed by radiating umbilical lines, each of which terminated at the base of a marginal segment of an orbicular valve; while alternating with them were rays passing between the segments to the margin. Perceiving, therefore, that these discs must either be included in the genus *Asterolampra* itself, or constitute one or more very nearly akin to it, I commenced a patient and prolonged examination of the "Barbadoes earth," which extended over many months; and the notes and drawings made during that period form the basis of the paper which I have now the honour of laying before the Society.

In my former monograph I endeavoured to show that there was not sufficient ground for keeping up the three genera, *Asterolampra, Asteromphalus,* and *Spatangidium,* and suggested that they should be regarded as sections of one genus, for which I proposed to retain the oldest name of *Asterolampra.* The first section of the genus so constituted, and which I considered as typical of the whole group, is composed of discs in which the rays are all equal and equidistant, as well illustrated in the first described species, *A. Marylandica.* After carefully studying the whole series of the Barbadoes frustules, I have arrived at the conclusion that in the present state of our knowledge it is more expedient to refer them to *Asterolampra,* than to attempt to arrange any of them into a separate genus. It is remarkable that, with a single exception, all the species belong to the first section above mentioned—the exception being *A. heptactis* (*Spatangidium heptactis,* De Breb.), which, at the last moment, Mr. Kitton informs me he has detected in a sample of the deposit obtained from "Cambridge Estate."

The series of diatoms to be now described and figured is a peculiarly interesting one; for, varied as is the structure in the twenty species formerly described, it is greatly more so in those under consideration. Commencing with valves which can scarcely be separated from *A. Marylandica,* we pass through various most remarkable modifications of the normal structure, until we come to individuals whose generic position may be almost regarded as doubtful. With the exception of the species just mentioned; of a second, which I call *A. affinis,* and which comes near to *A. Grevillii;* and of *A. heptactis,* the entire series is characteristic of the Barbadoes deposit. They differ in many respects from the subjects of my previous paper. They are more robust, although generally smaller in size, highly siliceous, vitreous in appearance, with the divisional lines hard and clear. Many of them are very convex, especially *A. Brightwelliana,* which Mr. Rylands aptly compares to a *Medusa.* The segments are seldom filled up with a minute uniform areolation, as in the older species, but have their inner margin frequently composed of a row of elongated and sometimes very large cellules, which, combined with the conspicuous umbilical lines, give a peculiar skeleton-like aspect to the valve. It is remarkable that, while this areolation is too variable to afford a specific character in some species, it is very constant in others; as, for example, in *A. Rylandsiana,* where single, large, lateral, wedge-shaped cellules, render the narrow portion of the rays obsolete; in *A. Ralfsiana,* where the cellulation, if such it can be called, is produced by repeated divisions of the extremity of the umbilical line, the whole closely resembling the delta of a river, as represented in a map; also in *A. punctata* and others. The umbilical lines are invariably simple. Among these discs we find, for the first time among *Asterolampræ,* the centre not unfrequently occupied with a cluster of cellules, which in some species, as in *A. vulgaris* and *affinis,* are not of the slightest value, being sometimes very numerous, at others wholly absent; while in a few species, as in *A. marginata* and *Ralfsiana,* they are invariably present, and highly characteristic.

In the second of the two sections into which I have divided these diatoms, we have an important deviation from the normal condition of the genus. The substance of the valve becomes thick and opaque (always excepting the rays), and there is in every case an umbilical nucleus which may be solid, or more or less punctate or cribriform, or irregularly areolate. The umbilical lines are robust; the segments smooth or irregularly punctate, or imperfectly cellulate, conveying the idea that the original cellulation was being gradually closed up, as if by the deposition of siliceous matter, as, for example, in *A. æmula* and *simulans.* If I am right in uniting the two valves I have figured under the name of *A. pulchra,* punctation may be either present or absent. In all the other species of the section the segments are smooth. In various species of both sections, the ray-tube (by which term I designate the internal channel which passes down the middle of the ray) is more or less visible; but in *A. pulchra* it is so prominently developed as to be not less conspicuous than the umbilical lines, giving a very rich and complicated appearance to the valve. Another character also makes its appearance in some of the frustules of the second section, in the shape of gland-like puncta or pores, often transmitting a brilliant light, the nature and value of which I am at present unable to determine. In *A. pulchra* they are situated on one or both sides of the extremity of the rays; in *A. stellulata,* *dubia,* and *aliena,* the pore is exactly opposite the end of the rays; in *A. Kittoniana* it is on each side of the narrow portion of the ray, about the middle. Similar pores exist in various discs from the Barbadoes deposit, which seem to belong to the genus *Liostephania.* There appears, indeed, to be a transition from this section of *Asterolampra* to that genus; and it will probably be found that the genera just named, along with *Rylandsia,* and possibly *Actinogonium,* may be conveniently united into a family. Of *Dictyolampra* of Ehrenberg, which has been associated with *Actinogonium* and *Liostephania,* Mr. Ralfs justly remarks, that it "differs from the other genera of this family (the *Melosireæ*) by its disc being cellulate only in the centre; and, indeed, it probably ought, together with *Liostephania* and *Actinogonium,* to form a distinct family; but, having seen no specimens, we are unable to decide on their proper position." (Prit. Inf., 1861, p. 813.) I labour under the same disadvantage as my friend Mr. Ralfs, and have only to suggest whether *Dictyolampra* may not be more closely allied to my genus *Stictodiscus.* Indeed, it very nearly resembles *S. Californicus.*

There is something so peculiar in the general aspect of the diatoms of the second section, that at first sight materials would appear to exist for the construction of a genus which would relieve *Asterolampra* from its most aberrant forms. But unfortunately frustules occur which partake of the characters of both sections. *A. lævis* is a transition species. It is the only one in the first section in which the segments are smooth; but it has at the same time slender umbilical lines, and wants the central nucleus. On the other hand, *A. simulans* possesses the nucleus and thick umbilical lines of the second section, while the segments show the large oblong cellules, and minute marginal punctation characteristic of various species of the first.

SECTION I.—Umbilicus simple or cellulate (not with a thickened nucleus). Umbilical lines slender.

I. Segments of valve having their inner margin composed of punctiform cellules.

1. *Asterolampra Marylandica,* Ehr.—Diameter ·0015″ to ·0021″. (Pl. VII, figs. 1—3.)

Hab. Barbadoes deposit, very rare; with four rays, T. G. Rylands, R. K. G.; with five rays, T. G. Rylands; with six rays, R. K. G.

All the specimens I have seen of the discs which I refer to this place, are diminutive in size, and deviate somewhat from the ordinary condition of the species. *A. Marylandica,* as hitherto observed, has the curve of the segments beautifully symmetrical. Specimens from the South Naparima, Trinidad deposit (having seven rays and a diameter of ·0052″), agree in this respect with typical examples. But such is not the case with those from Barbadoes. In these, the inner margin of the segments is by no means regular. It is often more or less truncate, sometimes sharply so on one side, while the other side of the same segment is rounded; in fact, I have not seen a single valve with regularly curved segments. Notwithstanding this circumstance, there can be no doubt, I think, that fig. 3 is really *A. Marylandica*. There is a much greater deviation from the type in fig. 2; the segments being actually truncate, and yet one of the sides is sometimes so rounded as to indicate a return to the normal outline. The valve represented at fig. 1 is very singular. The rays are broad and obese, and the segments have their curve so much flattened as to be partially truncate. It is very rare, three specimens only having come under observation.

2. *Asterolampra decora*, n. sp., Grev.—Segments short, having their inner margin truncate, and composed of oblong, punctiform cellules, the lateral angles not projecting; umbilicus (always?) cellulate. Diameter ·0023″ to ·0030″. (Figs. 4—6.)

Barbadoes deposit; T. G. Rylands, R. K. G.

Notwithstanding the punctiform character of the cellules of the inner margin of the segments, this species comes near to some of the varieties of *A. vulgaris*. The marginal cellules vary somewhat in size and in being more or less oblong, but still are very unlike the large oblong cellules of the diatom just mentioned, and the lateral ones do not project beyond the rest. The number of rays is most uncertain. I have examined a large suite of specimens, and in twenty-five, of which I have taken notes, the number varied from five to fourteen, and that of the umbilical cellules is equally uncertain. In one specimen only were the latter wholly absent, so that their presence may be fairly assumed as generally characteristic. The puncta of the segments are occasionally disposed in radiating lines.

3. *Asterolampra affinis*, n. sp., Grev.—Segments elongated, minutely punctate, sharply truncate; umbilicus simple or cellulate; umbilical lines undivided. Diameter ·0024″ to ·0050″. (Figs. 7—9.)

Hab. Barbadoes deposit.

A well-marked species, which cannot be confounded with any other in the Barbadoes deposit. To *A. Grevillii*, however, it bears a great general resemblance; but differs in the umbilical lines being invariably simple, and in the presence generally (though, not always,) of a nucleus of umbilical cellules. The number of rays in the specimens examined, vary from eleven to seventeen. I have only seen one individual in which umbilical cellules were entirely absent. The valve, fig. 9, is the largest disc belonging to the genus which has occurred in the deposit.

II. Segments having their inner margin composed of large elongated cellules.

* Lateral cellules of the segments not projecting beyond the rest.

4. *Asterolampra concinna*, n. sp., Grev.—Segments prominently arched inwardly, more or less flattened at the top, their inner margin composed of numerous oblong cellules which are continued partly down the sides. Diameter ·0032″ to ·0040″. (Figs. 10—12.)

Hab. Barbadoes deposit; rare; T. G. Rylands, De Brebisson, R. K. G.

Of this beautiful diatom, I have only seen four specimens, all with seven rays, and destitute of umbilical cellules. The segments project considerably into the interior, with an outline between conical and arched, and more or less flattened at the top. The oblong cellules which line the inner margin, are continued down the sides, rounding off the angles. Perplexing differences occur continually in the valves of several of the Barbadoes species. In the present instance, for example, the areolation of the segments is very much larger in fig. 10 than in the other two, which possibly may be owing to its larger size. In fig. 11, the narrow portion of the rays becomes somewhat ovate next the margin of the valve, and instead of the oblong cellules of the inner margin of the segments passing down the sides, there is a single large cellule occupying each corner, a little below the level of the rest. It remains to be seen whether these variations are of any importance.

5. *Asterolampra decorata*, n. sp., Grev.—Segments somewhat conical, truncate, with the inner margin composed of very large oblong cellules, the lateral ones single, elongated, elliptical, reaching to the extremity of the ray. Diameter, ·0034″. (Fig. 13.)

Hab. Barbadoes deposit; very rare.

Only one valve of this exquisitely beautiful disc has been found; but it is so unlike any of its congeners, there can be no hesitation in admitting it as a species. The general appearance is that of a medallion containing a sort of star, the salient angles of which are composed of the narrow portions of the rays grouped with the adjoining cellules. The latter are extremely large, with their walls strong, and sharply defined. The remainder of the surface of the segments is very minutely punctate. A shade caused by the ray-tube adds greatly to the rich effect of the whole.

6. *Asterolampra crenata,* n. sp., Grev.—Segments with their inner margin following the curve of the valve, and crenate with the terminations of the large subequal cellules. Diameter, ·0020″ to ·0039″. (Fig. 14—16.)

Hab. Barbadoes deposit; T. G. Rylands, R. K. G.

Allied to *A. vulgaris,* but differs in the even row of equal cellules which forms the inner margin of the segments. The number of rays vary from six to eight, and in the series of specimens which I have examined, these numbers bear about an equal proportion to each other. Not a single example has occurred with umbilical cellules, which are frequent in *A. vulgaris.*

** Lateral cellules of the segments projecting more or less beyond the rest.

7. *Asterolampra vulgaris,* n. sp., Grev.—Segments having the inner margin composed of large oblong or linear cellules, the lateral ones projecting more or less beyond the rest; umbilicus centrical, simple, or cellulose. Diameter ·0012″ to ·0043″. (Figs. 17 to 25.)

Var. a.—Lateral cellules of the segments linear-oblong or linear, projecting considerably beyond the rest; umbilicus either simple or cellulose. (Figs. 17—20.

Var. b.—Lateral cellules of the segments linear, straight, projecting considerably beyond the rest, and so close to each other as to render the narrow portion of the ray quite obsolete. (Fig. 21.)

Var. c.—Lateral cellules of the segments linear-oblong, slightly obovate and inclined at the apex, only slightly projecting beyond the rest; umbilicus simple or cellulose. (Fig. 22.)

Var. d.—Cellules of the inner margin of the segments linear, the lateral ones slightly projecting; rays numerous, and the umbilicus widely cellulose. (Figs. 23, 24.)

Var. e.—Cellules of the inner margin of the segments linear, the middle ones twice as long as the minutely punctate portion, the lateral ones shortly projecting; umbilicus (always?) cellulose. (Fig. 25.)

Hab. Barbadoes deposit; common. Vars. *b, c,* and *e,* rare; Var. *a* found also in Atlantic deep sea soundings; T. G. Rylands.

The most variable of all the Barbadoes *Asterolampræ,* not only in the number of rays, which range from six to twenty, and in the cellulate or non-cellulate umbilicus, but also in the characters derived from the segments. Discs from the extreme ends of the series, might readily be taken for distinct species; and yet it is exceedingly difficult to define the varieties. In drawing up the specific character, I have been unable to discover any part upon which I could place the least dependence, except the lateral cellules of the segments of the valve, which seem always to project more or less beyond the rest; and it is mainly to modifications of the same part, that I have had recourse in separating the varieties. There is no rule with regard to the amount of space in the valve occupied by the segments themselves. It is very frequently half the radius, often considerably less; and in some of the large varieties, where the centre is occupied with numerous cellules, the radius is generally divided into three nearly equal parts, viz., the segments, the hyaline area transversed by the umbilical lines, and the central group of cellules. (Pl. VII and VIII, figs. 23, 24.) With regard to the elongated cellules of the segments, they differ greatly in length in the more remarkable varieties, as do also the lateral cellules, compared with the intermediate ones. The lateral cellules are sometimes quite straight; at others, slightly curved inwards towards the apex. They are generally so far separated as to admit of the passage of the rays between them to the margin of the valve; but the passage is sometimes partially interrupted, in consequence of the cellules being occasionally somewhat enlarged toward their apices, and touching each other at that point. (Fig. 22.) Very rarely the lateral cellules are united throughout their whole length, and, consequently, the narrow portion of the ray is rendered obsolete. (Fig. 21.) Perhaps the most extreme variety is one which I at first considered distinct, and named *A. splendida* (fig. 25); and even now, I am not quite satisfied about its true position. The extraordinary length of the cellules, which constitute nearly the whole substance of the segments, distinguish the few imperfect valves I have seen. But the cellules of the segments in this species are so exceedingly variable, that a mere difference in length, however great, will scarcely, I fear, afford a satisfactory diagnosis. Of this protean diatom I have examined a multitude of specimens, besides taking notes of about sixty valves, in order to ascertain as far as possible the range of variation.

8. *Asterolampra Brightwelliana,* Grev.—Valve very convex; umbilicus somewhat eccentrical; segments unequal, having their inner margin composed of large oblong cellules, only

some of the lateral ones projecting. Diameter ·0024 to ·0040″. (Figs. 26, 27).

Craspedodiscus semiplanus, Brightw., 'Mic. Journ.,' vol. viii, p. 95, pl. vi, fig. 12 (imperfect).

Hab. Barbadoes deposit; Brightwell, Ralfs, T. G. Rylands, R. K. G.

Rather rare, and seldom quite perfect. It is the most convex of all the Barbadoes species, and is aptly compared by my friend, Mr. Rylands, to a *Medusa*. In several respects it possesses peculiar characters. The umbilicus is eccentrical. The rays are not equidistant, as in all the other species of the section, but are more widely separated on the side where the umbilical lines are shortest. On the opposite side, where the lines are longest, two or three of the segments are much smaller than the rest, and it is in these that the lateral cellules project most prominently. I find two varieties, which, in a larger series of specimens, would probably be found to run into each other—one with the cellules of the inner margin of the segments comparatively small and numerous; the other having them considerably larger, and fewer, and the valve furnished with a greater number of rays. In the first-mentioned variety the prevailing number of rays is seven: in the second eight or nine. Mr. Ralfs justly remarks ('Pritch. Infus.,' p.939), that Mr. Brightwell's figure must have been taken from an imperfect specimen, being deficient in one of the umbilical lines; and that the diatom is closely allied to *Asterolampra*. As the name bestowed upon this species indicates a formation common, in a greater or less degree, to the majority of the Barbadoes *Asterolampræ*, I have ventured to change it, and to confer upon it that of its estimable discoverer.

III. Segments, with their inner margin punctate; lateral cellules large, wedge-shaped, united.

9. *Asterolampra Rylandsiana*, n. sp., Grev.— Segments punctate, with large, wedge-shaped, united lateral cellules; narrow portion of the rays obsolete. Diameter about ·0018″. (Figs. 28, 29).

Hab. Barbadoes deposit; T. G. Rylands, De Brébison, R. K. G.

A most peculiar species, and constant in its leading characters. At the first glance, the valve is conspicuous for a circle of large geminate cellules, which, when they come to be close examined, prove to be the lateral cellules of the segments in such close juxta-position as to render the narrow portion of the rays obsolete. There are no other large cellules belonging to the segments, the whole of the remainder of the space being minutely punctate. The number of rays varies from seven to twelve. The umbilicus is sometimes simple; but the majority of specimens contain a few centrical cellules. The whole valve has a striking resemblance to the disc of an *Ophiocoma* deprived of its rays; the geminate cellules representing the parallel plates or scales which are seen opposite the origin of each ray in that genus of *Radiata.*

IV. Nearly the whole surface of the valve filled up with radiating puncta. Segments forming an undulating marginal annulus.

10. *Asterolampra marginata* (Bright), Grev.—Two thirds of the radius of the valve occupied with radiating puncta; umbilical lines very short; segments forming a narrow, punctate border; narrow portion of the rays obsolete. Diameter about ·0038″. (Fig. 30).

Craspedodiscus marginatus, Brightw., 'Mic: Journ.' vol. viii, p. 95, pl. v, fig. 7.

Hab. Barbadoes deposit; Brightwell, T. G. Rylands, R. K. G.

In this exceedingly beautiful diatom we find a remarkable deviation from the ordinary relative proportions of the several parts. The greater portion of the disc is filled up with puncta, which are not irregularly arranged like the umbilical cellules in former species, but radiate from the centre. The hyaline area is reduced to a narrow ring, and the segments to a mere waved border; the narrow portion of the rays having consequently no space for development. The rays are numerous, generally from fourteen to twenty. There can be no question that Mr. Ralfs was correct, when, with his usual acuteness, he referred this interesting diatom to the *Asterolampræ.*

V. Segments represented by a deltoid ramification of the umbilical lines.

11. *Asterolampra Ralfsiana,* n. sp., Grev.—Umbilical lines as they approach the margin dividing dichotomously into equal deltoid sections; centre very irregularly cellulate. Diameter about ·0032″. (Fig. 31).

Hab. Barbadoes deposit; Ralfs., T. G. Rylands, R. K. G.

This is, without exception, the most extraordinary species in the genus. The umbilicus is invariably cellulate, and the cellules very irregular and unequal in size. One of them is considerably larger than the rest. About half way between these cellules and the margin of the valve, the umbilical lines begin to divide in a dichotomous manner, until, by the time they have reached the margin, they have described a series of conical or deltoid figures, all of equal diameter. These deltoid sections, which are entirely destitute of any punctate portion, represent the segments. A lively imagination might compare the umbilical lines to a set of cords made to draw the segments by main force towards the centre, pulling them out of their normal shape, and straining upon the cellules of their inner margin, until the whole mass was screwed up from a truncate to a conical outline. The eye naturally rests upon the *lines* in this disc; but if it be fixed upon the *spaces*, the effect is very beautiful.

One of Ehrenberg's perplexing genera, *Cladogramma*, the character of which is not, I believe, anywhere published, seems from his figure (copied into 'Pritch. Infus.,' pl. viii, fig. 11), as if it might possibly bear some relation to our present subject. But as the valve is said not to be cellulate, there can, of course, be no affinity. It is not, indeed, certain that *Cladogramma* belongs to the *Diatomaceæ* at all.

VI. Inner margin of the segments either smooth, or not continuously punctuate.

12. *Asterolampra punctata*, n. sp., Grev. — Segments truncate, containing somewhat distant, and more or less imperfect, radiating rows of equal puncta; the lateral margins composed of similar puncta. Diameter about ·0030″. (Fig. 32).

Hab. Barbadoes deposit; rare; T. G. Rylands, De Brébisson, R. K. G.

