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TRANSACTIONS.

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

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(Communicated by F. C. S. Roper, F.L.S., &c.)
(Read Nov. 8th, 1865.)

(Plates I & II.)

Plagiogramma.

Plagiogramma decussatum, n. sp., Grev.—Valve elliptic-oblong, with 2 central costæ and numerous pervious striæ composed of minute granules, so arranged as to form decussating lines. Length ·0022″. (Figs. 1—2.)

Hab. St. Helena, in fifteen fathoms; Dr. Wallich. Shark's Bay, west coast of Australia, in stomachs of Ascidians; Dr. Macdonald. Zanzibar; Professor Hamilton Smith.

This species is so exceedingly like *P. Gregorianum* (*Denticula Staurophora*, Greg.) that it requires careful examination to detect the difference. One character, however, is amply sufficient to separate them. In *P. Gregorianum* the pervious striæ are merely obscurely moniliform, whereas in the species under consideration, under the same magnifying power, they are seen to be composed of distinct, somewhat transversely oblong granules, so regularly arranged that they form distinct longitudinal and transverse decussating lines. The valve is also considerably more robust than that of *P. Gregorianum*. The discovery of this species is due to Dr. Wallich, in whose notes and sketches it is clearly indicated.

Plagiogramma Barbadense, n. sp., Grev.—Valve narrow, elongated, contracted in the middle, then dilated, and again contracted into linear subacute extremities; costæ 2, strong, centrical; structure showing exceedingly fine longitudinal and transverse lines (dots) and another series of numerous very fine transverse pervious striæ. Length ·0035″. (Fig. 3.)

Hab. Barbadoes deposit, Cambridge estate; in slides communicated by C. Johnson, Esq.; exceedingly rare.

I regret to say that no perfectly entire valves of this species have been obtained; but the only deficient part is the striation of the inflated portion of the valve. The sutural ends of the striæ are, however, quite evident, and there can be no reason to conclude that they differ from those of the narrower portion. In form it is allied to *P. lyratum.* In structure it varies from the other members of the genus, having, in addition to a groundwork of exceedingly delicate decussating rows of dots, a series of transverse pervious striæ. Fine illumination and careful adjustment is required to bring out the characters.

MASTOGONIA.

Mastogonia Actinoptychus. (Fig. 4.) Ehr., 'Bericht. d. Berl. Akad.,' 1844, p. 269; 'Mikrog.,' pl. xviii, fig. 19. Kütz., 'Sp. Alg.,' p. 25. Ralfs, 'in Pritch. Infus.,' p. 814, pl. v, fig. 59.

As the figure published by Ehrenberg is not quite satisfactory, I have been induced to offer one taken from a fine example in my friend Mr. L. Hardman's cabinet. The station given by Ehrenberg is Virginia. Mr. Hardman obtained his specimens from the celebrated Monterey deposit in California. They exhibit a minutely punctate structure, and a very variable number of radiating lines or segments. Ehrenberg fixes them at 13, but his own figure has 19. The valve I have copied shows 25, and I have seen another with as many as 30. It is evident, therefore, that number in this case is not a trustworthy character.

XANTHIOPYXIS.

Xanthiopyxis? umbonatus, n. sp., Grev.—Disciforme, circular, broadly umbonate, the umbonate portion more or less covered with strong short setæ. Diameter about ·0040″. (Fig. 5.)

Hab. Monterey deposit; cabinet of L. Hardman, Esq.; R. K. G.

Of this fine diatom, which is by no means rare in the Monterey deposit, I have seen no specimen with the valves *in situ,* and I am consequently by no means certain that it is a genuine *Xanthiopyxis.* The curve of the umbo is variable, as well as the proportion of the disc which it occupies; and the setæ, although generally confined to the centre, sometimes occupy two thirds of the radius. The substance appears to be fragile.

COSCINODISCUS.

Coscinodiscus elegans, n. sp., Grev.—Disc small, with a smooth irregular umbilicus; granules rather large, equal, in radiating, not very close lines, which terminate in a narrow belt of minute crowded puncta; border strong, finely striate. Diameter about ·0030″. (Fig. 6.)

Hab. Monterey deposit; Laurence Hardman, Esq.; R. K. G.

Allied, apparently, to *C. Lunæ* and *gemmifer* of Ehrenberg, having, in common with those species, a smooth umbilicus and a narrow belt of minute puncta between the termination of the radiating lines and the border; but differing from both in the strong, finely striated border, which appears double in consequence of a fine dividing line. The narrow punctate belt is scarcely so broad as the border. Granules large, circular, conspicuous, about 8 in ·001″ in the radiating lines.

Coscinodiscus pulchellus, n. sp., Grev.—Large; valve convex, largely reticulate; cellules hexagonal, somewhat smaller near the margin, the last row more or less oblong; border strong, rather broad, with strong, subremote striæ. Diameter about ·0050″. (Fig. 7.)

Hab. Barbadoes deposit, Cambridge estate; C. Johnson, Esq.

A fine species, with a regular, somewhat delicate hexagonal cellulation, which becomes smaller only near the margin, the cellules of the last row being not wider, but only longer. The strong striæ of the border pass for a short distance into these oblong cellules.

Coscinodiscus robustus, n. sp., Grev.—Large; disc convex, cellulate; cellules large, roundish-hexagonal in the middle, becoming smaller, rounder, and more remote towards the margin; border very strong, broad, elevated, with irregular striæ. Diameter ·0045″ to ·0055.″ (Fig. 8.)

Hab. Monterey deposit; cabinet of L. Hardman, Esq.

A rather singular species, strong and robust in its general aspect with a broad elevated rim. The cellulation is coarse, and the hexagonal spaces are continued nearly equal in size to the margin; but the cellules themselves have a roundish appearance, large in the central region, then becoming gradually smaller as they approach the margin. The walls, of course, become correspondingly thicker, until at length the cellules look like mere circular perforations in the middle of the hexagonal spaces. In the centre of the disc the cellules are 4—5 in ·001″.

Coscinodiscus oblongus, n. sp., Grev.—Disc more or less oblong, having the centre depressed, and an umbilicus containing a number of subremote granules; surface filled up with radiating granules, which diminish in size next the umbilicus and towards the margin, where they resemble minute puncta. Length ·0028″ to ·0050″. (Figs. 9, 10.)

Hab. Barbadoes deposit, chiefly in Springfield estate; C. Johnson, Esq.; L. Hardman, Esq.; R. K. G.

This beautiful little species is liable, on account of its similarity in form, to be taken for a variety of *C. punctatus* of Ehrenberg; but on a close examination it appears to be essentially different from the figures of that diatom in 'Mikrogeologie.' The granules forming the radiating lines, for example, become smaller as they approach both the margin and umbilicus. The latter is not smooth, but always contains a number of granules, which, in the more elongated valves are generally arranged in lines. The centre of the valve is also much depressed. *C. punctatus* itself, however, is not very clearly established. Ehrenberg gives two figures ('Mikr.' Tab. xvii, figs. 40, 41), the first of which is oval, but neither of them exhibits the slightest indication of one of the most conspicuous characters contained in the description, viz., cellules "very densely crowded at the margin, and forming a broad yellowish-white border." At present I am under a very strong impression that two or three oval or oblong species belong to the American deposits, one of which may be the diatom Ehrenberg had in view.

BRIGHTWELLIA.

Brightwellia Johnsoni, Ralfs, MS.—Valve with the border composed of radiating lines of cellules diminishing in size from the coronal circle to the margin, and of ridge-like ribs at subregular intervals. Diameter about ·0035.″ (Fig. 11.)

Hab. Barbadoes deposit, Cambridge and Springfield estates, most abundant in the latter; C. Johnson, Esq.; L. Hardmann, Esq.; R. K. G.

This exquisitely beautiful diatom is similar in size to *B. elaborata*, but is at once distinguished by the radiating lines of cellules becoming smaller towards the margin, and by the dark ribs which radiate, at short intervals, parallel with them. The coronal circle of larger cellules and the spiral arrangement of the central cellules are very like the same parts in the species above mentioned. It is seldom that a good view of the spine-like character of the ribs can be obtained; but the disc now figured happened to be tilted up in such a way as to show it very conspicuously.

ACTINOPTYCHUS.

Actinoptychus minutus, n. sp., Grev. — Minute; valve 8-rayed; the compartments alternately slightly raised and depressed, very minutely punctate; umbilicus in the form of a minute cross, with the ends truncate. Diameter ·0017″. (Fig. 12.)

Hab. Monterey deposit; cabinet of L. Hardman, Esq.; very rare.

The smallest species of the genus, with the surface nearly even, and the cellulation so minute as to justify the term punctate.

HELIOPELTA.

Heliopelta nitida, n. sp., Grev.—Disc with six compartments, the cellulate ones with 4—5 marginal spines; central space obtusely hexagonal, containing a circular umbilicus; margin narrow, with a fine line running through it, and no perceptible striæ. Diameter ·0040″. (Fig. 18.)

Hab. Deposit at Los Angelos, California; L. Hardman, Esq.; very rare.

To my friend Mr. Laurence Hardman we are indebted for the discovery of what appears to be an unquestionably new species of this fine genus, and individually I have to thank him for enriching my cabinet with a specimen. Whatever view may be taken of the species described by Ehrenberg, the Californian disc differs from all of them in the non-striate rim and in the well-defined non-stellate centre. The latter is an hexagonal umbilicus, containing a circular nucleus, and of a thicker and more opaque substance than the stellate central space in the other *Heliopeltæ*. The margin is relatively narrower, and the cellules larger.

EUPODISCUS.

Eupodiscus minutus, n. sp., Grev.—Small; disc slightly convex, obscurely cellulate, with four circular, submastoid processes, distinguished by a prominent lip on their marginal side. Diameter about ·0020″. (Fig. 13.)

Hab. Barbadoes deposit, Springfield estate; cabinet of L. Hardman, Esq.

Considerably smaller than *E. obscurus*, and, like that species, possessing four processes, but is not otherwise allied to it. I place our present little diatom provisionally in *Eupodiscus*, but am doubtful whether that be its true position. The processes, which are situated near the margin, are somewhat similar to those of the genus *Craspedoporus*, having the edge next the margin of the disc considerably raised, and with a thickened lip. The structure is rather obscure, but can be made out to be a faint, uniform, minute, roundish cellulation.

AULISCUS.

Auliscus Hardmanianus, n. sp., Grev.—Large; valve circular, with two processes; whole surface more or less granulose; umbilical space four-angled, the angles attenuated, two of them passing to the base of the obovate ridges within which the processes are placed, the other two passing into rough transverse lines, terminating in a sort of capitate mass of radiating short lines and granules. Diameter ·0040″ to ·0055″. (Fig. 17.)

Hab. Monterey deposit; cabinet of L. Hardman, Esq.

There is no genus of diatoms in which a greater variety of sculpture occurs in proportion to the number of species than in *Auliscus*. The present most remarkable disc, of which I have seen a number of examples, is quite unlike any of those previously described. The most striking peculiarity is the attenuation of the angles of the umbilicus, especially those which are intermediate with the processes, which are prolonged into more or less distinct linear channels, ending in intra-marginal knobs or rough clusters of short radiating lines. These knobs are connected with the ridges surmounting the processes by a few fine, sometimes obscure lines, stretched, as it were, across from one to the other.

BIDDULPHIA.