A curious species, constituting a transition from the present to the next section. It has the slender umbilical lines and lax central cellules of this section, while the segments are partially smooth; and the puncta, instead of becoming more minute as they approach the external margin, are all of equal size, circular, and disposed in distant lines in the most irregular fashion imaginable. At the lateral margins, indeed, the row of punctation is complete; but in the rest of each segment there are often not more than one or two complete rows. Sometimes a solitary punctum stands for a whole row; sometimes two; sometimes three; and the deficiencies may occur in any part of the row. In this way the inner margin of the segment may be to a considerable extent smooth. The number of rays seems to average six or seven; but the umbilical cellules vary in the specimens I have examined—from five to nine—and have, probably, a still greater range. I have never seen them wanting.

Asterolampra lævis, n. sp., Grev.—Small; segments truncate, opake, smooth; the inner margins slightly thickened; rays short. Diameter ·0015″. (Fig. 33).

Hab. Barbadoes deposit; extremely rare.

Of this species, I have only seen the valve here figured. The smooth, opaque segments, in which I have been unable to trace the slightest punctation, indicate an approach to the subjects of the following section:

SECTION II.—Umbilicus occupied by a thick, solid, or more or less cribriform or areolated definite nucleus. Umbilical lines thick.

14. *Asterolampra æmulans,* n. sp., Grev.—Nucleus solid(?) or cribriform; umbilical lines thick; inner margin of the segments furnished with a row of intra-marginal oblong puncta. Diameter about 0023″. (Figs. 34, 35.)

Hab. Barbadoes deposit; rare.

It is impossible not to perceive in the valve of this species a strong likeness to fig. 6 of *A. decora.* There is, however, in the discs now represented, an unmistakeably definite nucleus, a thickness of substance and an opacity (except in the hyaline area) which is peculiar to themselves and other individuals of the present section. Even when the nucleus is widely areolate, as in fig. 34, the walls of the areolæ are thick and unequal, and quite unlike the more delicate umbilical cellulation which often occurs in the species of the previous section. In one of the valves of *A. æmulans,* it will be perceived that the nucleus is sparingly cribriform; it is highly probable that it is sometimes solid. The segments have a few puncta scattered remotely over their surface, in addition to the intra-marginal oblong ones. The rays are numerous, usually about 12.

15. *Asterolampra simulans,* n. sp., Grev.—Nucleus solid (always?); umbilical lines thick; segments with their inner margin composed of large oblong cellules, the lateral ones shortly projecting. Diameter ·0024″. (Fig. 36.)

Hab. Barbadoes deposit; rare.

This diatom also bears some resemblance to one already described:—var. *a.* of *A. vulgaris,* represented at fig. 17. The segments with their oblong cellules, the lateral ones of which project, are almost indentical; and there is, in addition, an indication of similar minutely punctate arches in the marginal portion of the segments, imperfectly, however, developed. Nevertheless, the same important differences exist in this as in the preceding species. There is especially the definite, solid nucleus, giving off robust, umbilical lines.

16. *Asterolampra Scutula,* n. sp. Grev.—Nucleus small, solid; umbilical lines thick; segments with the inner margin thickened, smooth, except a large clavate cellule at each angle. Diameter ·0019″. (Fig. 47.)

Hab. Barbadoes deposit; extremely rare.

This ornamental little species is well marked by the single, large wedge-shaped cellule at each angle of the inner margin of the segments, and which is connivent at its inner extremity with the cellules of the adjoining segments. The thickened edging of the segments is also extended round the cellules.

17. *Asterolampra pulchra*, n. sp. Grev.—Nucleus punctato-cribriform (always?); umbilical lines robust; ray-tubes conspicuous, with one or two gland-like pores at their marginal terminations. Diameter about ·0025″. (Figs. 37, 38.)

Hab. Barbadoes deposit; rare.

A singularly beautiful object, and perfectly distinct. The frustules are remarkable for the prominence of the ray-tubes, which, being actually as conspicuous as the umbilical lines, produce at first sight no little confusion, looking like wheels with two sets of spokes. The ray-tubes, in fact, are even *more* conspicuous than the umbilical lines, because they appear as if they were continued to the very margin of the valve, which is probably the case, the narrow portion of the ray being in this instance the ray-tube itself. By attentively observing the nucleus, the eye is able to trace the difference, the umbilical lines being given off from the substance of the nucleus, and being also darker and less broad. Both the specimens figured, it will be perceived, are slightly polygonal, a character not unfrequent among the *Liostephaniæ*, and which enters into the generic definition of *Actinogonium*. Another feature also makes its appearance here for the first time. I refer to the gland-like pore at the extremity of the rays. In one of the frustules there is only one pore on one side of the end of the ray. In the other there are two, the ray terminating between them. Certain other differences exist in these two specimens, but I am doubtful whether they are of sufficient importance to separate them. In fig. 37, the segments have an ornamental row of oblong puncta within their inner margin. In fig. 38, the segments are solid. It would require a suite of examples to determine the value of such variations; for in this genus characters cannot be taken in the different species from the same parts.

18. *Asterolampra Kittoniana*, n.sp. Grev.—Small; nucleus punctato-cribriform; umbilical lines thick; segments smooth, with a gland-like pore at their lateral margin, on each side of the middle of the narrow portion of the ray. Diameter ·0018″. (Fig. 39.)

Hab. Barbadoes deposit; Frederick Kitton, Esq.

For a drawing of this elegant little species I am indebted to my very obliging correspondent, Mr. Kitton, of Norwich, who alone has discovered it. The gland-like pores are here found in a different position, and apparently offer a good distinguishing character.

19. *Asterolampra stellulata,* n. sp. Grev.—Small; nucleus solid; umbilical lines thick; segments smooth; a gland-like pore exactly opposite the extremity of the rays. Diameter ·0016″. (Fig. 40.)

Hab. Barbadoes deposit; rare.

In the form of the segments this minute valve is like *A. Marylandica;* but differs essentially in every other character. The segments are about half the radius in length, and are quite smooth. The gland-like pore in this species is opposite the ends of the rays, and so close that it requires careful adjustment to separate them distinctly. I have only seen two examples, one of which has seven, the other nine rays.

20. *Asterolampra dubia,* n. sp., Grev.—Small; nucleus solid; umbilical lines thick, very short; segments very large, smooth; bases of the rays obovate; gland-like pore conspicuous, opposite the ends of the rays. Diameter ·0015″. (Fig. 41.)

Hab. Barbadoes deposit; very rare.

I have thrown together, at the close of this section, two or three curious and even whimsical-looking diatoms, in which the Asterolampoid structure can be traced, although some of the parts indicate an approach to other genera. In the present four-rayed frustule the segments are so large as to occupy two thirds of the radius; and a singular appearance is produced by the widest part of the ray being next the nucleus, inverting the usual order. The narrow portion is extremely short, and the brilliant and conspicuous gland-like pore is situated between the termination of the rays and the margin.

21. *Asterolampra ambigua,* n. sp., Grev.—Central nucleus solid; umbilical lines broad; rays more or less cordate, the narrow portion sometimes undeveloped; the ray-tube very prominent; segments smooth; diameter ·0007″ to ·0018″ (Figs. 42—45).

Var. a. Rays not prolonged; heart-shaped; three-lobed. (Figs. 42, 43, 44.)

Var. b. Rays prolonged; the bases deltoid. (Fig. 45.)

Hab. Barbadoes deposit; T. G. Rylands, R.K.G.

This is one of the perplexing organisms which may be looked for at the confines of a group in which a singular variation of structure exists. I am indebted to my friend Mr. Rylands for the use of two drawings, from which I have made the figs. 42 and 44. The first represents the diatom in its most simple form, but whether of babyhood I cannot say, because at fig. 43 I give a figure from a specimen of my own, in which the valve seems to be fully developed as to size, while the ray is in as elementary a condition as in fig. 42. In this state, there is no prolongation whatever of the ray beyond the broad portion, which constitutes the hyaline area; and the ray-tubes are so prominent as to cause an elevated, rounded ridge. Each of the rays in this condition might be correctly defined as cordate and 3-lobed. A somewhat more developed state is shown at fig. 44, where the rays begin to be slightly prolonged, and a gland-like pore occurs on one side of the extremity of each ray. In fig. 45 the ray has attained its normal length, and the valve has assumed more of the Asterolampoid character; only the umbilical lines are much broader than in any previously described species. There is some little difference in the shape of the base of the rays, the angles being sharper, rendering the term cordate scarcely applicable. It is an approach to the form of the ray exhibited in the following species. Possibly future investigations may show that this is distinct, for a difference also exists in the gland-like pores, those which are seen in fig. 44 being absent in the present disc, while there are indications of a pore near the margin of the valve, opposite the umbilical lines. Three such pores are visible in the valve figured (the only one which has been found). In the meantime, being averse from adding to the number of species on too light grounds, I prefer to notice it as a doubtful variety.

22. *Asterolampra? aliena,* n. sp., Grev.—Valve with a broad, thickened border; nucleus with a central pore; umbilical lines very broad; bases of the rays contracted into a deltoid-lanceolate figure, the narrow portion terminating in a gland-like pore. Diameter ·0024″. (Fig. 46.)

Hab.—Barbadoes deposit; very rare.

In this valve the umbilical lines are so broad as to lose much of their primary character, and the rays, consequently, bear a smaller proportion to the rest of the space in the frustule than in the other species. The points of the rays next the centre are very acute; the ray tube visible, but very narrow, and the pore at the marginal extremity very conspicuous and brilliant.

MICROSCOPICAL SOCIETY.

ANNUAL MEETING.

February 12*th,* 1862.

R. J. Farrants, Esq., in the chair.

Report of Council.

According to custom, the Council have to make their annual report on the progress and state of the Society during the past year.

The number of members reported at the last anniversary was 305. During the year, 8 members have died, 5 have resigned, and 12 have been removed for non-payment of arrears, &c., amounting to 25. These reduce the number, as reported last year, to 280. To these, however, must be added 37 members elected during the past year, thus giving a final total of 317, and showing an increase of 12 over the number at the last anniversary. It is with great regret the Council have to announce the following names as those of the deceased members:—Viscount Downe, J. Quekett, Esq., M. S. Legg, Esq., J. McMahon, Esq., W. S. Sargenson, Esq., W. Harkness, Esq., H. Druce, Esq., and Dr. Meeres.

The reports of the auditors and of the Library and Cabinet Committees will afford the necessary information respecting the finances, and the additions to the Library and Cabinet during the past year; and the Council have also to congratulate the Society on its possessing the curious microscope made about a century ago by the then celebrated Benjamin Martin, and also two other early microscopes, purchased at the sale of the late Professor Quekett's effects.

The Journal has been published regularly, and, as usual, circulated among the members.

AUDITORS' REPORT.

Receipts.

				£	s.	d.
By Balance of Account from previous year				75	5	3
Dividends for one year on £543 6s. 3d. Consols for the year 1860	15	12	4			
Ditto on £602 19s. 1d. for the year 1861	17	18	2			
				33	10	6
Subscription and Admission Fees—new members				57	15	0
Compositions of ditto				46	4	0
Annual Subscriptions				194	5	0
Sundries—Payments on account of Refreshments, &c.				15	0	6
				£422	0	3

Payments.

	£	s.	d.
To Rent	25	0	0
Salaries	29	0	0
Expenses of Journal	186	8	0
Printer	6	16	6
Purchase of £49 13s. 7d. Consols	46	4	0
Commission to Collector	14	18	0
Powell and Lealand, for Binocular Arrangement	15	4	0
Refreshments	13	4	3
Expenses of Soirée	27	4	7
Sundries	24	19	10
Balance	33	1	1
	£422	0	3

We, the undersigned, being the Auditors of the accounts of the Treasurer of the Microscopical Society, beg to submit an abstract of the said account, from February 7th, 1861, to February 7th, 1862. And having examined the same, and compared the several entries with the vouchers, beg to report that we find the accounts to be correct, the amount of the Stock now being £652 12s. 8d. Consols, and the Balance in favour of the Society £33 1s. 1d.

C. H. ALLEN.
WILLIAM HUGGINS.

February 10*th*, 1862.

Report of the Library Committee.

February 11*th*, 1862.

Since the last report the Committee have directed great attention to the collection of various works requisite to place the Library in a condition worthy of the Society, and they are able to report a large accession of curious and valuable works on the microscope and microscopic subjects during the past year.

The additions consist of 10 volumes presented, and 62 volumes purchased, together with 59 tracts and 32 volumes of tracts on subjects mostly microscopical.

The opportunity afforded by the sale of the library of our late lamented President, Professor Quekett, to add many rare works on the Microscope, having been brought to the notice of the Council, the Committee were authorised to purchase such works as were required, and they succeeded, at a very moderate expense, in securing for the Society the greater part of the collection, which had occupied many years and much labour to procure, and they have much pleasure in reporting that, with this acquisition, the library now comprises nearly all the works on the Microscope published from 1663 to the present time.

F. W. Roper.
Jno. Millar.

Report of Cabinet Committee.

December 11*th*, 1861.

At the date of the last report the collection of objects in the Cabinet of the Society comprised 779 slides, presented by 33 gentlemen; since then the Society has received 103 slides, presented by 8 gentlemen; so that the Cabinet now contains 882 slides, presented by 39 contributors.

Additions to the list of contributors—	Boston Soc. of Nat. Hist.	37	
,, ,,	Coates, J., Esq., per Hy. Deane, Esq.	10	
,, ,,	Freestone, J. R. Esq.	3	
,, ,,	Norman, J. T., Esq.	12	
,, ,,	Staunton, J., Esq.	24	
,, ,,	Whitbread, S. C.	1	
Added to former contributions (66) by—	Carpenter, Dr. W. B.	14	= 80
,, ,, (25)	Jackson, G.	2	= 27

The following table shows the additions to each class of objects, and the number now in the Cabinet:

—	3 x, '60.	Added.	11 xij,'61.
A. Entire animals	21	1	22
B. Cuticular appendages	43	—	43
C. Injected preparations	9	—	9
D. Animal tissues, not included in the above .	48	—	48
E. Desmidiæ and other Algæ	20	—	20
F. Vegetable tissues and portions of vegetables.	104	—	104
G. Sections of hard and soft tissues (animal, vegetable and mineral)	96	—	96
H. Infusoria, recent and fossil	325	73	398
I. Polythalamia and calcareous remains . .	22	2	24
J. Spicules and gemmules of sponge, &c. .	19	—	19
K. Polypidoms of zoophytes, &c.	17	14	31
L. Crystals and chemical preparations . .	28	11	39
M. Micrometry, photography, &c.	27	2	29
Total	779	103	882

Ellis G. Lobb.
R. J. Farrants.

The President then delivered the following address:

The President's Address *for the year* 1862.

By R. J. Farrants, Esq.

Gentlemen,—Following the usage of former years, I proceed to address to you some remarks on the state and prospects of the Society.

The Microscopical Society of London was established in 1840, this, therefore, is its twenty-second anniversary.

Finances.—The Report of the Auditors which has been read has made you acquainted with the state of our funds. To that report I have little to add. Our expenses have been covered by our receipts; we have no debts, and there is a balance in the hands of the treasurer, besides the funded property derived from the investment of the compositions of life members.

There are some items of expenditure which challenge attention, and may require explanation; I refer to the large sums paid for 'Transactions and Journal,' and for 'delivering them.' A copy of the Transactions (to which every member whose subscription is not in arrear is entitled) has been regularly forwarded as soon as published, and with it the accompanying number of the 'Quarterly Journal of Microscopical Science,' which is paid for from the funds of the Society. The Council recognise the Journal as a valuable instrument for advancing microscopical science, and believe that it is within the spirit of the intentions of the founders of this Society that its funds should be liberally used to promote its success. The existing arrangement has been in operation since 1854; its cost, however, is now far greater than was contemplated, and the propriety of appropriating so large a portion of the Society's funds to this one object has been anxiously considered by the Council, and has long been a subject of grave deliberation.

The continual increase of this item will be seen on comparing the charge on this account at intervals of three years.

In 1853, the cost of publishing the Transactions was £65 11*s*. 4*d*. In 1856, the payment to Mr. Highley for Transactions and Journal was £84 17*s*. 6*d*. In 1859 the amount had risen to £129 4*s*.—more than one-third of our expenditure. In 1860 this item amounted to £132 18*s*. 2*d*. In 1861, £137 19*s*. 7*d*. In 1862, the year just ended, it is £186 8*s*. I now wish to remind you that the continuance of this arrangement is contingent upon the state of our funds being such as will admit and justify the expenditure.

The high price claimed by the present publisher for all beyond the 200 copies named in the agreement, increases the cost far beyond the original estimate. Though the Council have not yet succeeded in obtaining more favorable terms, they are not without hope that all concerned will see that the present charge is greater than the income of the Society enables it to pay.

The virtual operation of the present arrangement is to reduce the annual subscription of each member to less than half a guinea, which is clearly insufficient to enable the Council to meet the necessary expenses, and advance as they would wish other objects which deserve attention, and are as well entitled to some portion of the funds.

Officers—Treasurer.—The office of Treasurer beecomes vacant this evening, by the retirement of Mr. Ward, who wishes to be relieved from duties which, as years advance, he feels to be onerous. He has been the Treasurer of the Society from its commencement; and for the satisfactory manner in which he has for so many years discharged the duties of a responsible office, he merits, and will have accorded to him, I have no doubt, the grateful acknowledgments of the Society.

The gentleman who was recommended by the Council for election to the vacant office would rather not be called upon to undertake the duties. In deference to his wishes, another gentleman was proposed at the last meeting of the Society, in the way the laws require. You will be asked this evening to choose one of these gentlemen as your Treasurer, it being understood that the election of the gentleman first recommended by the Council would not be in conformity with his wishes.

Secretary.—You will also be called upon this evening to elect a Secretary in the place of the Junior Honorary Secretary, recently deceased. The gentleman recommended by the Council for election to the office they believe to be in an especial degree qualified to fill it. The zeal with which he has already laboured for the Society justifies them in believing that its interests will be materially promoted by his election. This, however, is entirely in your hands.

Members.—The report of the Council shows that we now have 317 members, notwithstanding some withdrawals, some removals, and loss by death of some of our most valued members.

Professor Quekett.—The late John Quekett was one of the founders of this Society. In 1842 he became Honorary Secretary, and in that office laboured for nineteen years to promote its success. In 1860 he was elected President—an office which, from the state of his health at that time, he would rather have declined; and in his address, read from the chair last year; he expresses his regret that he had been prevented by illness from ever occupying the chair at any of the ordinary meetings. It was in compliance with his special request that he was not re-elected, or in the ordinary course he would have been President of the Society at the time of his decease.

He was "the fourth son of the late Mr. Quekett, head master of Langport Grammar School, at which institution he received his elementary education." His predilection for microscopical pursuits was manifested at a very early age; for, as stated in a brief memoir in the 'Times,' of the 22nd August, 1861, when only "sixteen he gave a course of lectures on microscopical science, illustrated by diagrams and a microscope of his own making . . . . made up of materials furnished by a common roasting-jack, a ladies' old-fashioned parasol, and pieces of brass purchased at a neighbouring marine-store dealer's, and hammered out by himself." Having selected the medical profession, he in due course became a licentiate of the Society of Apothecaries, and a member of the Royal College of Surgeons of London. In the latter institution he obtained, by competition, the appointment of "Student of Human and Comparative Anatomy." While holding this appointment, he gave a large share of his attention to microscopical pursuits, and prepared an extensive series of specimens of the elementary tissues of plants and animals. This collection, numbering 2500 preparations, was purchased by the College of Surgeons in 1846, and forms a part of the histological department of their museum. It contains a large number of specimens of minute injections of the capillaries, in preparing which he was remarkably skilful and successful. At the expiration of the term for which the studentship was tenable, he became "Assistant Conservator of the Hunterian Museum," and in the year 1844 was appointed by the Council of the College "to deliver annually a course of demonstrations, with a view to the exhibition and connected description of the collection, and to the explanation of the method and resources of microscopical study." On the retirement of Professor Owen, "Mr. Quekett was elected his successor, and also Professor of Histology—an appointment which he held at the time of his decease."

In 1848 he published 'A Practical Treatise on the Use of the Microscope,' a second edition of which was soon required and published.

In 1850 appeared the first volume of the 'Descriptive and Illustrated Catalogue of the Histological Series contained in the Museum of the Royal College of Surgeons of England;' Elementary Tissues of Vegetables and Animals.

In 1852 was published a volume of 'Lectures on Histology, delivered at the Royal College of Surgeons of England in the session 1850—51,' Elementary Tissues of Plants and Animals.

In 1854 was published a second volume of 'Lectures on Histology, delivered at the Royal College of Surgeons in the session 1851—52,' Structure of the Skeleton of Plants and Invertebrate Animals.