Biddulphia Johnsoniana, n. sp., Grev.—Large; frustules oblong, turgid; valves broadly oval, very minutely scabrous, destitute of spines, with large, very shortly produced, broadly truncate processes. Diameter of valve ·0040″ to 0055″. (Figs. 14, 15.)

Hab. Moron deposit; very rare; C. Johnson, Esq.

This very rare species has considerable affinity with *B. tur-*

gida, which it resembles in general form and dense structure, and especially in the short, broad, flat processes. I have been unable to perceive any trace of spines, nor is there any indication of a rough line or fringe of apiculi, like that in the valve of *B. turgida*. Like most of the other members of the genus, our new species varies greatly in size.

Biddulphia ? mammosa, n. sp., Grev.—Valve in front view produced at the angles into large, elliptical, mammæform, minutely punctate processes; median surface slightly convex, and transversely remotely striate; the rest of the surface smooth. Length of valve ·0040″. (Fig. 16.)

Hab. Barbadoes deposit, Cambridge estate; in slides communicated by C. Johnson, Esq.

We have here another of the dubious forms of which so many occur in the Barbadoes deposit, and of which it is desirable to place on record. It is fortunate that although, in the absence of the end view of the valve, we cannot describe the exact contour, characters amply sufficient for the determination of species are obtained from the front view. At least this has been found to be the case in the fossil *Biddulphiæ* and *Hemiaulidæ* from Barbadoes. The end view of the valve of the present species must be very beautiful, being apparently composed of a series of long, linear, transverse cellules, traversed by a median line.

Triceratium.

Triceratium Robertsianum, n. sp., Grev.—Large; valve with gibbous sides and subobtuse, slightly produced angles, a short, horn-like process at each angle, and 1—2 strong spines, arising from the surface within the margin on each of the sides; cellulation hexagonal, large, equal; margin broad, elevated. Distance between the angles ·0042″. (Fig. 22.)

Triceratium grande ?—'Brighton Mic. Jour.,' vol. i, p. 249, pl. iv, fig. 8.

Hab. Woodlark Island, South Pacific; in a dredging communicated by Dr. Roberts, of Sydney.

For nearly two years I have refrained from making any use of the drawing of this diatom, in the hope that I might be enabled to come to some satisfactory understanding relative to *T. Favus* and its varieties. In the mean time multitudes of that species have come under my observation, and I have met with no form which tended to unite the one under consideration with that species. *T. Favus* frequently occurs with the sides of the valve "slightly convex," in accordance with the specific character adopted by Mr. Ralfs ('Pritch. Inf.,'); but a slight convexity is very different from the prominent gibbous curve in the valve now before me. The presence of strong spines also, by themselves of very uncertain value, contributes, in connection with the other characters, to confer upon it great *primâ facie* distinctness. Size alone is of little importance, but it may be well to state that it is scarcely more than half that of *T. Favus,* as figured in the 'Synopsis of British Diatomaceæ.' At the same time the margin is far more decidedly defined, and the reticulation more delicate. After all, however, it may turn out to be nothing more than an extreme form of *T. Favus,* to which Mr. Ralfs seems disposed to refer *T. grande* of Brightwell.

Triceratium Stokesianum, n. sp., Grev.—Large; valve with slightly concave sides and subobtuse angles; surface with subremote, roundish, irregularly radiating cellules, minute in the centre, becoming large towards the sides and angles; angles imperfectly cut off by two vein-like lines springing from the margin on each side, obscurely united in the middle; margin strong, remotely striate. Distance between the angles ·0062″. (Fig. 23.)

Hab. Moron deposit, Province of Seville; Rev. T. G. Stokes; extremely rare.

This fine species appears to be allied, as my kind correspondent Mr. Stokes remarks, to *T. areolatum* of the Barbadoes deposit, being of the same form, and having a very similar radiating cellulation; but it differs in being a very much larger species, and in having the angles partially cut off by a pair of vein-like undulating lines given off on each side, which become faint and obscure towards the middle. The pair next the angle are less distinct than the others, and would probably be found obsolete in some specimens. The cellules are sometimes oval, and are larger and more regular as they approach the angles. The Moron deposit is remarkable for the small number of individuals of the new species which have been found in it. No one but Mr. Stokes has been so fortunate as to discover the subject of the present notice.

Triceratium inelegans, n. sp., Grev.—Small; valve pulvinate, with straight sides and broadly rounded angles; whole surface filled with irregularly radiating, somewhat remote, oblong, rather large granules, except the angles, which are minutely punctate. Distance between the angles ·0025″. (Fig. 21.)

Triceratium obtusum? Ehr., 'Mikrog.' Tab. xviii, fig. 48.

Hab. Monterey deposit; cabinet of L. Hardman, Esq.

Allied to *T. tesselatum* and *robustum*, and more nearly to *T. obtusum* of Ehrenberg; but that close observer would scarcely have omitted in his figure of the latter species the crowded puncta in the angles of the Monterey diatom. Nevertheless I think it right to quote it as a doubtful synonym.

Triceratium dulce, n. sp., Grev.—Small; valve with slightly convex sides and subacute angles, the margin with oblong striæ; surface depressed, with radiating lines of remote punctiform granules; angles raised, and filled with minute puncta. Distance between the angles ·0030.″ (Fig. 20.)

Hab. Barbadoes deposit, Cambridge estate; in slides communicated by C. Johnson, Esq.; very rare.

A very elegant species, of which but few examples have occurred. It is remarkable for its depressed surface, so that when the angles are in focus the central puncta are scarcely perceptible. The angles do not appear to be very prominent, but are so abruptly elevated that the vertical view of the side might be taken at first sight for a transverse line. The central puncta are minute, faint, and remote, becoming a little larger towards the margin. The latter is rather broad, and marked with elegant, oblong striæ, 8 in ·001″.