In 1855 appeared a second volume of a 'Descriptive and Illustrated Catalogue of the Histological Series contained in the Museum of the Royal College of Surgeons of England,' Structure of the Skeleton of Vertebrate Animals.

In addition to these published works, he contributed numerous papers to this Society, which are printed in the 'Transactions of the Microscopical Society of London,' from 1841 to 1857.

Subjoined is a list of these:

1. "On the Anatomy of Four Species of Entozoa belonging to the Genus Strongylus, from the Delphinus Phocœna, or common Porpoise." (Read August 18th, 1841. Published in 'Transactions of the Microscopical Society of London,' vol. i, p. 44.)

2. "Observations on the Structure of Bat's Hair." (Read Oct. 20th, 1841. 'Tr. Mic. Soc. Lond.,' vol. i, p. 58.)

3. "On a Peculiar Arrangement of Blood-vessels in the Air-bladder of Fishes; with some remarks on the evidence which they afford of the true function of that organ." (Read July 20th, 1842. 'Tr. Mic. Soc. Lond.,' vol. i, p. 99.)

4. "On certain Peculiarities in the Structure of the Feathers of the Owl Tribe." (Read Jan. 15th, 1845. 'Tr. Mic. Soc. Lond.,' vol. ii, p. 25.)

5. "On some Phenomena connected with the Movement of the Cilia of the common Mussel (*Mytilus edulis*)." (Read April 17th, 1445. 'Tr. Mic. Soc. Lond.,' vol. ii, p. 7.)

6. "On the Structure of the Flabella of some of the higher forms of Crustacea; with some remarks on their probable use in the function of respiration." (Read May 21st, 1845. 'Tr. Mic. Soc. Lond.,' vol. ii, p. 37.)

7. "On the Intimate Structure of Bone, as composing the Skeleton in the Four Great Classes of Animals, viz., Mammals, Birds, Reptiles, and Fishes; with some remarks on the great value of the knowledge of such structure in determining the affinities of minute fragments of organic remains." (Read March 18th, 1846. 'Tr. Mic. Soc. Lond.,' vol. ii, p. 46.)

8. "Additional Observations on the Intimate Structure of Bone." (Read November 11th, 1846. 'Tr. Mic. Soc. Lond.,' vol. ii, p. 59.)

9. "Observations on the nature of Capillaries, and on the mode of arrangement in those in the Gills of Fishes." (Read May 19th, 1847. 'Tr. Mic. Soc. Lond.,' vol. iii, p. 1.)

10. "Observations on the Vascularity of the Crystalline Lens, especially that of certain Reptilla." (Read January 13th, 1847. 'Tr. Mic. Soc. Lond.,' vol. iii, p. 9.)

11. "On the value of the Microscope in the determination of Minute Structures of a Doubtful Nature, as exemplified in the identification of Human Skin attached many centuries ago to the Doors of Churches." (Read April 26th, 1848. 'Tr. Mic. Soc. Lond.,' vol. ii, p. 151.)

12. "On a Peculiar Form of Elastic Tissue, found in the

Ligamentum Nuchæ of theGiraffe." (Read April 25th, 1849. 'Tr. Mic. Soc. Lond.,' vol. iii, p. 45.)

13. "On the Scales of the Viviparous Blenny, *Zoareus viviparus*." (Read January 15th, 1851. 'Tr. Mic. Soc. Lond.,' vol. iii, p. 136.)

14. "On the Structure of the Raphides of *Cactus enneagonus*." (Read January 28th, 1852. 'Tr. Mic. Soc. Lond.,' n. s., vol. i, p. 20.)

15. "On the presence of Fungus of Masses of Crystalline Matter in the interior of a living Oak Tree." (Read January 26th, 1853. 'Tr. Mic. Soc. Lond.,' n. s., vol. i, p. 72.)

16. "On the Minute Structure of a peculiar Combustible Material from the Coal Measures of Torbanehill, near Bathgate, Linlithgowshire, known in commerce as Boghead Canal Coal." (Read November 23rd and December 21st, 1853. 'Tr. Mic. Soc. Lond.,' n. s., vol. ii, p. 34.)

17. "Observations on the Structure of the White Filamentous Substance surrounding the so-called Mealy Bug (*Coccus vitis*) of the Vine." (Read January 14th, 1857. 'Tr. Mic. Soc. Lond.,' n. s., vol. vi, p. 1.)

The high position he attained, and the honorable estimation in which he was held by all cultivators of science, were the justly merited reward of his untiring industry and steady perseverance, to which alone he owed his success. His loss will be severely felt by all interested in microscopical pursuits, but it will be especially felt by the members of his own profession, who were continually applying to him for his opinion on doubtful questions of physiology and pathology, and the various matters in which the microscope is applied to practical medicine, and to whom he was at all times ready and willing to afford advice and assistance. His lectures, addressed to a class principally composed of students and practitioners in medicine, were especially interesting for the practical bearing of his remarks, and illustrations as applied to medicine. His knowledge on all subjects in the investigation of which the microscope is used was extensive, varied and accurate, and, what is of hardly less importance, it was ever at command; he was never at a loss; and though cautious and sometimes slow in giving an opinion, his apparent hesitation was occasioned rather by the abundance than deficiency of information. He was endowed with a rare combination of qualities, the exercise of which made him the accomplished microscopist he confessedly was. He was thoroughly familiar with the practical use of the instrument, dexterous and delicate in manipulation, singularly skilful in preparing objects for examination, diligent and patient in research, sagacious and cautious in interpreting the phenomena the microscope revealed—above all, he was honest and candid in recording his observations. Not given to speculation, he was unbiassed by, though not unacquainted with, the views of others. His simple aim was truth; his labours were mainly directed to determining facts, leaving to others to draw the inferences they might justly warrant. Hence the special character of his works; abounding as they do, in original observations, they are a rich treasury of well-ascertained facts, duly authenticated by a competent observer, and faithfully recorded by a trustworthy witness.

He died at Pangbourne, Berkshire, on the 20th August, 1861, at the early age of 46, leaving a widow (Ella, second daughter of the late David Scott, Esq.) and four children to deplore the loss of an amiable husband and indulgent parent.

The Council, anxious still to connect the name of the late Professor with the Society he so long and so ably served, determined to endeavour in the first place to secure some instruments and other articles which had belonged to him, and which it was known he highly prized. For this purpose it was proposed to raise a fund, which it was hoped, after paying for the property purchased, might leave a residue to be applied to the further object of founding a memorial to his honour. For this purpose a medal has been suggested, to be called "The Quekett Medal," and to be awarded, annually if possible, or at longer intervals, to such member of this Society as shall be adjudged to have been most successful in promoting the objects for which the Society was instituted. This suggestion would be favorably regarded by the Council, if a sum sufficient for the purpose should be obtained.

I very much regret that well intended but mistaken efforts of over-zealous friends, by the premature publication of a prospectus referring to the proposals of the Council, before their plans were definitively settled, gave the appearance of the movement originating in this Society being in competition with one commenced by other friends and admirers of the deceased.

The ends proposed are different indeed, but not opposed, and though some indecision may have been caused to intending contributors, it is hoped that neither fund will seriously suffer, and that success may equally attend the efforts of those whose aim is to benefit the bereaved children, and of those who desire to provide a memorial to the honoured parent.

M. S. Legg, Esq.—We have to lament the loss of our Junior Honorary Secretary, M. S. Legg. He was elected to that office in 1860, when a vacancy was occasioned by the election of Professor Quekett as President. Unhappily his ill health prevented him giving much attention to the affairs of the Society, and was the cause of its not realising all the advantages from his appointment that had been confidently anticipated.

He was an old member, constant in attendance at our meetings, frequently took part in the proceedings, and occasionally contributed to our 'Transactions.' He was the author of the following papers:

1. "On the application of Polarized Light in Microscopical Investigations." (Read December 9th, 1846. 'Tr. Mic. Soc. Lond.,' vol. ii, p. 83.)

2. "Addendum to the paper 'On the application of Polarized Light in Microscopical Investigations.'" (Read December 22nd, 1847. 'Tr. Mic. Soc. Lond.,' vol. ii, p. 122.)

3. "On the Improvement in the Stage of the Microscope." (Read January 26th, 1848. 'Tr. Mic. Soc. Lond.,' vol. ii, p. 127.)

4. "Observations on the Examination of Sponge-Sand, with remarks on Collecting, Mounting, and Viewing Foraminifera as Microscopic Objects." (Read June 22nd, 1853. 'Tr. Mic. Soc. Lond.,' n. s., vol. ii, p. 19.)

Of the other members lost by death I have no personal knowledge, and can only record their names, and the statement that they "were attached to scientific pursuits," and used the microscope in their investigations. They are:—Viscount Downe; J. C. Druce, Esq.; W. Harkness, Esq.; J. MacMahon, Esq.; Dr. E. Meeres; W. S. Sargenson, Esq.

I now propose rapidly to review the proceedings of the Society during the past year, to inquire how far we have fulfilled the intentions of its founders, or whether we have lost sight of any of the objects they had in view.

They proposed — α. The establishment of a library of standard micrographical works. β. The formation of an arranged collection of microscopical objects and preparations. γ. The affording the opportunity and *means* of submitting difficult and obscure microscopical phenomena to the test of instruments of different powers and construction. I am thus naturally led to consider the state of our collection of—α, books; β, objects; γ, instruments.

α. *Library.* — Our library now comprises 275 volumes; some obtained by purchase, many presented by their respective authors, and some donations from members and others. It contains valuable (in every sense) works by Ehrenberg, the publications of the Ray Society, and those of the Sydenham Society, which relate to the microscope. It contains many volumes illustrating the early history of the microscope, and the investigations made by means of its use; it is in fact rapidly becoming a complete collection of standard micrographical works. In short, the state of the library is eminently satisfactory, for which we are mainly indebted to the well-directed labours of Mr. Roper, and his zealous coadjutor, Dr. Millar, the acting members of the Library Committee.

β. *The Cabinet.*—The state of the cabinet is far from being as satisfactory as that of the library. The cabinet, it is true, is large and convenient, capacious enough to admit of very considerable additions to its present contents. The collection of objects, however, is not what might reasonably have been expected, after twenty-two years of the Society's existence. It is true, indeed, that no part of the funds have been expended upon it; such as it is, it is the result of the contributions of members and other friends. At the date of the last report it contained 779 slides, supplied by 33 contributors; during the last year there have been added 103 slides, presented by 8 contributors, of whom two were previously benefactors. Among these, Dr. W. B. Carpenter is distinguished for the number and value of his presentations. Many years ago he was the liberal donor of 66 slides, illustrating the structure and development of shell, and again, recently, he has added to the number and value of the collection by the presentation of 8 slides illustrating the development of Comatula, and 6 slides of Bryozoa. We have also thankfully to acknowledge the presentation by the late George Jackson, Esq., of numerous slides illustrating favorite pursuits, micrometry and microphotography. I now take occasion to draw attention to—

a. The valuable collection of diatoms of South Wales, upwards of 200 slides, presented by Fitzmaurice Okeden, C.E.

b. American diatoms, two series, 26 slides and 39 slides, from Messrs. Sullivant and Wormley.

c. American diatoms, 37 slides, from the Boston Natural History Society.

d. Diatoms from Warwick, 21 slides, presented by J. Staunton, Esq.

e. Diatoms from Australia, by J. Coates, through H. Deane, Esq.

f. A large collection of microscopical specimens of different woods used in ship-building, by W. H. Ince, Esq.

g. Series of slides illustrating researches of G. Rayney, Esq., presented by that gentleman at different times.

h. Interesting preparations by J. L. Clarke.

i. Series of slides of the structure of the hairs of insects and plants, accompanying the papers of Tuffen West, Esq.

j. Slides showing the vegetable structures found in coals, accompanying the paper of J. T. Tapholme, Esq., read at the last meeting.

I have noticed these as examples of what we have and what we want. We are desirous of obtaining series illustrating particular subjects, but single slides will be thankfully received, and I am authorised to say that Mr. E. G. Lobb, representing the Cabinet Committee, will be happy to take charge of, and deposit in their appropriate place in the collection, any specimens that members or others are willing to contribute.

I hope, and am willing to believe, there is at last a prospect of the collection of objects being one of which the Society need not be ashamed.

γ. *Instruments.*—The Society for many years has had four excellent microscopes—one bequeathed by the late Edwin Quekett, and three, purchased as examples of first-rate construction, by the three principal makers. The objectives and accessories of these instruments, though good, and at the time the best that could be procured, are not equal to the requirements of the microscopist of the present day. Nothing has been done in the way of supplying them with the apparatus needed for the improved modes of illumination, though scarcely less necessary than the objectives, however good. The reason for this apparent neglect is that the large expenditure for other purposes has left no funds at the disposal of the Council for the improvements of the instruments. During the last year a move in the right direction has been made; the binocular arrangement of Mr. Wenham has been applied to the excellent instrument of Messrs. Powell and Lealand—an alteration made by those gentleman in a manner which has given unqualified satisfaction to the Council. Some curious old instruments, valuable as illustrating the history and progress of construction of the microscope, have been purchased. The most important of these is the remarkable instrument made by Benjamin Martin, and so highly prized by the late Professor Quekett. A very complete description of it was read at the last meeting by the Assistant Secretary, Mr. Williams.

Here, perhaps, I may be allowed a short digression, to say a few words on the munificent gift of Mr. Peters, presented to the Society this evening—the machine for microscopic writing, and with it Ibbetson's geometrical chuck. The money value of these instruments is considerable, the chuck alone, I am informed, cost fifty guineas, and on the writing machine Mr. Peters expended upwards of one hundred guineas, exclusive of the cost for cleaning and embellishing before presenting it to the Society, exclusive also of the handsome stand, mahogany table, and glass case, which are now before you.

On a former occasion I gave a description of the principles and construction of the instrument (read April 25th, 1855; 'Tr. Mic. Soc.,' London, n. s., vol. iii, p. 55). Since that time some alterations have been made in the details, the chief of these is that instead of the diamond moving over the glass, as formerly, it is now detached from the levers; in its place a light stage, carrying a small piece of thin glass, is connected with the distal extremity of the combined levers, and is made to move over the diamond point, which is fixed and kept in contact with the under surface of the glass by the pressure of a spring nicely adjusted. Besides this alteration, some additions have been made to admit of its movements being guided by mechanism, instead of by the hand only; and now Ibbetson's geometric chuck, which accompanies the instrument, can be connected with the proximal end of the levers, and, so combined, they suffice to produce the almost endless diversity of figures resulting from two circular movements, with circles of similar or different diameters moving with equal or different velocities, either in similar or opposite directions. The subject of the curves, generated by the motion of a point of one of these circles, has been studied and largely illustrated by H. Perigal, Jun., Esq., one of your Council, whose numerous figures of bicircloids are, no doubt, well known to you. All of these, and any combination of them, can be produced on a scale of exceeding minuteness, and beautiful and complex designs of this kind have been engraved on glass, with wonderful precision, in the space of a circle $\frac{1}{50}$th of an inch in diameter. On this occasion I have only time to allude to a few of the marvellous results of the use of the instrument. For example, the Lord's Prayer is written in a circle only $\frac{1}{100}$th of an inch in diameter; yet it is distinctly legible with a half-inch objective, the writing having no appearance of crowding or of want of room. Few persons have a distinct notion of the space defined by a circle of $\frac{1}{100}$th of an inch in diameter. Dr. Lardner, in his treatise on the microscope, has given a woodcut (p. 62) showing several disks of from $\frac{1}{6}$th to $\frac{1}{100}$th of an inch in diameter, the latter of these to the unaided eye is not a disc, but literally a point; the space occupied by this point, though smaller than the full stop of ordinary print, is still sufficient to contain five circles, each $\frac{1}{300}$th of an inch in diameter; and in a circle of that size the Lord's Prayer is written, that is, about the size of a transverse section of a hair of the human head. These specimens have been seen by many, and some are in the possession of several gentlemen, some of whom, I believe, are present. The dimensions given are not loose statements, which may or may not be true; but the measurements have been made with the greatest care, and in the instances mentioned they were verified by the late Mr. George Jackson, whose skill in practical micrometry is well known. But there are productions more marvellous still, the statements about which are not to be regarded as travellers' tales; they are what, whether addressed to a learned society or the general public, such statements ought to be, the truth without exaggeration. The name and address of Mr. "Matthew Marshall, Bank of England," have been written in $\frac{1}{2,500,000}$th of an inch—the two and a half millionth part of an inch. The Lord's Prayer, too, has been written and may be read in $\frac{1}{356,000}$th of an English square inch. The measurements of one of these specimens were verified by Dr. Bowerbank, with a difference of not more than one five-millionth of an inch, and that difference, small as it is, arose from his not including the prolongation of the letter *f* in the sentence, "Deliver us from evil;" so that he made the area occupied by the writing less than that stated above. Some idea of the minuteness of the characters in these specimens may be obtained from the statement that the whole Bible and Testament in writing of the same size might be placed twenty-two times on the surface of a square inch. The grounds for this startling assertion are as follows:—The Bible and Testament together, in the English language, are said to contain 3,566,480 letters. The number of letters in the Lord's Prayer, as written, ending with the sentence, "Deliver us from evil," is 223, whence, as $\frac{3,566,480}{223}=15,992$, it appears that the Bible and Testament together contain the same number of letters as the Lord's Prayer written 16,000 times; if, then, the prayer were written in $\frac{1}{16,000}$th of an inch, the Bible and Testament in writing of the same size would be contained by one square inch; but as $\frac{1}{356,000}$th of an inch is less than $\frac{1}{22}$nd part of $\frac{1}{15,992}$nd of an inch, it follows that the Bible and Testament in writing of that size would occupy less space than $\frac{1}{22}$nd of a square inch; in other words, the writing is so small, that in similar characters the Bible and Testament together could be written twenty-two times in the space of one English square inch.

To return to the objects of the Society; its founders contemplated not only "the promotion and diffusion of improvements in the optical and mechanical construction, and in the mode of application of the microscope;" but, also, δ "the exhibition of new or interesting microscopical objects and preparations," and, ε the advancement of science by encouraging "communications and discussions relating to subjects of microscopical observation."

δ. *The annual soireé* provides both occasion and inducement to exhibit "*new or interesting microscopical objects and preparations.*" It was held last year on the 10th of April, when the Council were gratified by the assemblage of upwards of 700 ladies and gentlemen who honoured them by accepting their invitation. For the success of that meeting our grateful acknowledgments are due to the Council of King's College for the facilities afforded us, and for their kindness in permitting us the use of their noble hall for the occasion. For the complete and satisfactory arrangement of all the details, we are indebted to our esteemed Secretary, Mr. Blenkins, and his kind and attentive assistant, Mr. Williams.

ε. *Ordinary meetings.*—Besides the anniversary meeting, and the soireé, seven ordinary meetings have been held as usual, at which we have had "*communications and discussions relating to subjects of microscopical observations,*" &c. At all our meetings, I am glad to report, we were well supplied with papers.

A. Four refer to the *construction of the microscope* and its *accessories.*

1. "Description of the Universal Achromatic Microscope," by Mr. R. Beck. (Read, October 9th, 1861. 'Tr. Mic. Soc. Lond.,' n. s., vol. x, p. 11).

The instrument here described is not brought into competition with the first-rate and costly instruments of the same or other makers. It is emphatically a cheap instrument. It is gratifying to find our makers of first-class microscopes seriously endeavouring to produce an instrument to be sold at a price which will be within the means of the many who are "earnestly seeking the entertainment and instruction afforded by a microscope of even moderate powers." The more our means of observation are multiplied and brought within reach of a larger class of observers, the more rapidly may we expect to extend our knowledge and become acquainted with "that immense field of nature still unexplored."

2. "Description of a microscope by Benjamin Martin," by Mr. Williams. (Read, 8th January, 1862).

This instrument, so fully described by Mr. Williams, is in striking contrast with the small but effective instrument just noticed; it is, however, in all respects a remarkable production, whether considered with regard to the many ingenious contrivances, or the excellence of the workmanship shown in its construction.

3. For the effective use of the microscope, improved methods of illumination have been proved to be of not less importance than improved objectives. On this subject we have been favoured with a communication by the Rev. J. B. Reade. "On a new Hemispherical Condenser for the Microscope, and its use in illustrating an important principle in Microscopic Illumination." (Read, 8th May, 1861. 'Tr. Mic. Soc. Lond.,' n. s., vol. ix, p. 59).

"The principle sought to be carried out is to throw the axis of the pencil of illuminating rays in a direction at right angles to the line to be resolved." The author shows how, by the use of a simple lens, and a few diaphragms with apertures at their circumference, two or more illuminating pencils may be thrown at the same time upon an object having two or more sets of lines, and the direction of the axis of the pencil be determined by the position of the apertures on the margin of the diaphragm. The arrangement is simple, cheap, and easy of adjustment; its efficiency was placed beyond doubt by the most conclusive of all proofs, actual demonstration.