Triceratium mammosum, n. sp., Grev.—Minute, with thick, produced, rounded angles, filled with minute puncta and straight sides (reckoning from the base of the angles); the central space hexagonal, marked with remote and scattered puncta. Distance between the angles ·0015″. (Fig. 19.)

Hab. Barbadoes deposit, Cambridge estate; in slides communicated by C. Johnson, Esq.; extremely rare.

Very conspicuous at a glance, from the large, produced, mammæform, hemispherically rounded angles, which, being covered with puncta, appear out of all proportion to the rest of the valve. Central puncta circular, irregularly scattered.

AMPHITETRAS.

Amphitetras elegans, n. sp., Grev.—Small; valve with the sides slightly concave in the middle; angles rounded, terminating in a small, ring-like pseudo-opening; cellulation minute, radiating from the depressed centre, somewhat smaller and more crowded within the angles. Distance between the angles ·0025. (Fig. 24.)

Hab. Monterey deposit; L. Hardman, Esq.

A most beautiful small species, elegantly radiate, with a very narrow simple margin. The pseudo-openings have the appearance of being the ends of short hyaline tubes.

Further Observations on the VEGETABLE PARASITES, *particularly those infesting the* HUMAN SKIN. By JABEZ HOGG, F.L.S., M.R.C.S., &c.

(With Plates III & IV.)

(Read Nov. 8, 1865.)

MR. PRESIDENT,—Since you did me the honour to ask for a contribution to the 'Transactions of the Microscopical Society' during your term of office, I thought I could not better engage an evening than by putting together a short account of some further observations I have been making, during the recess, on the identity of the parasitic fungi infesting the human skin. And I must request the members to receive the few remarks I am about to make as a continuation of the investigations I communicated to the Society at the end of 1858, and which were published in our 'Transactions,' January, 1859, wherein I endeavoured to show the true character of the so-called parasitic diseases of the skin, their common origin and identity, and also the universal distribution of these parasites throughout nature.

You will, I am sure, pardon a small degree of vanity, when I say that it is exceedingly gratifying to me to find that the publication of the paper just referred to seems to have been the cause of directing the attention of other observers to this very important subject. For by the labours of scientific men diseases of the skin have been gradually rescued from the hands of the empiric; and as they are now acknowledged to be constitutional rather than local affections, a simpler and more effectual method of treatment for the cure of some of the greatest ills that flesh is heir to, is distinctly pointed out, and at once resorted to. But whether future investigations will tend to confirm an opinion now gaining ground, to the effect that the poison-germs which produce the more alarming infectious diseases are likewise of a *fungoid nature,* I am not at all prepared to say. But of this we may be quite certain, that it is only by the aid of the microscope, in the hands of those who will patiently sit themselves down to interrogate nature, "that we can ever expect to make out the character of those poisons which, generated in one body and conveyed to another, produce such terrible destruction to our race."* For these microscopic germs, in-

* Dr. Beale, in a highly valuable series of lectures "On the Passage of Germinal or Living Matter from one Organism to another," published in the 'Medical Times and Gazette,' 1864, enters into the question of contagion. He believes that when *germinal matter* has its powers of growth perverted or

visible though they be to the unaided sight, are nevertheless produced in myriads in the earth, air, and water around us, and are so diminutive that ordinary motes floating about in the atmosphere are large in comparison. And when we reflect on the very remarkable powers of life possessed by all —and the fungi in particular—which are found to resist a moist heat equal to that of boiling water, and also an intense frost, without at all losing their powers of germination, we can no longer feel surprised that their spores are found penetrating the hairs of the head or the hair-follicles and epidermic cells of the body; nor, indeed, that they should penetrate the internal parts, even where the hard textures, the bones, do not escape their destructive influence. For the very reason that these pests, botrytaceous or mycodermatous fungi, are found both upon the external and internal surfaces, it is proposed to divide them into *Epiphytes* and *Entophytes*.

Although, as I have before pointed out, it is not possible that in either of these cases fungi originate disease, it is pretty certain that they frequently aggravate it, and once let the spores establish themselves on any part of the body where the secretion is not sufficiently active or healthy, and it is a difficult matter to throw off the intruder.

These, then, were exactly the conclusions I had arrived at seven years ago, and since this subject has engaged the attention of our countrymen, it appears that men who are deservedly eminent on the Continent have been led to examine into the truth of these researches, and the result has been that Bazin, Hebra, and others, have considerably modified their views and reduced the number of species.

It will, however, assist our investigation if I enter very

degraded, it may obtain a power of indefinite multiplication, like the pus of an abscess or the secretion from purulent ophthalmia. Such pus, that is, such degraded germinal matter, he has shown to have the power of independent growth under various conditions, and to be capable of maintaining its vitality for long periods, if not completely deprived of moisture. When introduced into another animal's body, offering favorable conditions, it increases and multiplies. It would appear, then, that the growth of ill-conditioned germinal matter may be accompanied by the development of poison in the organism that supports it; just as the growth of mould changes the quality of bread, or cheese, or other substance, on and in which it is found. He does not, however, assume the existence of spores or other bodies, whose presence he has not yet discovered, but appeals rather to the germinal matter whose existence and growth he has demonstrated; and although he does not look for the extinction of all contagious diseases, yet he does expect that much good will be derived from keeping the body in an unsusceptible state —by living in good and pure air, by dryness and plenty of sunlight, and especially by general cleanliness, as preventives of these forms of disease.

briefly into the early history of the parasitic diseases, and their recognised division into species.