4. "On a Portable Revolving Table," by J. Burton, Esq. (Read, 9th October, 1861. 'Tr. Mic. Soc. Lond.,' n. s., vol. x, p. 9).

This falls under the head of "arrangements for affording increased facilities for the use of the microscope." It is a simple and ingenious contrivance for enabling an exhibitor to submit an object to several persons seated at the same table with the least possible disturbance. The table was exhibited at the meeting, and woodcuts of it are published in 'The Transactions.' The contrivance appears to be well calculated to accomplish the design.

B. *On Crystallography.*—This paper well illustrates the influence of improvements in the construction of the microscope. It is "On the Microscopic Characters of the Crystals of Arsenious Acid," by William A. Guy, M.B., Cantab., Professor of Forensic Medicine, King's College, London. (Read, 8th May, 1861. 'Tr. Mic. Soc. Lond.,' n. s., vol. ix, p. 50).

We must all admire the skill manifested in explaining the phases of the octohedron, to which form most, if not all, of the varied forms observed are referred. The existence of twin crystals, and the not unfrequent occurrence of a "half crystal" are satisfactorily established, and we are taught how many of the apparently aberrant forms may be explained by considering them as phases of the half crystal; the existence of crystals other than octohedra is also distinctly announced. All that relates to the characters of arsenious acid is of high interest from the grave questions which are frequently involved in medico-legal investigations of which it is the subject. Regarded from this point of view, I think this communication fairly deserves to be considered the most important and most interesting of the many interesting papers of the year. You all, I am sure, have much satisfaction at now being able to reckon its learned author among the members of the Microscopical Society. The author assures us that one of his objects in presenting this paper was to show "by a striking instance the great value of the binocular microscope as a means of diagnosis," and in summing up the results of his inquiries, gives important testimony to its usefulness. He remarks:—"I felt that my views concerning the large part played by the half crystal, though highly probable, were still only probable; but under the binocular microscope all my doubts were dissipated, my errors corrected, some surmises confirmed, and most of my inferences justified." He adds:—"If there is any one who doubts the value of this form of microscope, or is disposed to treat it simply as a philosophical toy, I would ask him to examine these crystals with the monocular instrument by transmitted light, and with the binocular instrument by reflected light;"—"the fine relief and perfect roundness of the tube and its contents is at one and the same time a proof of the utility and faithfulness of the binocular microscope."

c. *On Zoology.*

1. "On the Circulation in the Tadpole," by W. U. Whitney, Esq. (Read June 13th, 1861. 'Tr. Mic. Soc. Lond.,' n. s., vol. x, p. 1).

In this paper we have additional testimony to the value of the binocular microscope, applied to investigations in a widely different field of research.

2. "On the Metamorphoses of a Coccus found upon Oranges," by Richard Beck. (Read March 13th, 1861. 'Tr. Mic. Soc. Lond.' n. s., vol. ix, p. 47).

The author describes the development of a species of coccus found under the shield commonly met with on the sweet oranges sold in the shops; they are not so common on the fruit sold in the streets. To those who propose to take advantage of the season when oranges are plentiful to pursue this investigation, I would recommend attention to the suggestion of the Rev. Mr. Reade, viz., immersion of the shield for a short time in hot liquor potassæ, by which the vegetable portion is dissolved, while the animal part remains, and the insect in all its stages of development is distinctly revealed. The author concludes with this remark:—"I have invariably used Mr. Wenham's binocular arrangement with the microscope, and I can only say that for this class of investigations the results are perfectly marvellous."

These are some of the first fruits of that invention which Mr. Wenham has so freely given to the world, without restriction or reservation. The Microscopical Society has good reason to be proud of such a member, distinguished alike for his scientific attainments and mechanical skill, as well as the modesty and liberality which prove him to be a true disciple of science.

3. "On a Coccus upon a Rosebush," by Richard Beck. (Read November 13th, 1861. 'Tr. Mic. Soc. Lond.,' n. s., vol. x, p. 16).

The author notices that the coccus described in the former paper is to be met with in our gardens, and "that the same species may differ very considerably, more especially on the exterior of the shield, according to the climate, its position, or the nature of its food."

4. "On the Viscid Lines in a Spider's Web," by Richard Beck. (Read November 13th, 1861. 'Tr. Mic. Soc. Lond.,' n. s., vol. x, p. 17).

The author describes the process of the formation of the viscid globules on the concentric lines of the web, he having witnessed the operation. The whole process he considers an instance of "molecular attraction," a subject so profoundly studied and lucidly explained by Mr. Rainey.

5. "On some points in the Structure of the Hairs of Insects in different degrees of development," by Tuffen West. (Read November 13th, 1861).

D. *Phytology.*

We have had seven papers on the Diatomaceæ, six of which are by R. K. Greville, LL.D., F.R.S.E., &c.

1. "Descriptions of New and Rare Diatoms." 1st series. (Read March 12th, 1861. 'Tr. Mic. Soc. Lond.,' n. s., vol. ix, p. 39.)

2. Ditto, 2nd series. (Read June 12th, 1861. 'Tr. Mic. Soc. Lond.,' n. s., vol. ix, p. 67.)

3. Ditto, 3rd series. (Read June 12th, 1861. 'Tr. Mic. Soc. Lond.,' n. s., vol. ix, p. 73.)

4. Ditto, 4th series. (Read June 12th, 1861. 'Tr. Mic. Soc. Lond.,' n. s., vol. ix, p. 79.)

5. Ditto, 5th series. (Read December 11th, 1861. 'Tr. Mic. Soc. Lond.,' n. s., vol. x, p. 18.)

6. "On Asterolampræ." (Read January 8th, 1862. Not yet published.)

7. "On Fossil Diatomaceæ." By W. F. Cooper, Sheffield. (Read October 9th, 1861. 'Qr. Jr. Mic. Soc.,' n. s., vol. ii, p. 65.)

These organisms are favorite objects with a large class of observers. Their numbers, their almost universal diffusion, the great diversity and beauty of the forms, and their use as test objects, sufficiently account for this; besides, they afford opportunities for the use of the highest powers of the microscope; they demand a high degree of practical skill to exhibit their delicate markings, and they require, as well as amply illustrate the advantage of, the modern refinements of illumination. Notwithstanding the attention they have received, their structure is still imperfectly understood: opinions differ greatly respecting them; the determination of species is a matter of extreme difficulty; so that probably for a long time to come they will afford a subject for study and research.

8. "On the Seed of Dictyoloma Peruviana." By Henry B. Brady, F.L.S. (Read Jume 12th, 1861. 'Tr. Mic. Soc. Lond.,' n. s., vol. ix, p. 65.)

The points of interest are the great size and peculiarities of the alæ or membranous expansions, the structure and development of which are well explained and illustrated.

9. "On the Microscopic Structure of the Hairs of Vegetables." By Tuffen West. (Read December 11th, 1861.)

10. "On Coal, and the Vegetable Structures found in Coals." By J. T. Tapholme. (Read January 8th, 1862.)

The last two papers were accompanied by slides illustrating them, which the authors contributed as additions to our collection—examples especially deserving imitation, as appropriate means of adding to, and giving increased value to the contents of the cabinet.

I have now completed the review of our proceedings during the past year, and find that none of the objects contemplated when the Society was constituted have been lost sight of. In evidence that our members have laboured for the advancement of science, it is sufficient to refer to the number of valuable papers they have communicated. No subject has been neglected. We have had four papers *on the Microscope* and its adjuncts; one on a subject of *Inorganic Chemistry;*

five on *Zoology*, or the Structure and Physiology of Animals; ten on *Phytology*, or the Structure and Physiology of Plants; altogether twenty papers—a greater number, I believe, than has ever been contributed in any previous year.

The unabated interest of the members has been manifested by the good attendance at the ordinary meetings, and the spirit with which the discussions have been carried on.

For the improvement of our microscopes, as much has been done as our funds allowed. The collection of objects has received numerous additions. The library has had its due share of attention, and has increased in numbers and value. Our numbers have considerably increased.

Our finances give no serious cause for concern. On the whole, I think I may fairly congratulate you on the state and prospects of the Society on entering upon its twenty-third year.

I have to apologise for having occupied so much of your time. I thank you for the patience with which you have endured what I fear was an unwarrantable trespass, and especially I thank you for the indulgence you have afforded me while endeavouring to discharge the duties of the office I have the honour to hold.

On the Preservation *and* Mounting *of* Microscopic Objects *in* Minute Tubes. By Dr. Guy.

(Read March 12th, 1862.)

The several modes of preparing, preserving, and mounting objects for the microscope have been so thoroughly examined and so well described by competent writers, and the art has attained to such perfection in the hands of those who practice it, that little, if anything, can remain to be said respecting any of the methods in common use. I, at least, have no suggestions to offer regarding them. But there is one mode of preserving and mounting objects for the microscope which appears to me to be deserving of the attention of the Society. I have some experience of it; and I think that I may venture to commend it, as combining perfect preservation with great ease of application, cleanliness, and satisfactory display of all the objects to which it is applicable. I speak of the preservation and mounting of objects in small tubes.

I may premise that there is a small class of objects, of great importance in a practical point of view, which cannot be completely identified without being examined under the microscope, and which, being actually developed in tubes of narrow bore, and not admitting of being detached from them, compel us to resort to some method of tube-mounting. I speak of the deposits of metallic arsenic and antimony which the chemist obtains in medico-legal analyses by Marsh's method, and of the sublimates of mercury, of arsenic, and of arsenious acid, which he procures from the small fragments of copper foil coated with the metals mercury and arsenic, by the method of Reinsch; also of sublimates of arsenious acid obtained as crystals from the powder of white arsenic, or from the green aceto-arsenite of copper, of which we have lately heard so much. This small but important group of objects, obtained in glass tubes of small bore, and, if necessary, perfectly preserved by sealing the tubes at both ends in the flame of the spirit-lamp, have to be mounted in some convenient way for microscopic examination. I will begin by indicating one or two obvious modes of effecting this. 1. A card of the size of the usual microscopic slide has a circular opening punched out in the centre; this opening is enlarged by side-cuts, so as to receive the tube and to support it at each end. A common label, with a central circular opening to correspond with the hole in the card, is pasted at the back; the tube is dropped upon it, and is secured in its place by a slip of paper crossing it at either end. A description of the specimen is then written on the card in front, or on the label behind. 2. Or, using a card of the same size and shape, with the same central circular opening, this opening is enlarged by two smaller openings of the same shape, one on each side, which openings are made to touch the central opening, or are somewhat separated from it, according as the tube is shorter or longer, the three apertures being joined by cuts made with a penknife or chisel. An oblong strip of gilt paper is then gummed at the back, and the tube, made to rest upon it, is fastened in its place by a similar label in front. The openings being made near one margin of the card, room is left beneath for a description of the object. 3. If we prefer the common glass slide to card-board, the three openings, joined together as before, are punched out of a small oblong piece of card-board, the card-board is gummed to the slide, or, better, to an oblong piece of coloured paper, perforated like the card-board itself, gummed to the glass; and the glass tube is then secured in the card-board and upon the slide by a coloured slip of paper projecting beyond the card-board, so as to fix it more firmly to the glass. A similar arrangement of a perforated card, bound down by slips of gummed paper to the surface of the glass, will enable us to examine the contents of the tubes before mounting them. 4. There is also a very simple method of mounting the tubes so as to submit them to immediate examination. It consists in separating the layers of the card-board, furnished as before with a circular central opening at the edges of the card, and inserting the tube between them. The tube, after being examined and adjusted, may be secured in its place by an edging of gummed paper, and the card may then be labelled and ornamented if required. 5. There is still one other mode of mounting these small tubes. The card-board is first indented with a groove running in the centre line of the card and in the direction of its length. Around this groove a black band is rubbed in with a stencil-plate; the tube is then dropped into the groove and secured in its place by two narrow strips of gilt or coloured paper. If the object is to be examined by transmitted as well as by reflected light, a small circular hole may be punched in the centre of the card and of the black band.

The specimens to which I referred at the beginning of this paper were such as would have to be used for the instruction of a class of pupils; and I may, therefore, take this opportunity of indicating the easiest method of rendering these tubular specimens available for class-teaching.

For this important purpose it is necessary either to resort to a costly arrangement for circulating the ordinary microscope from person to person among a class seated at a table, or to make use of a cheaper instrument passed from hand to hand. Such a simple and cheap instrument I have been for some time in the habit of employing. A more expensive and complete instrument, with and without a light attached, has been since devised and successfully employed by my colleague, Professor Beale. In his instrument, Dr. Beale makes use of the ordinary microscopic slide; but I have always preferred to use a disc of glass, or of card-board, ivory, bone, or wood, or rings of gutta percha turned off the tube. Such discs can be completely enclosed in the instrument, and may thus be rendered secure from accident or intentional displacement. I need not detain you by describing the mode of mounting the tubes on these discs. I send round specimens which will suffice, after the details I have already given. I may, however, observe that the readiest mode of mounting the tubes for cursory examination is to warm the ends in the flame of the spirit-lamp, and drop the tube on to a ring of *gutta percha.* This ring, placed in an appropriate holder, can be put under the microscope and examined.

Having now indicated some simple and obvious methods of mounting these small tubes, so as to be able to examine their contents under the microscope, I must next give some account of the mode of making the tubes themselves, of placing the objects within them, and of securing and preserving them.

It will be understood that the tubes of which I am speaking are always of much smaller bore than the tubes or *canes* (as they are technically called) drawn in the glass-house. They must be the work of the glass-blower, and are made by melting the smaller sized tubes or *canes* in the flame of the lamp, and drawing them out. They can be made by any one, after a little practice, by using for the purpose a spirit-lamp with a large wick. They are best drawn out, several in succession, from the same piece of tubing, and then divided into lengths by marking the tube with a file. Each portion of the tube so drawn out and divided assumes the shape of a long tube of uniform, or nearly uniform, minute bore, terminated at either end by a short tube of the size of the cane from which it was drawn. (I send round specimens of the tubing or "cane," as supplied by the glass-blower, of a portion of this tubing drawn out into two small tubes, and of a minute tube of the form I have described.) I may here state that though, for certain exceptional purposes, the chemist employs green, or German glass made without lead, for all other purposes the common white glass, containing the usual quantity of lead, is to be preferred. I may add, that it is desirable to procure tubing recently drawn, and not such as has been lying for a long time in the glass-house contracting dust. The tubing is very cheap, sold by the pound, and the ultimate cost of the minute tubes in which the specimens are mounted would be some small fraction of a penny.

It will be seen that each tube thus drawn out consists of a small central tube able to receive one or two microscopic specimens, and of a larger portion at each end available as a funnel for the introduction of the specimen itself.

When we wish to obtain a sublimate within the narrow portion of the tube, and the substance to be operated upon does not sublime at a low temperature, we first introduce the object through the large open mouth of the tube into the commencement of the narrowest portion; we then seal the tube in the flame of the lamp, and thus form a retort in miniature. We now shake the object into the sealed end of the tube-retort, heat the end, and obtain the sublimate in the narrow portion of the tube. The small tube, being drawn off and sealed on both sides of the sublimate, may now be mounted for the microscope. I send round a tube which has been dealt with in this manner. A piece of copper-foil coated with the metal arsenic by Reinsch's process has been introduced, sealed up, and heated, and a crystalline ring of arsenious acid has been sublimed into the narrow portion of the tube. The crystalline texture of this ring may be seen by the lens, but it is clear that for thorough examination of the sublimate, and the identification of the crystals as those of arsenious acid, the microscope must be brought into play. This specimen, then, will suffice to prove the necessity of using the microscope.

In those cases where the substance to be operated on sublimes under a comparatively low temperature, we must either employ a tube with a longer extremity, so that the substance may not be unduly heated in the act of sealing the tube, or we must first seal the tube at one end, dry it carefully by passing it repeatedly through the flame of the lamp, and then so contrive to introduce the substance to be operated on through the open end of the tube, as not to soil it in its passage. To effect this, the tube must be held in a vertical position, and the substance to be heated must be dropped in in very small fragments.

I have hitherto spoken only of round tubes drawn out from round tubing; but I may now add that the oval tubing sold by the glass-maker may be treated in every respect in the same way as the round tubing; and that when drawn out in the flame of the spirit-lamp, it retains its form of a flat oval, and presents under the microscope a surface so slightly curved as to differ little (for all practical purposes not at all) from the surface presented by the flat microscopic glass. I send round specimens of this tubing corresponding with those I have already shown from the round tubing. This oval tubing is sold for two-and-sixpence a pound, and the cost of each minute tube must be exceedingly trifling.

I have now said enough on the subject of tube-mounting as applicable to chemical sublimates; and at this point I might perhaps be reasonably expected to stop. But though my own practical interest in the question ceases here, I was unwilling to leave my paper imperfect by omitting to indicate, and to illustrate by specimens, some of the more obvious non-chemical applications of the method of preserving and mounting objects in tubes. Let me premise that I am not about to recommend this method as better than those now in use; I speak of it merely as a convenient, simple, easy, and cleanly method, sufficient for every purpose of identification, if not of display. Requesting you to bear this in mind, I will proceed to indicate some of the objects to which the method is applicable.

1. In the first place it is important, not only in the case of those chemical substances which I have spoken of as obtained in small tubes for practical purposes—I mean sublimates of arsenic, antimony, mercury, arsenious acid, &c.—but also in the case of the more volatile chemical substances, such as camphor, sulphur, and iodine, which we may wish to examine by preserving them in sealed tubes, also of such crystals as those of corrosive sublimate, which undergo rapid decomposition when exposed to the air.

2. Again, the method is obviously applicable to the preservation and display of round and flat seeds, the flat tubes being used for both, or the round tubes for round seeds, and the flat tubes for flat seeds. It is equally applicable to the preservation and display of such objects as pollen and starch.

3. The method is also convenient for such small cylindrical objects as the antennæ of insects, and the stamens and pistils of most plants. Some of these objects are very delicate, and are both distorted and spoiled, if flattened.

4. The method of tube-mounting is also obviously applicable to the preservation and display of minute insects.

5. Lastly, the flat tubes, obtained from the oval tubing or cane, may be used for any purpose to which the ordinary modes of mounting are applicable. I speak, however, only of mounting in the dry. I have no experience of the use of

Canada balsam, glycerine, castor oil, or other liquids, though I can conceive it to be quite easy to draw these liquids into the tubes, without admitting air into them, and then sealing them securely by Brunswick black. I must be understood, however, to recommend the preservation and mounting of objects in tubes chiefly as superseding the necessity of using any of these liquids for preserving the objects. The exclusion of air and moisture by sealing the tubes at both ends answers every purpose of preservation, and most purposes of display.

I have placed under the microscopes at the side table, specimens of objects mounted in round and flat tubes, and also on the table several other specimens—some chemical, others belonging to the several divisions of natural history—seeds, pollen, and other portions of plants, antennæ and legs of insects, portions of the wing-cases of beetles, &c.

The objects which I have placed under the microscopes are—

1. A stamen of the rhododendron in a round tube. This is a very beautiful transparent object consisting of a long cylindrical axis with jointed spokes radiating from it. It has been now enclosed in the tube about nine months, and is as fresh and clear as when first inserted. It has undergone no change itself, nor is the tube dimmed in the least degree.

2. Crystals of arsenious acid, in a flat tube, being an ordinary specimen of the sublimed acid. The surface of the glass is apparently flat, and the specimen as distinct in every way as if obtained on a flat surface, and covered with a flat microscopic glass.

3. Arsenite of zinc, in a round tube. My colleague, Professor Bloxam, has kindly allowed me to exhibit this curious salt, in anticipation of a paper he is about to read at the Chemical Society. It consists of small pellucid, and large opaque, globular masses. The smaller ones cohere something after the fashion of bunches of white currants, and the larger ones show a similar tendency to cling together. I have placed them under the binocular microscope, for which they form a very appropriate object. Though there are one or two other minerals and chemical compounds which assume the same globular form, it is believed that this substance will prove unique as an object for the microscope.

TRANSACTIONS.

On the Scales *of* Lepidocyrtus ———? *hitherto termed* Podura-scales, *and their value as* Tests *for the* Microscope. By Richard Beck.

(Read March 12th, 1862.)

The subject of the following remarks was cursorily alluded to in an abstract published in the last number of this Journal (April, 1862, p. 122). It is here intended, with the help of illustrations, to give in detail the proofs of the value of the Podura-scale as a test; also some observations upon the structure of the scales, a description of the insect, its habitat, and some remarks upon the best method of obtaining the specimens.