It is now more than a quarter of a century since Bassi, of Milan, discovered the vegetable character of a disease which caused great devastation among silkworms; and, about the same time, Schönlein, of Berlin, was led to the detection of certain cryptogamic vegetable formations in connection with skin diseases. The observations of this distinguished man have been abundantly confirmed by Gruby, Remak, Robin, Küchenmeister, Bennett, Jenner, and others, most of whom attempted to identify the fungus with the disease which they believed to be produced by it, and in this way separate and detach some of the most common skin diseases from the rest, and so regard them simply and almost exclusively as *fungoid or parasitic diseases.* Thus, the parasite supposed to be peculiar to, and productive of, each disease has been minutely described, and honoured with a name derived from the name of the disease which it is supposed to have originated, as appears in the following table:

Willan.	Bazin.	Wilson.	Parasite.
Porrigo favosa and lupinosa	Tinea favosa	Favus	*Achorion Schönleinii.*
Porrigo scutulata	Tinea tonsurans	Trichosis furfuracea	*Tricophyton tonsurans.*
Porrigo decalvans	Tinea decalvans	Alopecia	*Microsporon Audouini.*
Mentagra	Tinea sycosa	Sycosis	*Microsporon mentagraphytes.*
Pityriasis versicolor	Pityriasis	Chloasma	*Microsporon furfur.*

Now, this very tempting theory involves an important principle of pathology, inasmuch as it places the parasitic fungi above described in a category by themselves, and invests them with characteristics entirely at variance with those of the natural history of the family of fungi, whose leading feature appears to me to be that of selecting diseased and decayed structure as the soil most essential to their existence; whereas this hypothesis assigns to them healthy organized matter to live and prey upon, and thereby establishing specific diseases. In examining into the truth or fallacy of this theory by the light of physiology, we must bear in mind that the surface of the human body is supplied with a delicate covering, one office of which is to excrete, and another to eliminate or exude, effete matter from the blood. The excretion consists chiefly of epithelial scales, and the exudation is mostly made up of fluid and gaseous matters, which sometimes become condensed and dried on the surface of the epidermis. The epithelial scales are friable and separable by very slight friction during health, and the transpired fluid makes its free escape, under ordinary circumstances, without any assistance from without. But want of cleanliness, deficient exercise, and much more frequently a deranged state of the health, especially a vitiated condition of the body, interfere with the natural processes of elimination; and then the skin itself becomes diseased, and in this diseased condition may become infested by parasitic fungi, the spores and filamentous threads of which find a nidus in an abraded portion of the cuticle; or, what is more generally the case, the shafts and roots of the hairs are invaded, the hairs become brittle and stunted in growth, and at length perish and fall off.

Dr. Tilbury Fox, who in 1863 published an excellent work on 'Skin Diseases of Parasitic Origin,' was the first to call the attention of the profession to a point of considerable practical value in conjunction with parasitic growths, namely, that whenever we find fungus in connection with a skin disease we must look upon it as a something superadded to the diseased condition—" a complex condition, an eruptive disease *plus* a tinea" (parasite). By taking this definition as our guide, we may say without hesitation that "the pathognomonic sign of parasitic disease of the surface is the infiltration and destruction of the hairs by the spores; and the diagnosis can in nowise be considered perfect until spores or mycelia have been detected by the microscope." For the future, then, we must look upon parasitic disease as *non*-existent without this test. I cannot, however, admit that this complex condition at all invalidates, as Dr. Fox would seem to imply, the opinion expressed by me in my former paper, namely, *that the growth of a fungus is not necessarily pathognonomic of any special form of skin disease;* nor do I quite think, with him, that the complex eruptive condition is so entirely of a secondary character simply because in *tinea decalvans* we sometimes find the parasite in the perished and falling hairs unaccompanied by any eruption of the skin. In the course of my experience, which appears to slightly differ from Dr. Fox, I happen to have seen in my friend Mr. Hunt's practice cases of alopecia, sycosis, porrigo decalvans, &c.,* with a scaly desquamation preceding the perishing and falling of the hairs, and at the same time unaccompanied

* See former paper, Vol. VII, 'Quart. Jour. Micro. Science,' 1859.

by parasitic growth; therefore I still believe that an eruptive condition or an abraded secreting surface is a very necessary part of the disease, and that then the skin affords a more particularly favorable soil for the development of the fungus; but leaving this part of the subject for the present, I shall proceed to show in an experimental and, I trust, a satisfactory way that the same species of fungus often exhibits varieties of character, as well as form, at different stages of development and under varied influences; so much so, "that neither size nor outline affords any basis for distinction into species until it has been ascertained, from extensive comparison of forms brought from different localities in the widest area over which the species can be traced, what are the average characters of the type, and what their range of variation." (Bentham.)

First, with regard to collecting and taking fungi, I find that the prevalence of damp or moist close weather is especially favorable for the purpose; while in an opposite condition of the atmosphere—fine frosty weather—I have rarely been able to secure a supply; and, moreover, my experience has proved to me that in the winter season diseases of the skin accompanied by parasitic growths disappear from among the poor who frequent our skin infirmaries. Mr. Hunt also finds that season brings with it its own peculiar type of skin disease.

It appears that at particular periods of the year the atmosphere is, so to speak, more fully charged with microscopical atoms than it is at others. The spores of the moulds, *aspergilli, penicillia,* and *puccinia,* are perhaps the most widely distributed bodies, and towards the end of the hot weather, or about autumn time, they are very abundant. Among those who have taken them at this period of the year we must ever associate the name of one of our body, the Rev. Lord Godolpin Osborne, who, I believe, first experimented in this way during the cholera visitation of 1858. He exposed prepared slips of glass, slightly moistened with glycerine, over cesspools, gully-holes, &c., near the dwellings of those where the disease appeared, and caught what he named *aërozoa*—chiefly minute germs and spores of fungi. I was favoured with a few specimens, one of which I have placed under a microscope on the table for the purpose of comparison with the more recent specimens taken by myself two months ago; a drawing made from this (see Plate V, fig. 4) exhibits spores almost identical with those found in the skin, &c.

From the year 1858 to the present time I have amused myself by catching these floating atoms, and, so far as I can judge, they are found everywhere, and in and on every conceivable thing, if we only look close enough for them. Even the open mouth is an excellent trap; of this there is ample evidence, since we often find on the delicate membrane lining the mouth of the sucking, crying infant, and on the diphtheritic sore throat of the adult, the destructive plant *Oïdium albicans.* The human or animal stomach is invaded, and in a certain deranged condition we find the *Sarcina ventriculi,* with its remarkable-looking quaternate spores, its torulæ, &c., seriously interfering with the functions of this organ. I may mention a curious fact in connection with stomach fungus, the discovery of Lehmann, namely, if an emulsion of casein (the casein of sweet almonds) be mixed with a small quantity of amygdaline and then introduced into the stomach of the animal, it very soon ferments, and the yeast-fungus quickly changes the chemical constituents of the mass into the poisonous substance *oil of bitter almonds,* and thus destroys the life of the animal.

In specimens of the vomit from another fearful disease, the *yellow fever,* sent to me from Bermuda, I found a large admixture of spores and torulæ, with altered blood-corpuscles and disintegrated epithelial scales.* Here, then, we have striking examples of the ravages committed by the fungi, but I think no one will say we are justified in attributing either fever, thrush, or diphtheria, to the presence of the Oïdium found in connection with these diseases. I might go on multiplying examples of a similar kind; but as that would inconveniently extend my paper, I will rather proceed to give the results of experiments made with the *favus* fungus taken from the human body.

At the time I read my former paper I was unable to show the results of any examinations, or, indeed, make more than a passing allusion to favus, although a well-known form of disease, from the circumstance of its having attracted the attention of Schönlein, who found a fungus growth always

* My own observations on the presence of fungi in these vomits receive confirmation from Dr. Buchanan, who was sent by the Privy Council to make inquiries into the outbreak of yellow fever at Swansea last September. Upon making a microscopical examination of the vomits he discovered large quantities of fungus-spores, changed blood-cells, &c. Last year I met with fungus-spores in the chamber of the eye, a still more remarkable portion of the human body, than any above alluded to. A man fifty years of age, came to me complaining of impairment of sight. His attention was first directed to the defect by the very unusual appearance of a small "plant-like body" always before him. By a careful examination of the eye with a magnifying ophthalmoscope I was quite able to satisfy myself of the presence of a small group of puccinia spores in the vitreous humour.

mixed with favus crusts. The disease is one commonly known as *cupped ringworm*, or honeycomb scall, and is now rarely seen in this metropolis; therefore I consider myself fortunate in having been able, through the kindness of my friend Mr. Hunt, to investigate three cases, from each of which I collected scales for microscopical examination. I have here a few of the peculiar-looking crusts, and it will be observed that they are cupped in appearance, and of a dingy yellow colour. The crust is almost entirely composed of the *Achorion*, mixed with epithelial scales and broken hairs. When the fungus once establishes itself, so fearful are its ravages that in a very short space of time the whole of the cutaneous surface, with the exception of the palms of the hands and soles of the feet, becomes covered with it. I attempted to obtain a photograph of one of the patients, but cannot say very successfully; the print gives but a faint idea of the disagreeable picture really presented to the sight. Large masses of the crusts fell off daily, each one leaving its mark behind. As the spores penetrate the hair-follicles they destroy the sheaths of the hairs, which shrivel up and lose their colouring matter, and then break off, leaving the surface bald.

The fact of the surface becoming so entirely denuded is explained in this way:—The shaft of the hair is less in circumference than the bulb, and consists of hardened, shrunken epithelial cells, almost devoid of germinal matter; and the further removed from the bulb the less of vital power does it possess, and consequently, when its nutrient supply, small even at first, become interfered with and lessened by the increasing spores, it loses the little vitality it ever had, dies, and drops off. And in this, as in other cases, the fungus feeds upon the dead, and not the living, material.

If we now take a crust and examine it more closely, it will be seen to be made up of an outer and older part, thick and dark in colour, the fungus being here in a more advanced stage, and chiefly composed of sporangia, spores, and mycelia, with fragments of several hairs imbedded in them. The under or inner and younger layer is paler in colour, and consists of spores mixed with epithelium, fatty and granular matters, and sometimes pus; and I suppose we may consider that in some cases a very large quantity of the latter ingredient (pus) has been mixed up with the outer parts of the crusts. Mr. Wilson started a new theory, founded on this exceptional condition, namely, "*that the favus matter is produced from the development of the nuclei of pus-cells;*" *that the parasite is not a vegetable, or that, if it be, it might be* *looked upon as an example of the conversion of an animal into a vegetable product.* It is quite possible, without a careful microscopical examination, to mistake the stroma, always present in large quantities in favus crusts, for pus. This, I think, is a mistake often committed by the more casual observer. We will not, however, enter into any discussion upon this theory, nor upon one still more improbable, "the spontaneous generation hypothesis"—of all hypotheses the most gratuitous; I was almost about to say *absurd.*