The very mention of the Podura-scale as a test is often met with the immediate reply—"Why, its markings can be seen with an inch;" and of this there is no doubt. It is not, however, a matter of seeing the markings, but of the way in which the markings are shown. I shall, indeed, only allude to the examination of the higher powers by this test, selecting, in the first instance, chromatic and spherical aberrations, and bad workmanship, as the errors that these object-glasses are more especially liable to.

Pl. X, fig. 1, is a camera lucida drawing of part of one of the best scales, as seen by a one-eighth, with No. 3 eye-piece, the magnifying power being about 1300 linear; the markings are wedge-shaped, very black and brilliant, but with a narrow bright space towards the top; they are consecutive in the longitudinal direction of the scale, and no transverse markings whatever are present.

In correcting a lens for colour, a secondary spectrum cannot be avoided, and a light green, resulting from the union of blue and yellow, is more generally approved, as being inoffensive, and quite immaterial. This or any stronger colour is instantly seen on the edge of all the dark markings, or on the outline of the scale itself.

The test for spherical aberration is still more severe. If the object-glass be well corrected, and the object in focus, the markings are seen as at fig. 1; but in addition to this, and owing to the simplicity of the structure, the appearance fig. 2 produced by the least movement possible of the slow motion will be exactly the same, either within or beyond the focus. On the other hand, if the object-glass be wrongly adjusted, which is the same as being badly corrected, there will be no distinct focus anywhere, the best being that shown at fig. 4; whilst on one side of the focus there will be strong lines (fig. 5), and on the other side a still more indistinct image (fig. 6) than that shown at fig. 2. This test supplies, therefore, to a remarkable degree, the means of detecting, to the greatest nicety, the exact point when a good object-glass is rightly adjusted; or, what is the same thing, the exact condition of the spherical aberration. A careful experiment with a one-eighth will show that, by moving the adjusting collar only one thirtieth of a revolution (a real movement between the lenses of less than $\frac{1}{1000}$th of an inch), there will be a marked difference in the performance. Besides detecting the condition of the two aberrations, the Podura-scale will show an error in the centreing of the lenses by one side of each marking being darker than the other, or by a variation of appearance when the direction of the scale in the field of view is changed. It is impossible to describe the effects produced by many other kinds of bad workmanship, but generally they will more or less resemble those of wrong correction. It may be necessary to state here that the best kind of illumination is by an achromatic condenser of very small pencil, the light being either used direct or reflected by a ⊾ prism. In speaking of a test for the microscope, there is one other point to allude to, viz., aperture. The Podura-scale in itself is no positive test of aperture; an increase of angle up to a certain point improves the brilliancy and sharpness of the markings; but this particular matter may be put in the following form:—If the Podura-scale be shown well by an object-glass, measure its aperture by some mechanical means, and you can exactly predict how much it will do on Nobert's lines, or on the Diatomaceous tests; but reverse the proceeding, and you can by no means be certain that, from the mere fact of an object-glass separating fine lines or minute dots, it will also have a proportionate defining power over other and more general objects, which owe their appearance to an entirely different arrangement of structure.

As regards the structure of the Podura-scales, my own observations were made without the knowledge, although they are entirely confirmatory, of what has already been published in the 'Micrographic Dictionary.' It is stated there, under

"Scales of Insects," "The interesting markings seen upon the scales vary considerably in different insects. The most common, as seen by transmitted light, are longitudinal, simple, continuous, parallel, or slightly radiating dark striæ or lines. . . . . . These longitudinal striæ consist of elevations or ridges upon the surface, probably representing folds of the upper layer or membrane of the scale. They often project slightly from the free end of the scale, and, when moistened, bubbles of air may not unfrequently be found imprisoned between the surface of the scale and the cover, which, being confined between two of the ridges, assume an oblong form. . . . .

"In the scales of Podura the striæ consist of longitudinal rows of minute wedge-shaped bodies. . . . . .

"The darkness of the longitudinal striæ is caused by refraction; for scales containing no pigment appear perfectly white by reflected light, although the striæ may be very dark. . . . .

"Upon certain scales other irregular, more or less transverse curved striæ exist; these appear to consist of wrinklings or folds of the under membrane of the scale. . . .

"When the insects are pressed against the slide to remove the scales, a number of globules of oil adhere simultaneously to the slide; and when the cover is applied, the scales often become partially or entirely covered with the oily matter, producing an appearance as if the upper layer of the scale were removed, and rendering the markings so pale and indistinct, as to be apparently absent."

The remark that the striæ on the Podura-scales consist of longitudinal rows of minute wedge-shaped bodies, conveys the idea that each marking is isolated, and the illustration, besides confirming this error, shows neither the blackness nor the light spaces of the markings, and the absence of these two essential points are proofs of inferior definition. The other points noticed in the extract are entirely confirmed by my own observations. I believe, when no pigment is present in the scales, not only that the darkness of the longitudinal striæ, but that all the markings on the scales are entirely due to the refraction or to the reflection of the light. In the ordinary course of things, the naked eye is totally unaccustomed to the the examination of transparent objects by light transmitted through them; but in using the microscope, this is the common mode of procedure. No little care is required in observation to discover the true structure under such circumstances, for the presence or the absence of matter may produce the same appearance.

In the present instance the most conclusive proof of the perfectly transparent nature of the whole substance of the scales is, that the markings almost entirely vanish when the irregularities of the surface are removed by the presence of moisture. Fig. 3 represents this appearance on the Podura-scale; and I cannot but think that Dr. Carpenter is mistaken when he says that such "scales have lost a portion of their superficial layer by some accidental injury."

That the particular wedge-shaped bodies of the Podura-scale are elevations upon the surface can, I believe, be satisfactorily proved by viewing the scales under illumination from above. This method would generally be spoken of as making them opaque objects; an expression, however, which cannot be correct, for unless the real nature of an object be changed, if it be a transparent object it must remain so still, whether it be illuminated from above or below. If, in the latter case (that is with light from above) these scales be placed under a one-eighth and third eye-piece, *without any cover* (for with the oblique illumination that is necessary under such a power the thin glass is a most perfect reflector), quite sufficient light can be obtained by means of the usual large and small condensing lenses combined, and we have the following result:

When the markings are at right angles to the direction of the light (fig. 7), the side farthest off is illuminated; when they lie in the same direction as the light, with their narrow ends pointing to it (fig. 8), the broad ends appear like brilliant spots, but when this direction is reversed (fig. 9), the light from the points is so slight that the scales appear to have lost their markings altogether. Now, if the object were an opaque substance, this result would have been a convincing proof that the markings were depressions; but as we know it to be transparent, it follows that these particular appearances can only be produced by elevations.

At the present time the next and most natural question will be, how do the scales appear under the binocular microscope? Here the same caution is necessary, from the object being transparent. After witnessing some very curious effects arising from this cause when the object was under dark field illumination, I found, entirely to my own satisfaction, that by selecting a peculiar scale in which the markings had a curious turn in their direction and were very distinct, and by using a condenser-illumination from above, on both sides, that a series of toothed ridges, the profile of which might be said to resemble the edge of a saw, might be brought into view; and my own belief is, that the markings upon this and all other varieties of Podura-scales are more or less elevations or corrugations upon the surface, which answer the simple purpose of giving strength to very delicate membranes.

The Podura-scale is, unfortunately, no exception to all other known objects for the microscope, in not having that uniformity which would make it an universal test. I will, however, do all I can, to enable any one who takes an interest in the subject, to obtain the proper scale; for as yet it has been comparatively seldom mounted for sale. The first good specimens that I had ever seen, were those supplied by Messrs. Powell and Lealand; and I can well remember, when an accident occurred to one I had long used as a test, that I could only obtain another by borrowing a slide from a private collection. Subsequently to this, a few could be obtained from Mr. Topping, and also from the late Mr. George Jackson; but I have hunted for years without ever being able to meet with the right kind myself. I can only account for this by my strictly adhering to the directions of others, that they were to be found in damp cellars; whereas, I met with them first on a heap of stones out of doors, but thoroughly protected by some outhouses, and the best specimens were not on the damp, but underneath the comparatively dry stones. After this I found them in an unused candle-house, where some old sacking and pieces of wood were stowed away in a trough that had been used for chopping tallow; this was in Bedfordshire. I met with them afterwards in a hovel in Hertfordshire, amongst old garden implements and billets of wood, and since then I have found a few specimens on some rock-work and in a tool-house near London. My own impression is, that the drier the place in which you can find the insects at all, the more likely will they be to furnish the best scales. I have altogether mounted some hundreds of slides, and any one who has the time for careful search can, I believe, also, obtain them in any quantity. Mr. Pritchard's directions, "to sprinkle a little oatmeal or flour on a black piece of paper, and place it near their haunts," I have found of no help, for this simple reason, that the difficulty is in finding their haunts, after which the insects themselves are easily caught; there is, however, this simple guide, which deserves notice :—I believe the whole family feed either on decaying vegetable matter, or on the most minute fungi.

As the determination of the precise species of *Lepidocyrtus*, Bourlet (*Cyphodeirus*, Nicolet), which affords the proper test-scales is, I find, attended with considerable difficulty, it has been left for a future opportunity, when I shall be better able to remove all doubts concerning it than I am at present.

My mode of removing the scales may be a help to some. Whenever practicable, I prefer taking the stone, piece of wood, or whatever the insects may be on (if at all portable), into the house, where I spread a large piece of paper on the table; they are easily brushed off on to this, when they should be immediately covered over, before they, have time to hop, by some small thing, such as the top or bottom of a pill-box; if this be left over them for a minute or so, and then removed, they will be found to be quite quiet, and a 3 × 1 slide, or a piece of thin glass, may be carefully pressed upon them without squeezing out of any of their juices; whilst the scales will adhere closely to the glass. As by this method, however, the insects will frequently hop away and escape, they may be made perfectly motionless by applying, with a camel's hair pencil, a little chloroform near them, upon the paper, before the cover is moved.

At some future time I may, perhaps, be allowed space to furnish descriptions of the scales of several other species; for I have found it impossible to determine the structure of any one specimen except by comparison with other varieties—a theory that appears applicable to the one structure being impossible in another. Neither is the subject an exclusive one; for a consideration of the appearances produced by transparent objects under the microscope extends vastly beyond determining the mere fact, as to whether the wedge-shaped markings of the Podura scale possess an individuality as little scales, or are mere inequalities in the substance or on the surface of a membrane.

Descriptions of New and Rare Diatoms. Series VI.

By R. K. Greville, LL.D., F.R.S.E., &c.

(Communicated by F. C. S. Roper, F.L.S., &c.)

Cymatopleura.

Cymatopleura angulata, n. sp., Grev.—Lateral view, narrow-oblong, with elliptic ends; the transverse undulations at each extremity angulated; margin with a row of minute puncta, about 10 in ·001″. (Pl. IX, fig. 1.)

Hab. Californian guano.

This species approaches *C. elliptica;* but, in addition to being a marine species, appears to be truly distinct. The most important character lies in the transverse bars at each extremity of the frustule being bent so as to form a distinct angle. The outline of the frustule is not strictly elliptical, but has more or less straight sides, never, however, panduriform. The length varies from ·0035″ to ·0050″; breadth in the larger examples about ·0015″.

Campylodiscus.

Campylodiscus Browneanus, n. sp., Grev.—Valve circular; canaliculi slender, numerous (about 48), radiating from an ovate or oval blank central space occupying about a fourth part of the breadth of the disc. Diameter ·0060″. (Fig. 2.)

Hab. Manilla. Obtained from shell-scrapings; G. Mansfield Browne, Esq.

Nothing can be more beautiful than the graceful symmetry of this disc; and, if such an expression be applicable to a diatom, it pre-eminently merits the "simplex munditiis" of Horace. Its nearest ally appears to be my *C. Normanianus,* which was also found in the scrapings of shells (*Spondyli* from the West Indies). The difference is obvious at a single glance; the canaliculi of the latter reaching a linear central blank line situated within a linear-oblong depression.

Eupodiscus.

This genus has been much improved by Mr. Ralfs in his reference of *E. fulvus, crassus,* and *Ralfii* of Smith to *Actinocyclus* of Ehrenberg; and by the adoption of the genus *Auliscus* of Bailey for *Eupodiscus sculptus* of Smith. I take the opportunity of expressing the satisfaction experienced by diatomists in general, with the just and judicious arrangement of Mr. Ralfs with regard also to the genera *Actinocyclus* and *Actinoptychus*. "Professor Smith seems to have erred," remarks that eminent authority, "by choosing as the type of *Actinocyclus*, not one of Ehrenberg's species, but a form placed in that genus by Professor Kützing, though really belonging to *Actinoptychus*;" and hence confusion arose between the followers of Smith and Ehrenberg. It was imperatively due to the latter, by what may be called the common law of science, that the error referred to should be corrected. With respect to *Eupodiscus*, however, a further revision of the genus will soon be desirable, as forms very different in habit and structure are being provisionally associated under it. Descriptions in these papers I offer merely as *adumbrationes* of future systematists.

Eupodiscus oculatus, n. sp., Grev.—Disc very convex, conspicuously cellulate, with two large circular processes somewhat distant from the margin; extreme edge composed of a row of minute bead-like granules; cellules 5 or 6 in ·001″. Diameter about ·0052″. (Fig. 3.)

Hab. Monterey stone. George Norman, Esq.; Fred. R. Kitton, Esq.; R. K. G.

A splendid species, remarkable for the large processes, which resemble those of *Auliscus*, having a ring-like border. The cellulation is tolerably uniform in general effect, but is irregular in shape, and the walls thick, so that in particular lights the surface has a somewhat pitted appearance. Towards the margin the cellules are rather smaller, and occasionally present a semi-radiate character, not in any degree perceptible in the rest of the disc. The row of minute granules at the extreme edge, when clearly seen, are extremely beautiful.

Eupodiscus obscurus, n. sp., Grev.—Disc very convex, with four circular marginal processes, and two or three minute internal marginal tubercles between them; cellules very minute, 30 in ·001″, in the centre of the disc. Diameter ·0028″. (Fig. 4.)

Hab. Cape of Good Hope; Dr. Macrae.

The structure in this species is more dense than in any other hitherto described, and not clearly visible except with the aid of a good instrument and favourable light. I was myself unable to measure the cellulation with certainty, but my friend Mr. T. G. Rylands has determined the cellules to be 30 in ·001″ in the centre, and 42 in ·001″ at the margin of the disc.

GLYPHODISCUS, n. gen., *Grev.*

Frustules somewhat four-sided, with the corners much rounded. Valve containing a large, four-cornered nucleus, the angles of which alternate with those of the margin; and a circular prominent process within each marginal angle, from which costæ radiate to the nucleus, while similar costæ radiate from the angles of the nucleus to the sides of the disc.

As nothing whatever resembling this most singular diatom has been recorded, I have been under the necessity of constructing a genus expressly for its reception. With *Auliscus*, it has a decided affinity in the arrangement of the costæ, and at first sight in the circular processes also. But after a close examination of a suite of specimens, I am satisfied that the processes are not flat and mastoid, as in *Auliscus*, but considerably prominent, although to what extent it is impossible to say, as no front view has been observed. The radiation of the costæ is arrested almost immediately by the large nucleus which occupies the greater portion of the disc; and this dense, opaque nucleus, with its four corners alternating with the rounded corners of the margin, has nothing in common with *Auliscus*. There is no other genus with which it can be brought in comparison, unless it be *Amphitetras*, on account of its somewhat cubical frustule; but there is no affinity between the apparent openings in the angles of that genus and the prominent processes in *Glyphodiscus;* while in general structure there is not the most remote resemblance.

Glyphodiscus stellatus, n. sp. Grev. (Fig. 5.)

Hab. Monterey stone; F. Kitton, Esq., 1854; Professor Walker-Arnott; G. Mansfield Browne, Esq.; R. K. G.

Disc minute, somewhat quadrate, but with the corner so much rounded as to bring the outline nearly to a circle. Within, the greater part of the area is occupied by a sort of dense, opaque nucleus, more decidedly quadrate than the disc itself, with rounded or subtruncate angles, alternating with those of the exterior, and leaving but a narrow space between it and the outer margin. Within each of the outer corners is a large circular or somewhat oval process (as viewed vertically), at first sight resembling those of the genus *Auliscus*, but it is in reality so prominent as to be at least mammillate. From each of these processes costæ radiate in a converging manner, exactly as in *Auliscus;* while another set of similar costæ radiate from the angles of the nucleus to the sides of the disc. In fact, if we were to imagine an *Auliscus* with four corners and four processes, and the greater part of the radiating costæ concealed by a foreign body placed in the middle of the disc, we should have much the appearance presented by the diatom now under consideration. The centre of the nucleus is distinguished by a small, circular umbilicus, from which emanate pale and slender rays, such as artists conventionally represent as given off from a point of brilliant light. There is also a border to the nucleus, within which it appears to be somewhat concave. The distance between the processes is about ·0012″, while that across the disc is about ·0015″. It is remarkable how rarely this strange little object is found in a perfect state. The most perfect example which I have seen, and which I have represented, is in Mr. George Norman's cabinet. The surface appears to be generally more or less abraded; and the radiating costæ, which form a somewhat prominent ridge, is the first part to be injured. In proportion to the extent and degree of abrasion, the surface presents different aspects; the outline of the nucleus sometimes almost entirely disappearing. The four processes, however, are always conspicuous, shining like brilliant eyes, even under a moderate power of the microscope.

TRICERATIUM.

Triceratium pectinatum, n. sp., Grev.—Valve with somewhat rounded sides, and broadly rounded angles; surface filled up with small, distinct cellules, radiating from the centre, and increasing in size until near the margin, which is furnished with very strong pectinate striæ, 10 in ·001″. Distance between the angles, ·0040″. (Fig. 6.)

Hab. India; obtained from shell-scrapings. Mr. George Norman's cabinet.

This fine species bears a general resemblance, in outline at least, to *T. orbiculatum;* but differs in the very broadly rounded angles, undeveloped pseudo-nodules, much larger cellulation, and, above all, in the presence of exceedingly strong, sub-distant marginal striæ. These striæ are confined, and do not extend to the angles themselves.

Triceratium decorum, n. sp., Grev.—Valve with convex sides and somewhat obtuse angles; striæ radiating from the centre, composed of pale puncta, becoming gradually smaller and closer towards the margin; the latter rather broad, narrowing off at the angles, marked with coarse striæ, 11 in ·001″. Distance between the angles ·0028″. (Fig. 7.)

Hab. Indian Ocean soundings in 2200 fathoms, made by Captain Pullen.

We have here another diatom with the outline closely resembling that of *T. orbiculatum* and of my *T. convexum*,* but differing conspicuously in the absence of pseudo-nodules, the character of the punctation, and in the peculiarly strong, coarsely striated border. The latter is the broadest in the middle of each side, and becomes gradually narrower towards the angles, which show no pseudo-nodules. The puncta are oblong and distant in the centre, and become rounder, smaller, and closer as they approach the margin.

Triceratium Roperianum, n. sp., Grev.—Small; valve with nearly straight sides, rounded angles, and no perceptible pseudo-nodules; striæ few, thick, moniliform, very short, marginal, 7 in ·001″. Distance between the angles ·0018″. (Fig. 8.)

Hab. Indian Ocean soundings in 2200 fathoms, made by Captain Pullen.

One of the most distinct species of the whole genus, and allied to *T. margaritaceum, Harrisonianum,* and *giganteum.* The short striæ, which constitute a marginal band, are of equal thickness throughout, and although moniliform, have a sort of semicostate appearance. By careful adjustment the centre is seen to be filled up with cellules, large for so small a species, and too delicate to be represented in the engraving. In this respect, as well as in the thick moniliform striæ, its affinity is shown to the species above mentioned.

I have much pleasure in dedicating this species to the distinguished diatomist who kindly presented me with a portion of the Indian Ocean soundings, containing the *Asterolampræ*, already published in the Society's Transactions, and the four species of *Triceratium* now described.

Triceratium flexuosum, n. sp., Grev.—Small; valve thin,

* A question has been started whether this species be *T. orbiculatum.* I have not seen a single valve the side view of which comes at all near to my *T. convexum* in slides from Mauritius or the East Indies; but a slide from the Sandwich Islands, submitted to my inspection by Professor Walker-Arnott, contains side views more nearly resembling it, and it is possible that the two may be identical, viz., my *T. convexum* and *T. orbiculatum* of Brightwell. With regard to the *T. orbiculatum* of Shadbolt, I have had an opportunity of examining the original specimen, now in the possession of Mr. Tuffen West, and find, as I anticipated, that the figure engraved by him in 'Mic. Trans.,' vol. ii, Pl. I, fig. 6, is correct, with the exception of the omission of a row of marginal puncta or granules, 14 in ·001″. The cellulation is, as there represented, roundish, nearly equal in size throughout, and not exhibiting the very slightest indication of radiation from the centre—an organic difference so important in my view as to separate it at once from *T. orbiculatum* of Brightwell, although the front view of the valve should prove to be very similar. Indeed, there is no reason why the *general* character of the front view in that diatom should not be common to several species.

with nearly straight sides and very rounded angles; surface covered with lines of very minute dots, radiating from the centre in variously curved fasciculi to the margin, which is composed of a very narrow blank space. Striæ about 20 in ·001″. Diameter between the angles ·0024″. (Fig. 9.)