I must now be permitted to add a few words upon the physical aspect of persons suffering from *favus,* because, as I have already stated, and not without proof, that such diseases are the embodiment, or rather the impersonification, of a weakly, unhealthy state of the body, well understood as the scrofulous habit; and associated with a dirty or neglected state of the skin in the majority of cases. Hebra, the great authority on skin diseases, lays much stress upon the feature of *dirtiness* as a cause of favus, and goes so far as to say that this accounts for its rarity among the upper classes of society. "The subject of one of the worst cases," says Mr. Hunt, "was a puny, half-starved boy of seventeen, whose appearance was that of a child of nine or ten. When he was taken from his miserable home into purer air, and well fed, the crusts died and dropped off; but when he returned to the wretched habitation of his parents, situated in one of the filthiest parts of Lambeth, and was insufficiently fed, the vegetation grew again most rapidly—flourishing in the vitiated fluids like a vine in a mass of stercoraceous mould." From this boy I obtained, in 1859, large supplies of the fungous crusts, and at that time, to make sure of the results of my examinations, I sent portions of the same to friends upon whose experiments I could rely for the confirmation of my own. Having perfectly satisfied myself, and not by one but by many trials, that the achorion (favus) produces as good a ferment, and nearly as briskly, as healthy yeast, when added to barley-wort, with only a slight difference of size and form "a difference of degree, and not of kind," my next experiment was one slightly varied, for the purpose of observing the modifying influence of light over these fermentations, and at the same time ascertaining if this agent at all affected the character of the results. I was, perhaps, led to make this observation from finding that yeast requires for its more perfect growth, not only a proper temperature, but almost occlusion from daylight—a fact that appears to hold good in the development and growth of most fungi. I therefore, in April last, procured a supply of fresh wort from a brewery, which

I divided into three equal portions, and, for the sake of convenience, numbered 1, 2, and 3. Into Nos. 1 and 2 I put a few favus crusts; No. 1 was put carefully away in a darkened place, the temperature of which was about 70° Fahr.; Nos. 2 and 3 (the latter being simple sweetwort only) I exposed to a good light in my sitting-room window, where the temperature ranges from 65° to 75° Fahr.; and each bottle was closely corked. On the second day, upon examining a portion of 1 and 2 with a ¼-inch power, I found fermentation had commenced, a film spreading over the whole surface of the liquid. In No. 1 were seen a fair quantity of yeast-cells, varying in form and size; shown in Pl. III, fig. 1, *a*. No. 2 was in a more advanced stage, and some of the spores were rather larger than in No. 1. On the 4th and 5th days I took portions from all three bottles. That from No. 1 gave the best results; the spores, yeast-cells, were more numerous and spherical in form, well filled with granular matter and numerous moniliform chains of smaller spores and amorphous stroma, shown in fig. 1, *b*. Compared with a small portion of fresh yeast from a beer-barrel, fig. 3, the cells and spores appeared about half the size (in the drawing, however, they are represented too small). In specimen No. 2 spherical cells were fewer and smaller, with groups of ovoid spores mixed with torulæ, and bacterium-like bodies floating rapidly about; here and there were seen tufts of penicillium, represented in fig. 2, *a*. In the sweet wort No. 3 were numerous ovoid spores, without granular matter, but highly refractive, and not unlike fat-globules.

On the 10th day the changes seen in specimens taken from each bottle were still more marked. From No. 1 the spores were more numerous, but certainly rather smaller, and variable in form, and the greater portion of them were filled with granular or nuclear matter; there were also groups of torulæ mixed with still smaller spores, fig. 1, *c*. This specimen when the cork was removed from the bottle, gave indications of the presence of carbonic acid, and the odour was that of good fresh beer, and the greater portion of the heavy yeast had fallen to the bottom of the bottle. No. 2, on the contrary, had become quite of a dark colour, smelt sour, and the spores had much decreased in size, granular matter with bacteria being by far the more numerous; represented in fig. 2, *b*. The wort in No. 3 was still sweet—of a somewhat vinous sweetness—and the top was thickly covered over by a whitish, flocculent, filamentous-looking mass of mould.

A fortnight or rather more elapsed, and then another examination gave somewhat similar results. No. 1 was still perfectly sweet, while No. 2 was more sour, and of a dark red colour; the filamentous masses were broken up, and had fallen to the bottom of the fluid, and the surface was slightly covered with a mould. No. 3, although smelling somewhat like bad wine, was not much altered in colour, but on its surface the aspergillus was growing. Six months later No. 1 was perfectly sweet, exhibiting well-marked spores and torulæ; No. 2 was rather more decomposed than it was on the former examination; and No. 3 remained the same.

Now, upon comparing the fermentation of the achorion fungus with that of good healthy yeast, it will be seen to be almost identical. In the first place, it is as actively carried on by the former as by the latter. There is, however, just a slight difference in the size of the spores or cells already mentioned, those from yeast being the larger and more nearly spherical, with a greater number of reproductive spores, that is, cells with a single, clear, nucleated cell in their interior, while others are filled with a darker granular matter, and having only a slight tendency to coalesce or become filamentous, while the achorion are for the most part ovoid and very prone to coalesce and produce elongated cells or torulæ. Now, with reference to the slight difference in size, we must look upon this as a matter of very little importance; for to the presence of light in the one case, and its almost total exclusion in the other, this difference, I have no doubt, is almost entirely due. It would be more trustworthy if comparisons of this kind could be made at the same stage of development; for be it remembered that yeast obtained from a brewery is in a more favorable state, inasmuch as it is stopped at a certain stage of growth or development, and then *set* to begin its fermentation over again in fresh supplies of a new pabulum, which gives increased health and vigour to the plant; while, on the other hand, the achorion, or favus fungus, is obtained and used in an exhausted state from an already ill-nourished or starved-out soil. Neither can we attach much importance to differences of size and form of the spores, for even this occurs in yeast ferment; and although the ovoid is most frequently seen in achorion, it is equally common to yeast when exhausted. This is strikingly exhibited in Pl. IV, fig. 2, a drawing made from a drop of exhausted yeast taken from porter; here we have the oval and elongated cell with torulæ. To ensure success in these and similar experiments, the fungus or yeast should be left floating on the surface of liquids; the process is either carried on very slowly or is entirely arrested by *submersion.*

Turpin and others, in their experiments on yeast, noticed that the cells become oval and bud out in about an hour after being added to the wort; but this change depends as much upon temperature and density of the solution as upon the quality of the yeast. It is a well-ascertained fact that when yeast is added to distillery wash, which is worked at a higher temperature than brewers' wort, fermentation commences earlier, and the yeast-cell grows to a much larger size. It is, indeed, forced in this way much as a plant in a hothouse is, and then obtains to greater perfection in a shorter time. It will, however, be seen that it sooner becomes exhausted; and now, if we take a portion of this yeast, and add it to barley-wort, and at the same time keep it in a temperature of from 60° to 65° Fahr., it ferments languidly, and small yeast-cells are the produce. If the yeast is allowed to stand in a warm place for a few days it partially recovers its activity, but never quite. With such a yeast there is always a good deal of torulæ mixed with the degenerated cells, and sometimes a filamentous mass, which falls to the bottom of the vessel; from this stage it readily passes to that of *must* and *mildew*, and then becomes a wasteful feeder or destroyer.