Hab. Indian Ocean soundings in 2200 fathoms, made by Captain Pullen.

A delicate neat-looking species, very similar in outline to *T. obscurum*, of my Series III, but the striæ are much more minute, and arranged in curved fasciculi of eight or nine or more rows, which follow no apparent plan of arrangement. These curved bundles of striæ are so decidedly marked as to remind the observer of the (more uniform) arrangement in *Coscinodiscus subtilis*. It does not approach in any degree, in the curvation of the striæ, to *T. condecoruni*.

Triceratium inornatum, n. sp., Grev.—Minute; valve with slightly concave sides and rounded angles, the whole surface covered with short, imperfectly radiating lines of very minute dots pointing in all directions, about 20 in ·001″. Diameter between the angles ·0017″ to ·0024″. (Fig. 10.)

Hab. Indian Ocean soundings in 2200 fathoms, made by Captain Pullen.

The most noticeable feature in this little unattractive species is the equal distribution of the minute, dot-like cellules over the entire surface, and their arrangement, by which the lines are broken up, as it were, into short bundles, which cross each other in all directions. Towards the margin they radiate more regularly. The margin itself appears to be composed of a delicate double line, which passes round the angles.

AMPHITETRAS.

Amphitetras producta, n. sp., Grev.—Lateral view, with the sides nearly straight; angles rounded, produced, containing conspicuous apparent openings; cellulation minute, radiating in distinct lines from the centre; the lines at the margin 10 in ·001″. Diameter between the angles about ·0020″. (Fig. 11.)

Hab. Manilla; obtained from shell-scrapings. George Mansfield Browne, Esq. Dredged off St. Helena; Dr. Wallich.

All the specimens I have examined of this small species agree exactly with each other. The most remarkable feature about it consists in the angles, which have the appearance of being double. Beyond the primary boundary of the valve, a supplementary projection is added, and in the small space so enclosed the apparent opening is situated.

AMPHORA.

Amphora Sarniensis, n. sp., Grev.—Frustules sharply constricted at the middle; lobes with a double undulation, the ends produced, truncate; striæ about 30 in ·001″. Length ·0017″ to ·0022″. (Fig. 12.)

Hab. Guernsey; Dr. Wallich.

A beautiful and most distinct little species, with an outline reminding the observer of some species of *Euastrum.* It is readily distinguished from all other species of the section characterised by a distinct middle constriction, by possessing two undulations between the nodule and the extremities. The first is large, from which the margin descends in a more or less sharp curve, and then forms a sort of shoulder, before the frustule contracts into the short, broadly linear, produced ends. It is a very hyaline species, but the striæ are evident at the margin, although very obscure in the middle of the frustule. As will be seen by the figures, there is some variation in the relative proportions, some being less deeply constricted, the undulations less prominent, and the breadth greater or less in proportion to the length. I have given the extreme range of variation which has come under my notice.

NAVICULA.

Navicula indica, n. sp., Grev.—Large, broadly elliptical, with mammæform ends; striæ fine, about 30 in ·001″, forming a narrow marginal band; similar striæ forming a linear band on each side the median line, next to which is a linear blank space, the rest of the interior being filled up with a minute equal granulation. Length ·0043″. (Fig. 13.)

Hab. Ceylon; Dr. Macrae.

A beautiful *Navicula,* having the form of *N. clavata,* but no real affinity with that species. The very fine striæ constitute a marginal band, considerably less than a third of the space between the margin and the median line, and also a very narrow linear band on each side of the median line, which, like the median line itself, is interrupted at the central nodule. The whole of the internal area is filled up with a minute uniform granulation, except a narrow blank line, which occurs on the median boundary, and which becomes attenuated and disappears near the ends. In some respects, this fine diatom is allied to *N. prætexta,* but differs in important particulars. The striæ in the latter are bold and moniliform, and there are no definite striated bands next the median line, as in our new species. The granulation in

N. indica is equally distributed, while in *N. prætexta* it is irregular, the granules being sometimes widely scattered. Then the termination of the marginal bands of striæ are widely different in the two species; and although a considerable number of examples of *N. prætexta* have been examined, in no instance have the apices shown the slightest deviation from the oval or oblong outline.

On the Generation *of* Acari *in a* Nitrate *of* Silver Bath. By R. L. Maddox, M.D.

(Communicated by G. Shadbolt, Esq.)

I venture, through your indulgence, to offer the following remarks on a subject connected with both photographical and microscopical science, and trust they may not prove unacceptable. Very possibly others may have had their attention directed to the point in question, yet I am not aware of any observations concerning it having been published. Should you find me to be forestalled, may I beg you to append a notice of the same.

In the early part of December a twenty-ounce nitrate of silver-bath, forty grains to the ounce, which had been in use during 1861, and placed for a month previous in a stoppered bottle, was returned to the bath and set aside in a cupboard, partitioned off in my working-room so as to convert it into a dark chamber. The bath, which is of cemented glass, covered outside with asphalt varnish, and kept in a wooden case with the cover shutting down over half its depth, remained unopened until the 12th of last month. When the solution was returned to the bath, half a sheet of white foolscap paper was first folded down on the top, and then the cover placed over it. The bottle was a perfectly clean one, kept to receive the nitrate bath when filtered, or when the sides of the bath were to be cleaned. The bath, after cleaning, was always washed out finally with boiled and filtered or simply filtered fresh-caught rain water—not out of the butt. I am thus particular in these details for reasons that will appear.

Late on the afternoon of April 12th I moved the bath from the dark cupboard to the table in the room. On removing its cover, lifting off the paper, and looking along the surface of the liquid (as is my habit) to see if any scum be visible and remove the same by a little blotting paper wrapped round a strip of whalebone, I noticed on the surface numerous bright, glistening points, the mass being altogether in length about one and a quarter inch, and three eighths of an inch in width. Supposing these points to be crystals, I proceeded to remove them with the blotting paper; but I could not gather them up, for they floated by and opened out on the surface. A thin piece of wood was turned up, and with this a few of the points were lifted out. Examining them with a doublet, I found them to be insects with beautifully curled and long straight hairs. Sixty-six were in this way taken from the surface of the solution. Not knowing exactly what to do with them, I placed some in spirit of wine and acetic acid, which happened to be at hand, and the rest in water in a test-tube. These were replaced in the dark cupboard; the others left to diffused daylight. On the first appearance they looked like very miniature FAT SHEEP with eight legs, curled and straight feathers from the back, a long depending snout, which was always turned down in the liquid, and some with a very short tail or tubercle. On a slip of glass they looked like a mass of fat of a dirty yellow colour, the snouts and legs of the parents being darker and more defined than those of the rest of the progeny. Sunday intervening, they were further examined on the Monday. Those in the acetic acid were all at the bottom of the tube. Their colour had altered to a darkish brown. Of those in water a few were at the bottom, the rest floating on its surface. None were found in the stoppered bottle, which had also been kept in the dark, wrapped in paper.

A few were now mounted in a cell with a little alcohol and water, and placed under the compound microscope, but I could not discern their general structure. They appeared to be covered with a granular deposit. Concluding this to be some silver compound entangled at the surface, it became a question how to remove it. At first washing with water and a fine sable pencil was tried; but the insects got so injured, and were so exceedingly tender, that this plan was set aside, and they were soaked for a short time in a solution of cyanide of potassium. This quickly cleared off the deposit, and also seemed to abrade or break up the substance of body; for they became more tender, so that I could not keep the form at all perfect under the slightest pressure. Alcohol mixed with the cyanide solution answered no better. Others were now placed in a solution of iodine in iodide of potassium. This turned them yellow; and on being replaced in a watch-glass with a little water, a well-marked precipitate of iodide of silver was thrown down. They were now removed to a solution of hyposulphite of soda. By alternately treating them to these baths, and finally washing them, the general structure was rendered very visible under the microscope, though still very fatty in appearance. Wishing to preserve some of the specimens, I proceeded to put them upon the slides—first trying washing in spirits of wine, then drying, soaking in turpentine, and setting up in Canada balsam diluted with benzole. I could not set them out in this, as the parts gave way very readily, from the tenacity of the balsam, and portions were rendered too transparent. Others were first cleared of the deposit, soaked in glycerine and camphor water, and finally mounted in the glycerine and *gelatine-medium;* this proved the most successful, though I found that they still so retained their fatty quality that I dared not use sufficient pressure to flatten out their rotund bodies, ere the skin gave way. They gave me considerable trouble, although long accustomed to put up objects of various kinds. Further observation led to the opinion of their being *Acari,* though not like any I was acquainted with.

The insects are quite visible to the unaided eye, being a little larger than the cheese-mite. They are variable in size. The sexes are evident, the females being provided with a curious short protuberance or tubercle at the end of the abdomen, nearer the upper surface; and at a slight distance from it, on the under surface, when seen sideways, are two thin projecting flaps which meet at the free edges, thus forming a sort of deep and long triangular space, sack, or groove, protected at the anterior entrance with a few short crossing hairs. Looking down on this structure it has an elliptical form: the edge of each flap has from four to six reddish marks (glands or hooklets of apposition?) In this pouch I was fortunate enough to find a body sus-

Surface of body covered with minute sharp points.

pended, which I considered to be an extruded ovum. Pressure in several cases, especially after the use of the cyanide solution, forced out larger ova or ovisacs through the same groove. The ova or ovisacs in some were eight in number; in others I could find only six. The males are rather smaller than the females, and have no projecting tubercle, groove, or pouch. In some I found a very

Female.

curious structure, visible only from the abdominal surface, but the exact plane of which, even by the most careful focussing, I could not decide on, as it was only seen when the two surfaces were closely pressed. It was oval in shape, with a slight projecting limb from the upper part of the oval on each side. In the centre of the ellipse was a well-defined line, and, abutting against this, on each side, short, slightly curved marks or lines, looking somewhat like the gizzard-teeth of some insects; but whether it belonged to the digestive or genital system I could not satisfy myself. Many attempts were made by pressure, but yielded no good result, the whole breaking up into a sort of fatty sarcode, The outer surface of the skin is covered with minute granulations, which, seen edgeways, are resolved into very minute points—not *cilia*, being much shorter and stouter. The long curled hairs on the back, and the straight ones near the posterior end of the body, are finely barbed or feathered. The insects are provided with a pair of formidable, strong-looking mandibles, each composed of two claws with four or five irregular teeth, that interlock. The labia are notched at the end like a small reversed ∧ set in a larger ∨ (*vide* photograph No. 4). The legs are furnished with sharp bristles, the ends of the foot padded, and on some of the feet I noticed a sort of short rod with a knob at the end. No eye-spots were visible.

Mandibles.

This description of the insect is very imperfect. I had purposed to have enclosed a drawing with measurements, &c., but severe indisposition has disappointed me in the attempt, which the accompanying figures, taken from photo-micrographs, must replace. Of their life-history I know nothing, nor do I attempt to advance a theory of how they came into the bath. After the strange incidents met with by the late Mr. Cross, the celebrated electrician, of the Quantock Hills, when forming crystals by the agency of his small but numerous-celled water battery, we may well pause before the portal of creative power, without bringing to our aid equivocal or spontaneous generation, as some of the critics of his labours ventured unreasonably to apply in his case. No doubt the ova were there in the exact conditions to favour their dormant energy, though strange to us may seem those conditions— The liquid a solution of a caustic salt, capable of seriously injuring animal membranes, at least in ourselves; the light *nil* or non-actinic; the creatures themselves highly organised, yet not high in the scale—a genus of *Arachnida*. Few, I think, would look for animal life in their nitrate baths; yet these remarks may, if of no further use, now call the attention of photographers to the fact of its supporting living organisms, even to fatness, and elicit, perhaps, more of their history and structure.

As a plea for the poverty of the figures, I had nothing at hand but very old paper to print on. The day of taking the negatives was most tantalising—sunshine by fits, with a plenitude of rain, and those fits only of a few seconds' duration. In fact, everything had to be tempered with much patience. The apparatus, extemporised for the purpose, had its defects; the small plates were, by a modified "dry process," prepared for other purposes. Of the eight taken, enclosed are figures from six; the other two—one of a crushed insect, and a repetition of the plate with two insects—I do not send.

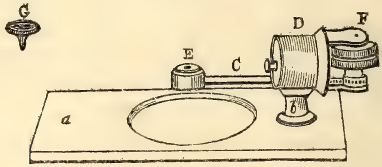
Bearing on the subject of life in strange places and curious conditions, and enjoying what we deem poisons, is a short remark in the 3rd number of the 'Popular Science Review' for this month—Mr. Attfield having found *Acari* nourishing themselves on an extract of nux vomica, and even feasting on strychnine. In the article *Acarus* ('Microscopic Dictionary') I cannot find among the described species any that exactly correspond with these. The projection or tubercle, at the end of the body, is named in the *Acarus hippopodos,* found on the ulcer crusts of horses' legs but the curious pouch-groove I do not see noticed. If new, perhaps you may venture to be sponsor, for I feel too uncertain about the baptismal registry of others to propose a name. The microscope used for the observations was Smith, Beck, and Beck's, with objectives two-third and one-fifth; for the photographs, their one-fifth, and an acromatic of lower power of my own making. The micro-camera was put together with Abraham's achromatic prism for a mirror, a Coddington lens (which, by the way, was fractured across the groove entirely through the glass) as a condenser, and a small pocket camera for the sensitive dry-plate. Therefore, you will please not criticise the prints, as they are but rude specimens, and not examples, of what can be done with care in photo-micrography.

A REVOLVING DISC-HOLDER *for* OPAQUE OBJECTS.
By RICHARD BECK.

THIS piece of apparatus is designed to facilitate the examination of objects when under Lieberkuhn illumination. The forceps which are most frequently used under such circumstances are very limited in many of the requisite movements, and in no one direction can an object be turned about quickly and with certainty under moderately high powers.

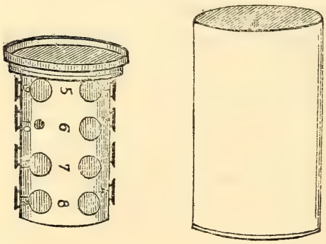
The instrument which I have used myself for some time with considerable advantage is shown in fig. 1.

Fig. 1.



A brass plate (*a*), which is adapted for clamping in the ordinary way upon the stage of the microscope, has a hole through it sufficiently large for a low-power Lieberkuhn. On the right side, at (*b*), is attached a short upright stem, which turns at its base; and at its top is another fitting, in which the arm (*c*) can be revolved by a milling at (D); but the most important movement of all is the rotation of a small socket (E), at the extremity of the arm (C). This is accomplished by means of a fine chain, which communicates with the milled-head (F). The object is gummed upon a small disc (G), which fits in the socket at (E), and with the arrangements I have already described, as many as five sides of a cube may be examined with perfect ease, and without disturbing the position of the object on the disc.

Fig. 2.



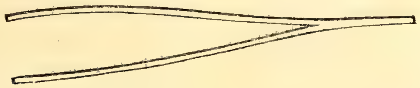
To preserve those objects which are permanent, the box, fig. 2, may be used. It will contain twenty-four discs, and the holes in which they fit being numbered, the objects may be easily registered; the top of the box on the outside will also hold a paper label. I may mention, in addition, that a wire is attached to the outside case of the box as a guide, to prevent rubbing off the objects when it is screwed on.

The space between the inner and outer cases is also so arranged, that if a disc should shake loose, there is no room for it to get quite free, and tumble about to the injury of the other specimens.

Each disc has a small groove on the edge to facilitate its being put on or taken off by the pliers (fig. 3), which are specially made for the purpose; otherwise the object is not unfrequently injured when the fingers only are used.

I hope, at some future time, to bring before the notice of this Society some definite observations which can be made

Fig. 3.



by this mode of adjusting the position of an object when illuminated from above; for, although by the aid of this piece of apparatus, I have already ascertained many facts which I never could satisfactorily determine before, and which I also find have been unknown to many microscopists, I am unable, without further investigation, to connect them in a form suitable to the character of these meetings.

On Fungous Destruction *of* Lozenges *in a* Dry Atmosphere. By F. M. Rimmington.

(Communicated by Tuffen West, Esq., F.L.S.)

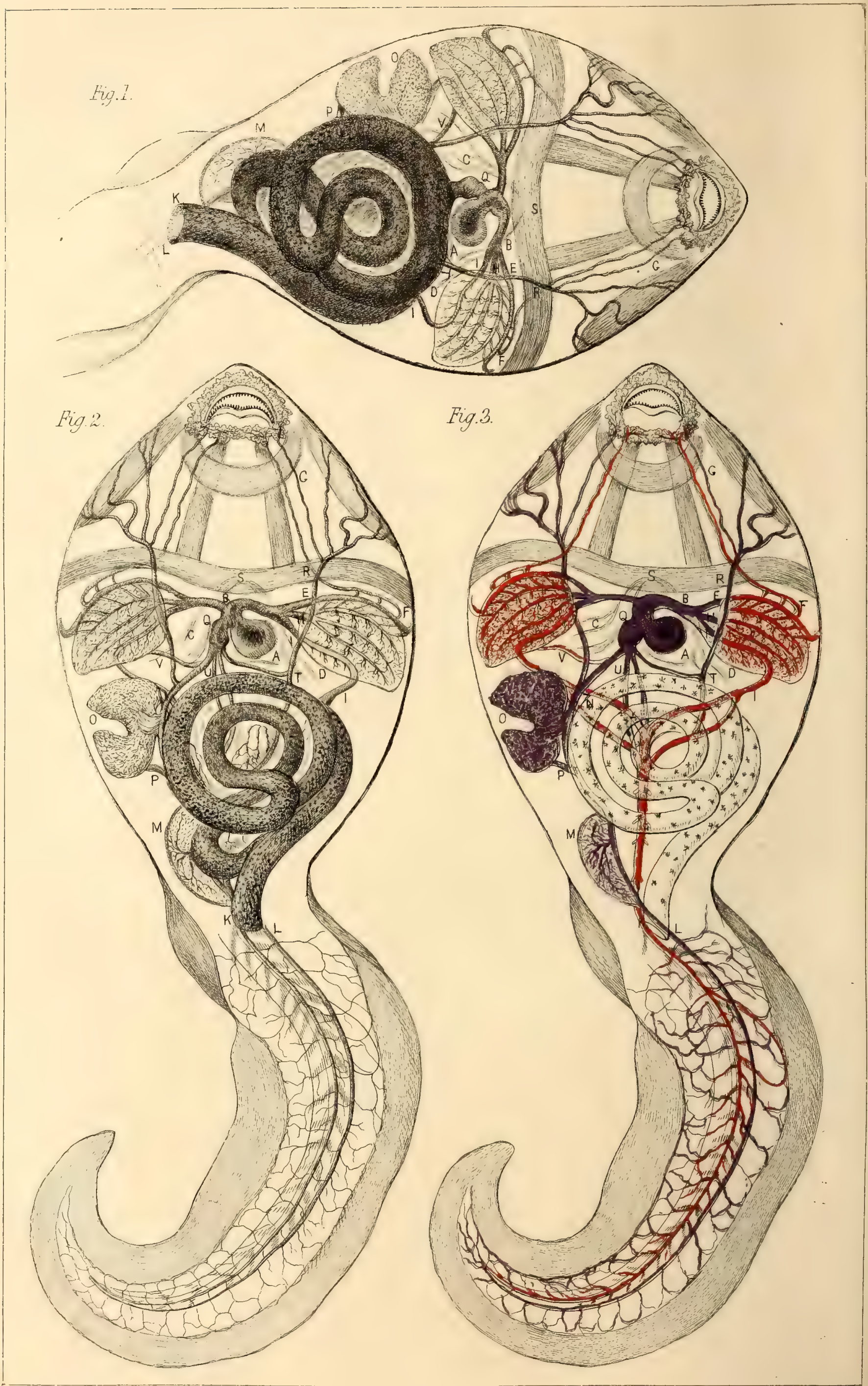
In the course of four or five years it has happened that I have had several lots of lozenges of different kinds spoil in a very remarkable manner. At first, the cause of this singular effect was inexplicable, and it was not until two or three parcels had suffered that I began to suspect the nature of it, when, after careful observation of the phenomenon, I discovered that it arose from the slow growth of a fungus. The diseased condition always showed itself as a minute speck on some of the lozenges, having very much the appearance as if a small drop of moisture of some kind had accidentally been spurted on them; or, as if particles of some deliquescent substance had been scattered amongst them; and this was, at first, the idea I entertained of the origin of the cause. This small spot, however, never dried, but slowly and gradually extended its diameter, penetrating deeper into the substance of the lozenge, and reducing the sugar to the condition of syrup, rendering the article unsightly and unfit for sale. By cutting out an infected part, and dissolving out all the extraneous matter, or by allowing the vegetative growth to go on until the aërial fructification shows itself, the mycodermous character is then clearly made out.

As regards the origin of the spores, I think, when all the circumstances are reviewed, there can be no doubt of their existence in the syrup, and that they are introduced with either the gum or the starch—the first is the most probable. That they had an external origin I think cannot be entertained, looking at the mode the articles had been kept, the dryness of their condition, and the hardness of their substance. Another fact in support of the internal existence of the spores is, that all the various lots of lozenges came from one maker, and that none from any other ever showed any symptoms of anything of the kind. The probability therefore is, that there has been mismanagement in the manufacture.

The manufacturer could not account for it, therefore it may be considered uncommon.

[It would be interesting to ascertain by the fruit the exact species to which the mischief is due. *Aspergillus, Penicillium* or *Mucor*, are the most likely genera. In examinations of urine, Dr. Hassall found a species so invariably appearing where sugar was present, that he gave it the name of "The Sugar Fungus;" where there was no sugar in the urine *Penicillium glaucum* as invariably appeared.

The growth in a perfectly dry atmosphere, and the great amount of deliquescence caused by the fungus, are very remarkable.—T. W.]



Tuffen West sc. W. West imp.

DESCRIPTION OF PLATE I,

Illustrating Mr. Whitney's paper on the Circulation in the Tadpole.

Figs. 1, 2, and 3.

A.—The heart, the ventricular portion.
B.—Truncus arteriosus.
C.—Pericardium.
D.—The lung.
E.—The cephalic artery.
F.—The labial artery.
G.—The labial vein.
H.—The pulmonary artery.
I.—The aorta.
K.—The caudal artery.
L.—The caudal vein.
M.—The kidney.
N.—The vena cava.
O.—The liver.
P.—The vena porta.
Q.—Sinus venosus, or auricle.
R.—The jugular vein.
S.—The large transverse muscle.
T.—Abdominal vein.
U.—Abdominal veins.
V.—Pulmonary vein.

DESCRIPTION OF PLATES II & III,

Illustrating Dr. Greville's paper on New Diatoms, Series V.

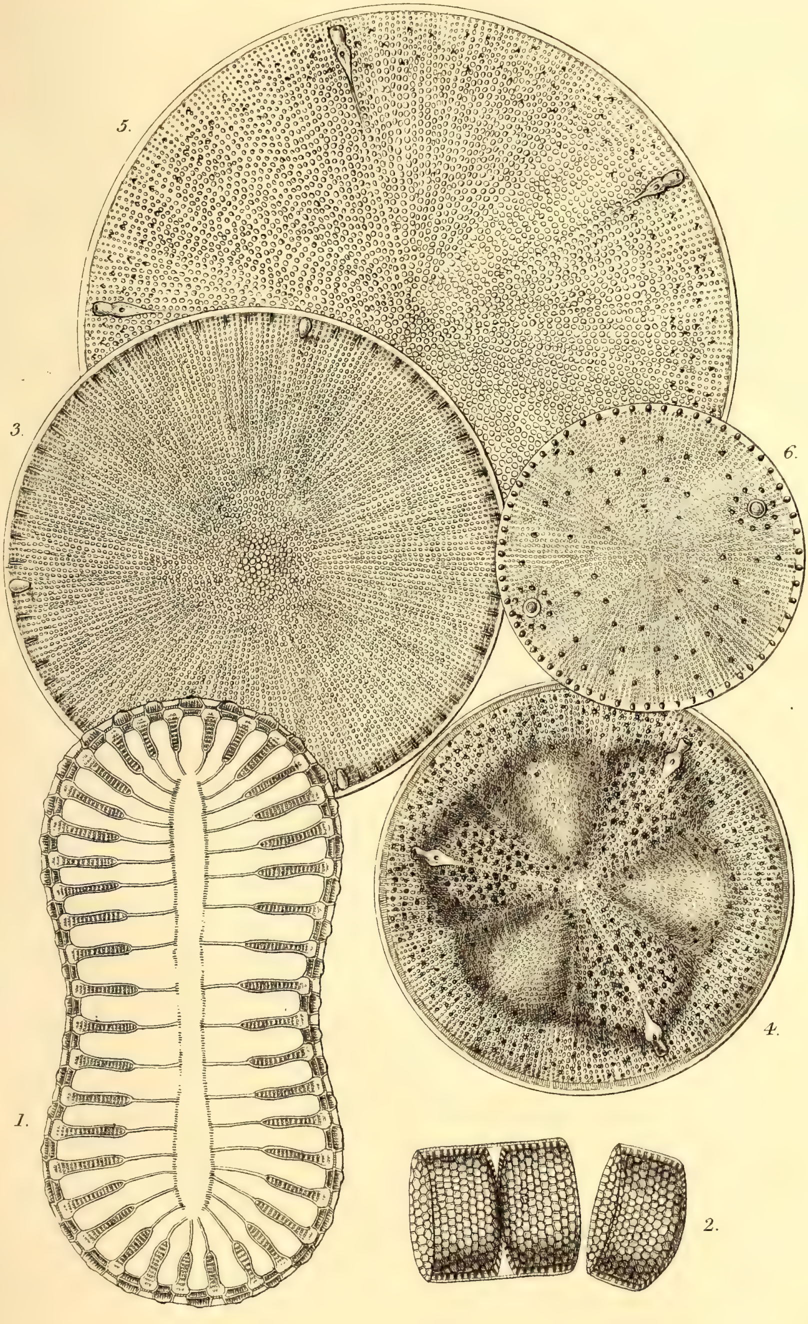
PLATE II.

Fig.
1.—*Surirella Macraeana.*
2.—*Dictyopyxis brevis.*
3.—*Eupodiscus Jonesianus.*
4.—*Aulacodiscus Macraeanus.*
5.— „ *Jonesianus*, × 300.
6.—*Auliscus Peruvianus.*

PLATE III.

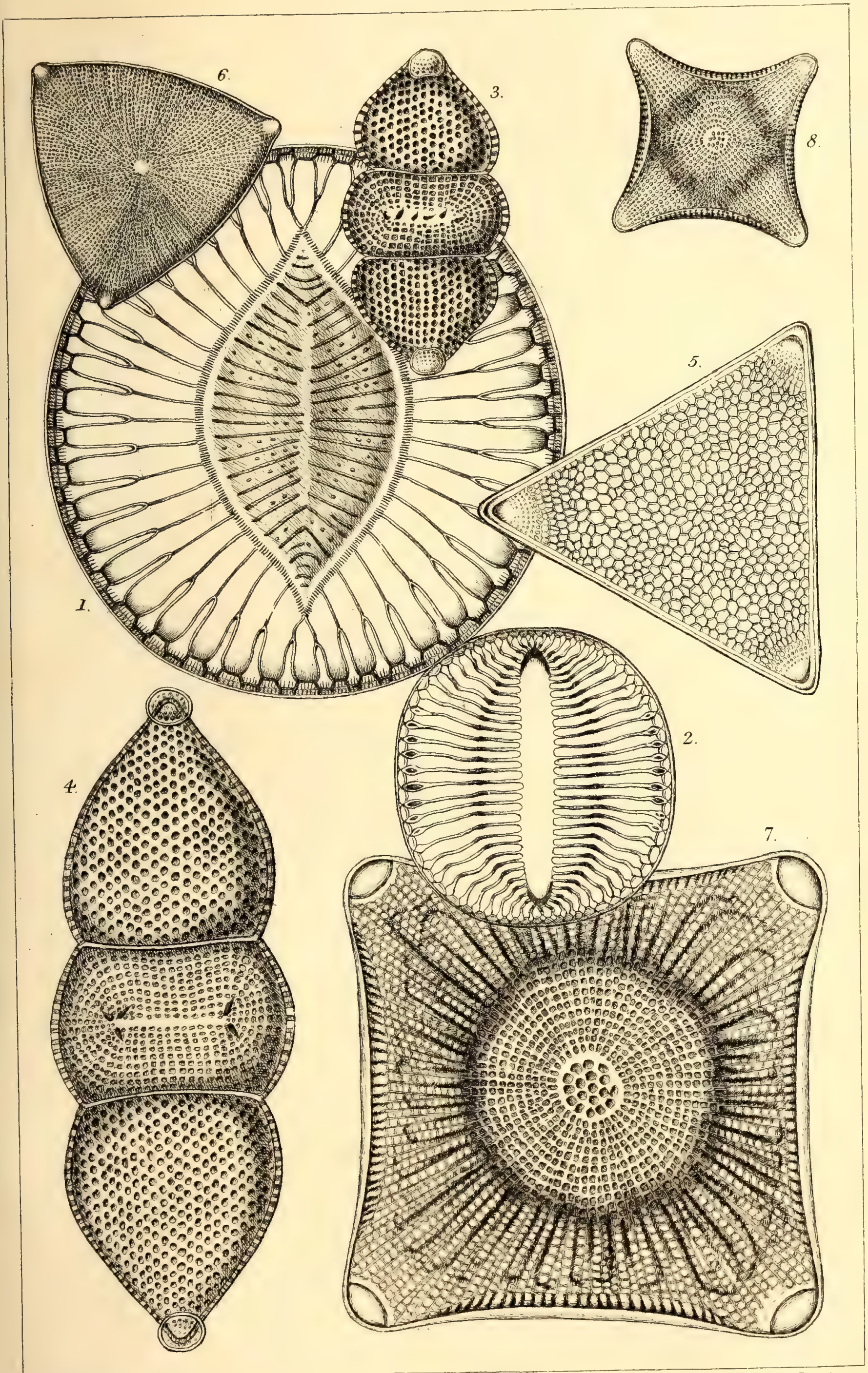
Fig.
1.—*Surirella fastuosa.*
2.—*Campylodiscus biangulatus.*
3.—*Biddulphia pulchella*, side view.
4.— „ „ „
5.—*Triceratium Thwaitesianum.*
6.— „ *convexum.*
7.—*Amphitetras radiata.*
8.— „ *punctata.*

All figures, except fig. 5 in Plate I, are × 400 diameters.



R. K. Greville, del. Tuffen West, sc.

W. West, imp.



R. K. Greville, del. Tuffen West, sc.

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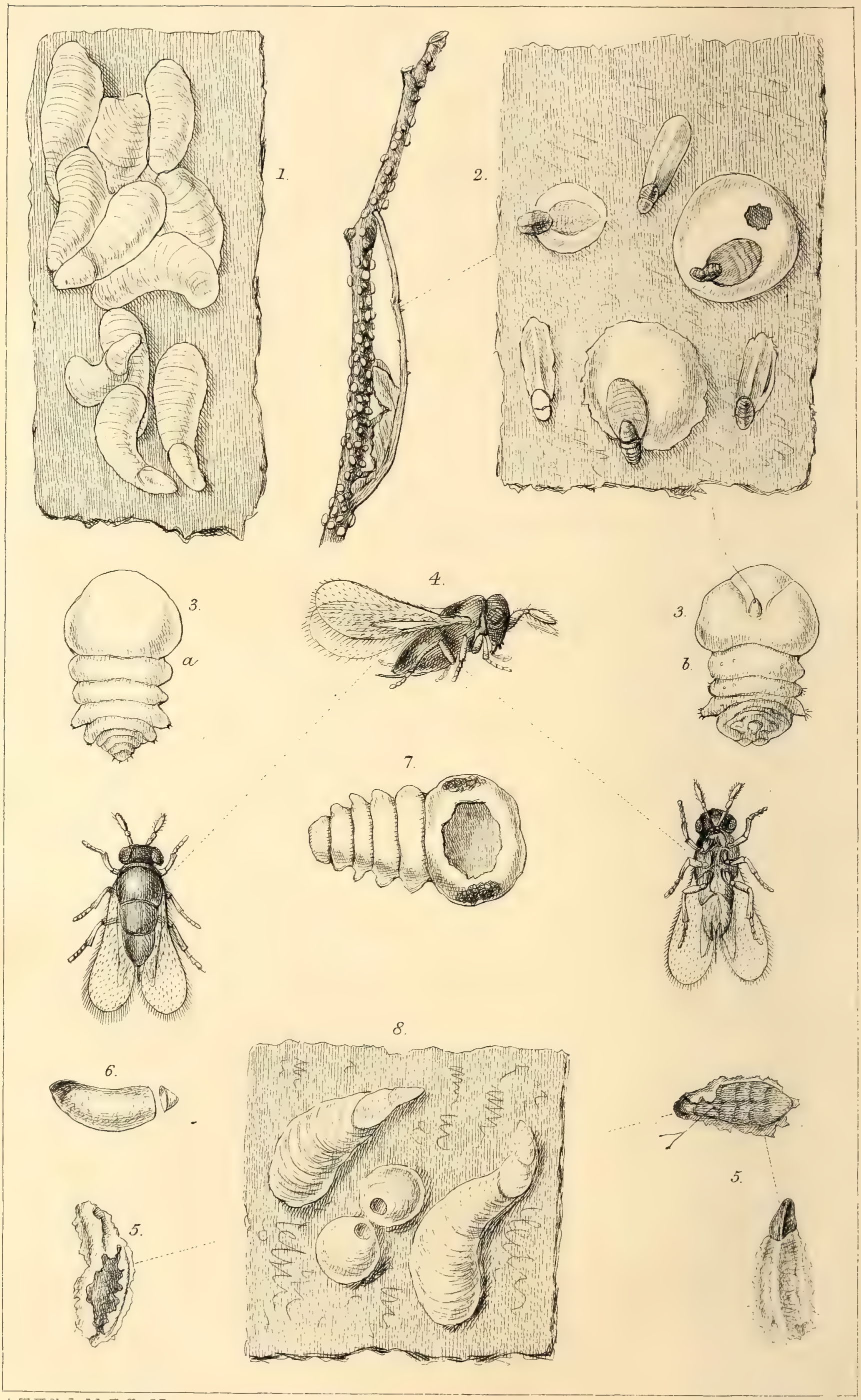


A. T. Hollick, del. Tuffen West, sc.

W. West, imp.

DESCRIPTION OF PLATE IV,

Illustrating Richard Beck's paper on *Coccus* from the Rose-bush.

Fig.

1.—Female *Coccus* on Cotoneaster.

2.—Male and female *Coccus* from rosebush.

3.—Female *Coccus*; *a*, on its upper, *b*, on its under, surface.

4.—Ichneumon from *Coccus* on rosebush.

5.—Ichneumon in male *Coccus*.

6.—Shell left by ichneumon after escaping from male *Coccus*.

7.—Shell left by ichneumon after escaping from female *Coccus*.

8.—Female *Coccus* from plum.

DESCRIPTION OF PLATE V,

Illustrating the "Universal Microscope" as contrived and manufactured by Smith, Beck, and Beck.

Fig.

A.—Base.
B.—Pillar supporting remainder of the instrument.
C.—Milled head to tighten joint.
D.—Milled head of quick motion.
E.—Body.
F.—Lever of slow motion.
G.—Limb.
H.—Stage.
I.—Double spring over object plate.
K.—Object plate.
L.—Ledge for object to rest upon.
M.—Small spring for holding object.
N.—Pin for forceps.
O.—Forceps.
P.—Cylindrical fitting of stage.
Q.—Diaphragm.
R.—Mirror stem.
S.—Mirror.
T.—Semicircle of Mirror.
U.—Side condenser.
V.—Pliers.
W.—Glass plate.
X.—Opening in diaphragm.
Y.—Shutter to do.

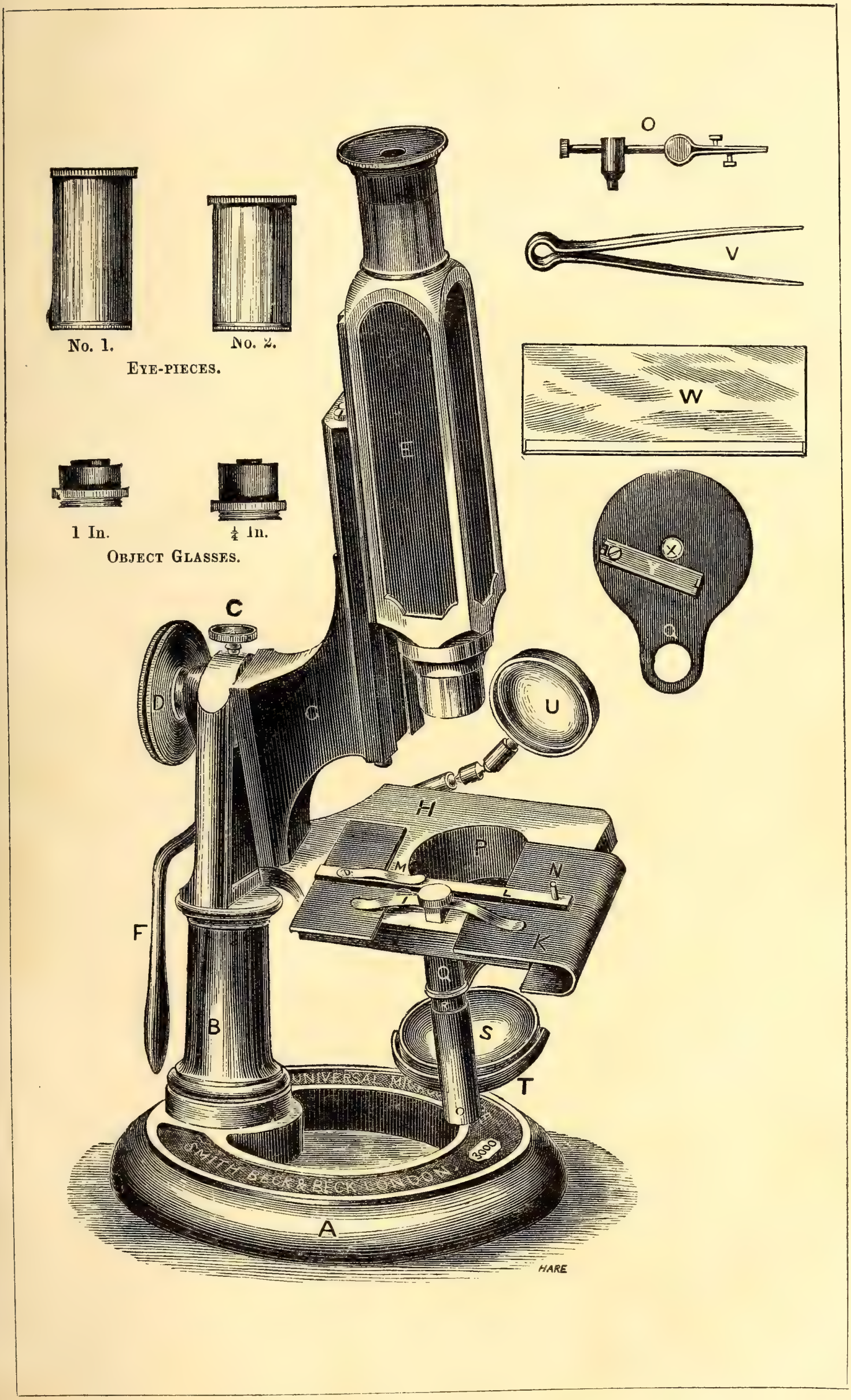

No. 1.
No. 2.
EYE-PIECES.
1 In.
$\frac{1}{4}$ In.
OBJECT GLASSES.
O
V
W
C
D
E
G
U
H
P
M
N
L
K
F
B
S
T
A
SMITH BECK & BECK LONDON.
3000
HARE

FIG. 1.

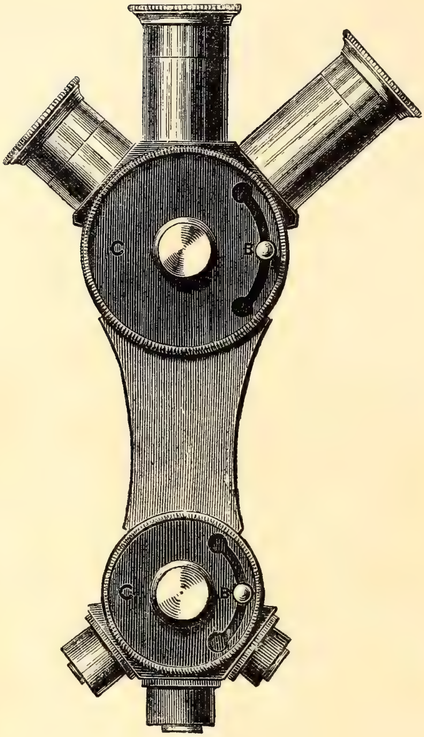


FIG. 2.

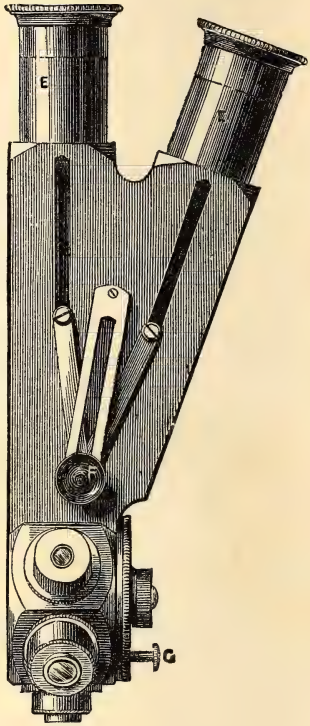
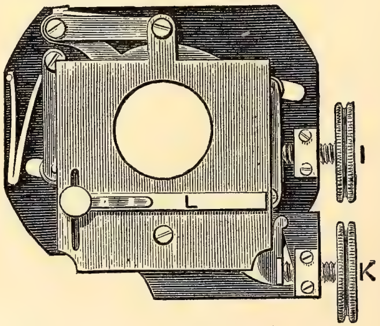


FIG. 3.



TRANSACTIONS OF MICROSCOPICAL SOCIETY.

DESCRIPTION OF PLATE VI,

Illustrating the additions that can be made to the "Universal Microscope," as contrived and manufactured by Smith, Beck, and Beck.

Fig.

1.—The compound body, with three eyepieces and three object-glasses attached.

C.C. Rotating discs.

B.B. Stop-pins to ditto.

2.—The binocular body.

E.E. Draw-tubes to vary the distance of eyepieces.

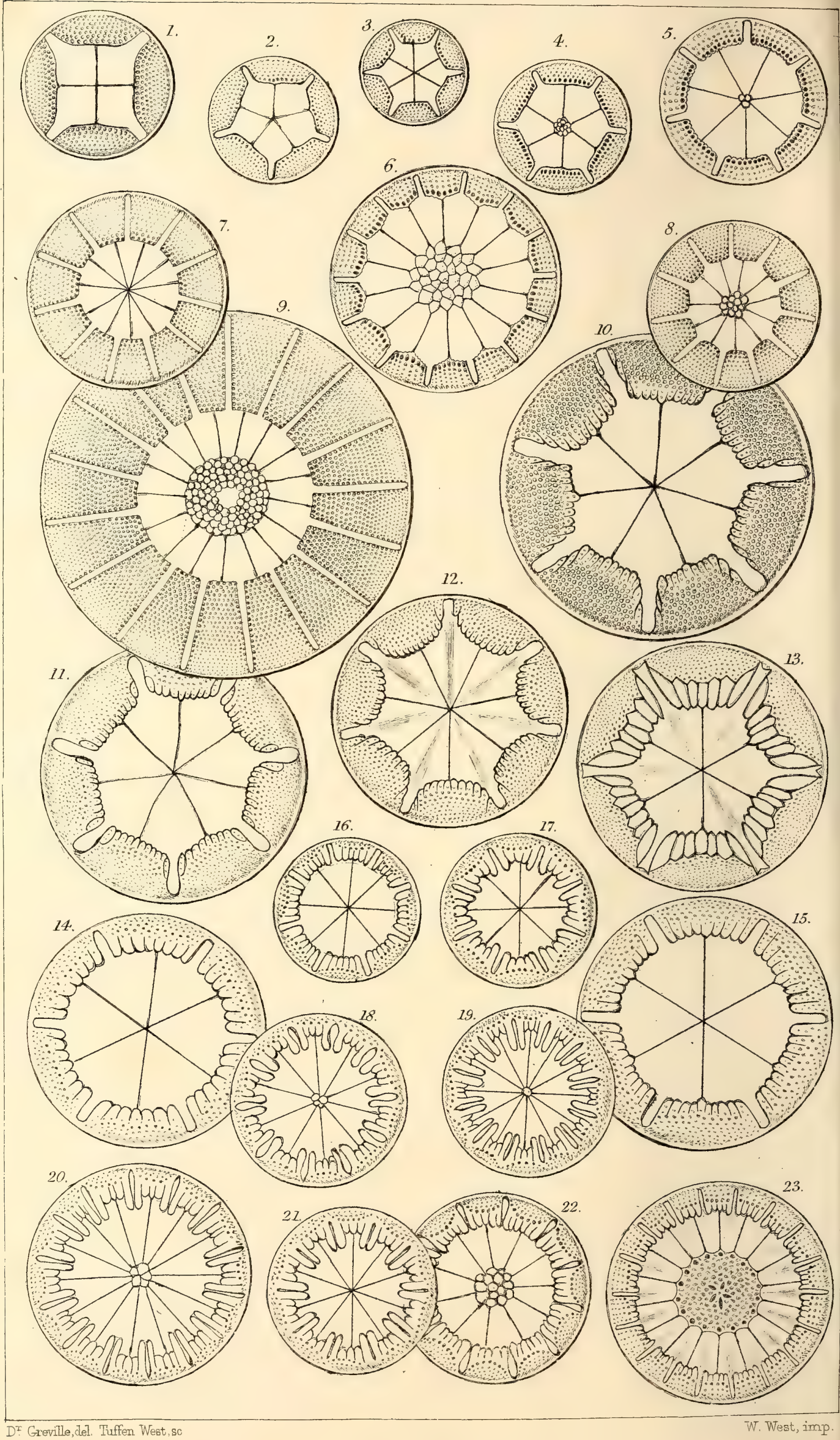
F. Tightening milled head to ditto.

G. Pin attached to binocular prism.

3.—Stage with actions.

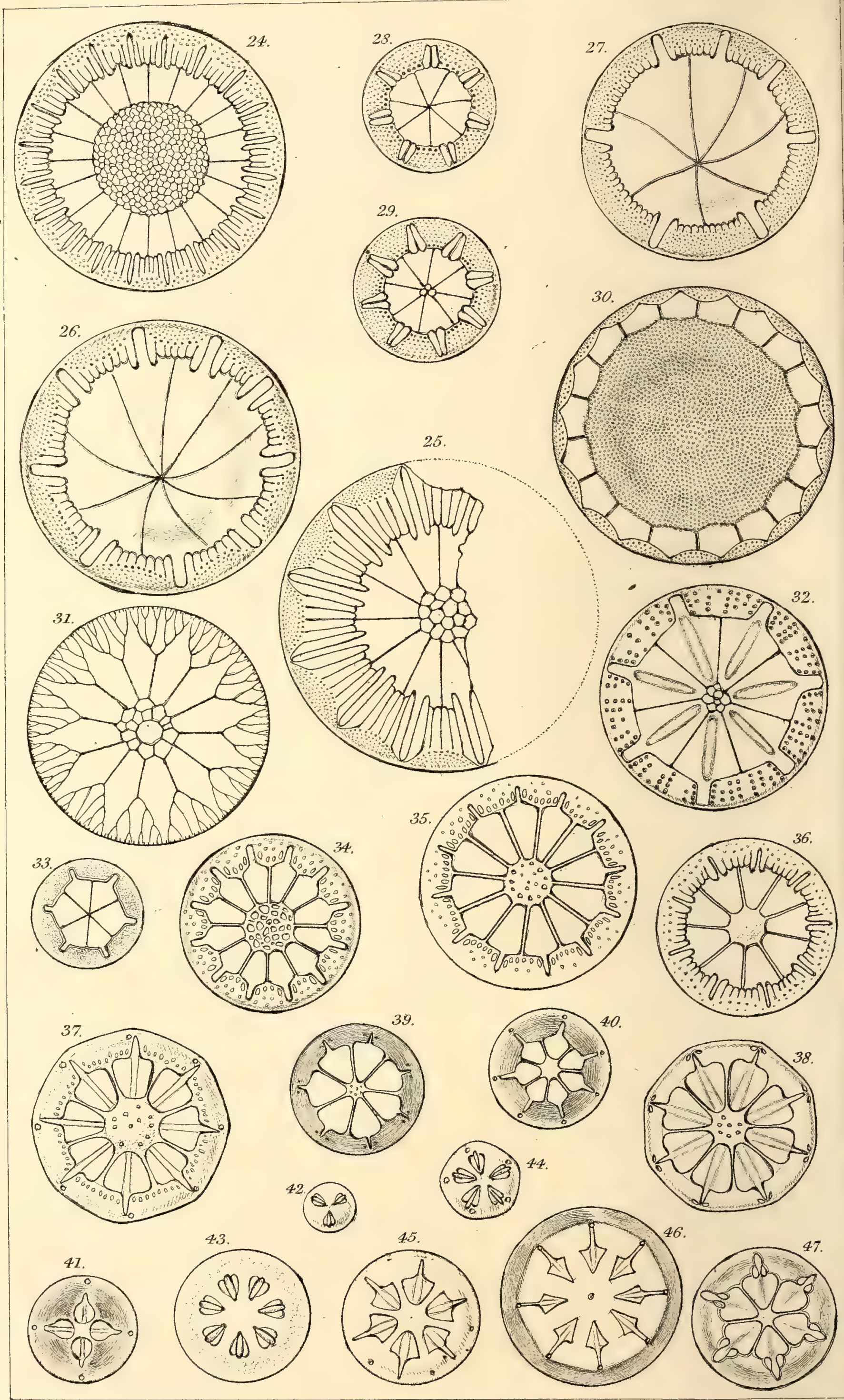
I. & K. Milled heads for movements.

L. Ledge for object.



Dr. Greville, del. Tuffen West, sc

W. West, imp.



Dr. Greville, del. Tuffen West, sc.

W. West, imp.

DESCRIPTION OF PLATES VII AND VIII,

Illustrating Dr. Greville's paper on Barbadoes Asterolampræ.

Fig.
1— 3.—*Asterolampra Marylandica*, vars.
4— 6.—*A. decora.*
7— 9.—*A. affinis.*
10—12.—*A. concinna.*
13.—*A. decorata.*
14—16.—*A. crenata.*
17—20.—*A. vulgaris*, var. *a.*
21.—*A. vulgaris*, var. *b.*
22.—*A. vulgaris*, var. *c.*
23—24.—*A. vulgaris*, var. *d.*
25.—*A. vulgaris*, var. *e.*
26—27.—*A. Brightwelliana.*
28—29.—*A. Rylandsiana.*
30.—*A. marginata.*
31.—*A. Ralfsiona.*
32.—*A. punctata.*
33.—*A. lævis.*
34—35.—*A. æmulans.*
36.—*A. simulans.*
37—38.—*A. pulchra.*
39.—*A. Kittoniana.*
40.—*A. stellulata.*
41.—*A. dubia.*
42—44.—*A. ambigua*, var. *a.*
45.—*A. ambigua*, var. *b.*
46.—*A. aliena.*
47.—*A. scutula.*

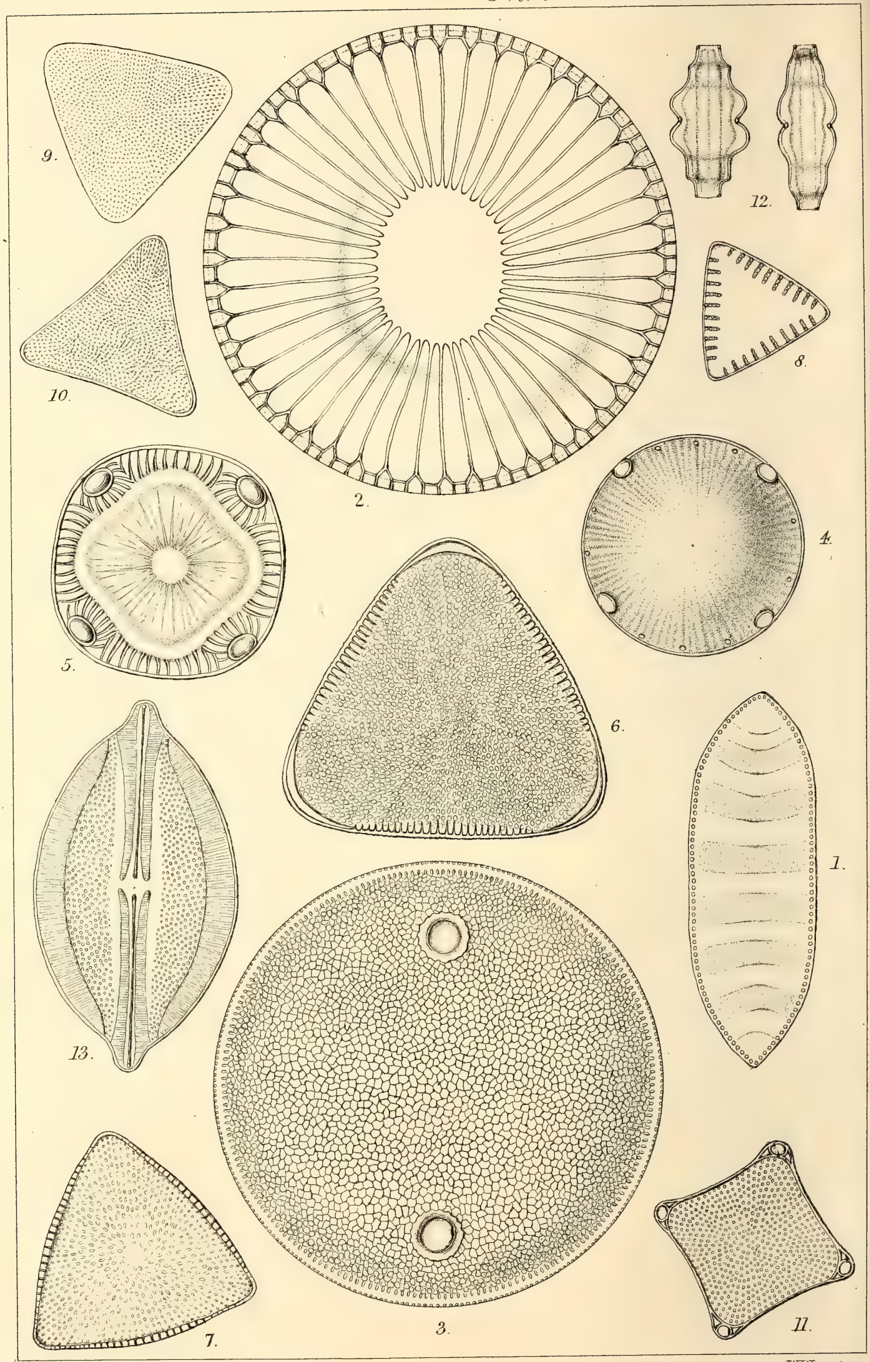
All the figures are × 400 diameters.

CORRIGENDA IN SERIES V.

Various errors have unfortunately occurred in the engraving of the plates.

Plate II, fig. 2. The cellulation should have been regularly hexagonal. Fig. 3. The short marginal striæ should have been only just visible. Fig. 5 should have been shaded throughout, to represent the lurid colour. Fig. 6. The scattered raised points on the surface should have been exceedingly faint.

Plate III, fig. 6. The punctation should have been quite pale. Fig. 7. The dark radiating lines should not have been represented as shadows, but as defined lines, passing into, and anastomosing with, the quadrate cellulation towards the margin.



Dr Greville del. Tuffen West sc

W. West imp.

DESCRIPTION OF PLATE IX,

Illustrating Dr. Greville's paper on New Diatoms. Series VI.

Fig.

1.—*Cymatopleura angulata.*
2.—*Campylodiscus Browneanus.*
3.—*Eupodiscus oculatus.*
4.— „ *obscurus.*
5.—*Glyphodiscus stellatus.* × 800.
6.—*Triceratium pectinatum.*
7.— „ *decorum.*
8.— „ *Roperianum.*
9.— „ *flexuosum.*
10.— „ *inornatum.*
11.—*Amphitetras producta.*
12.—*Amphora sarniensis.*
13.—*Navicula indica.*

All the figures except fig. 5 are × 400 diameters.

DESCRIPTION OF PLATE X,

Illustrating Richard Beck's paper on so-called Podura Scales.

A.— Upper side.

B.—Group of scales.

C.— Under side.

Fig.

1.—Appearance of markings when the object-glass is corrected and the object is in focus.

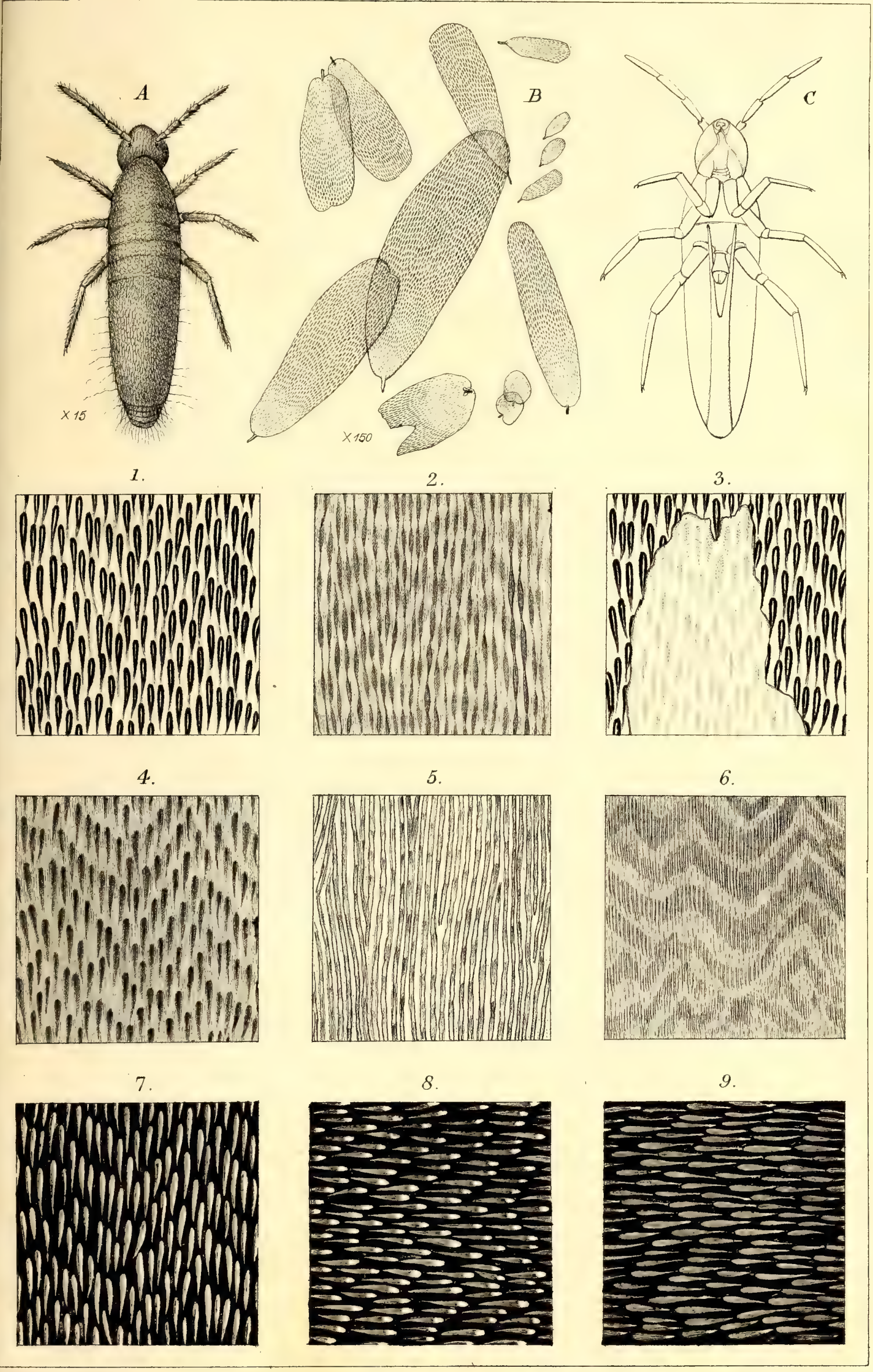
2.—The appearance a very little within or beyond the focus when the object-glass is well corrected.

3.—Effect produced by fluid in scale.

4.—The best focus when the object-glass is not well corrected.

5 and 6.—The appearances within and beyond the focus when the object-glass is not well corrected.

7, 8, and 9.—The markings as they appear in different positions, when illuminated from above, and as shown here, from the left-hand side.



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