With yeast passing to the stage of exhaustion I have seen a crop of yeast fungus produced in the head of a strumous boy, seven years of age, who was much out of health, and had suffered from eczema of the eyelids, with impetigo. The disease had obstinately persisted in spite of well-directed efforts to remove it. The scabs were frequently examined, but no fungus found. The mother, by the recommendation of a friend, washed the boy's head every morning for a week with *stale beer*. I saw the child a few days after these washings were discontinued, and warm water only used to soak the scabs off. On placing portions of the broken hairs on a glass slip, and moistening with a drop of liquor potassæ, spores and torulæ were seen in abundance. Represented in Pl. III, fig. 4.

I have made frequent microscopical examinations since, with the same results. Two years have passed, and the disease remains, although parasiticidical washings have had a fair trial. A change to country air and good diet always does more good than medicine in this case. I do not look upon this single experiment as at all sufficient to prove the production of the yeast fungus by transplantation into the human skin, although it is not very unlike the achorion fungus, or that of tinea tonsurans (*tricophyton*); but, taken with many negative trials that I made, to introduce both yeast and achorion into *perfectly healthy* skins, without any abrasion of surface, I think it has an important bearing on the subject of my paper. At all events it is a fair illustration of change of type,* for when Mr. Hunt saw the boy, after the disease had persisted for at least twelve months, he at once pronounced it to be *pityriasis rubra* or *versicolor*. Had the fungus played any part in bringing about this change in the character of the disease?

In another experiment I took portions of some *penicillia* and *aspergilli* moulds, and upon adding these to sweet wort I obtained results confirmatory of Dr. Lowe's,† which were pretty much as follows. Having placed small quantities of spores in the wort, I stood them by in a warm room. On the second day in one of the solutions, and on the third in the other, fermentation had fairly set in; the surface of the solution was covered with a film, which proved to be well developed ovoid spores, filled with smaller granular spores (*conidia*) (fig. 5, Pl. IV). On the sixth day the cells changed in form, and were more spherical. Again removing these to another supply of fresh wort, the results obtained were quite characteristic of exhausted yeast ferment.‡

* The Rev. Mr. Berkeley, in his 'Outlines of British Fungology,' writes:—"It is not possible that in these cases fungi originate disease, though it is pretty certain that they frequently aggravate it." Nevertheless, after this clearly expressed and positive statement, we find, a few pages further on, the following contradictory assertion:—"That a few spores rubbed into the skin or inserted in it will soon produce the disease known as *porrigo lupinosa*" (favosa?). And he cites Dr. Lowe as his authority for this statement; but on looking over this gentleman's writings, what do we find? Why, that in the course of a somewhat extended inquiry into the causes of diseases of the skin he only met with two cases in brewers' draymen, and one in a dirty cellarman, of parasitic growths, with sycosis and favus, and which, he tells us, *commenced with a sore.* I would ask any one conversant with these diseases if this at all justifies the above assertion, or proves that the parasite can be communicated to, and grown upon, the *healthy* human skin. For my own part, so thoroughly satisfied am I of the utter fallacy of such a statement, that I should have no hesitation in submitting my own skin to be experimented upon to test the truth of what I have stated.

† It is only right to say that *I did not follow* Dr. Lowe, as some writers have stated, in this field of inquiry. My observations on skin diseases were commenced at the suggestion of my friend Mr. Hunt, in 1856, and continued for three years before my first paper appeared in print. At that time, 1859, neither Mr. Hunt nor myself had heard of Dr. Lowe's researches, which, it appears, were communicated to a local society, and published in the 'Edinburgh Botanical Society's Transactions,' 1857.

‡ *Directions for preparing and mounting.*— The mode of preparing specimens of fungi for the microscope.—After having removed a small portion of the crust or a hair from the affected part, place it on a glass slip, and gently separate the mass with needle-points, and add a drop of liquor potassæ, which will render it transparent; then cover with a piece of thin glass and remove any superfluous fluid with a small piece of blotting-paper.

From these experiments I believe that it matters little whether we take yeast, achorion, or penicillium spores, the resultant is the same, and depends much more on the food or nourishment supplied whether the pabulum contains more or less of a saccharine, albuminous, or nitrogenous material, lactic acid, &c., together with light and temperature; whether we have a mould (green or blue), an achorion or yeast fungus produced. Diversity of form in the cells, as well as quality and quantity of their material contents, is certainly due to, and in a manner regulated and controlled by, the beautiful law of *diffusion*, which admits, separates, sifts, and refines the coarser from the finer, the lighter from the denser particles, through the porous structure of the cell-wall.

In conclusion, I trust I have satisfactorily shown that—

1st. There exists but one essential organism, a fungus whose spores find a soil common alike to the surface and the more secluded parts of the human or animal body.

2nd. That variations in skin diseases associated with parasitic growth are due to differences in the constitution of the person affected; to the moisture, exudation, soil, and temperature, under which the development of the fungus takes place. Consequently it is neither correct nor desirable to separate and classify them as "*parasitic diseases of the skin.*"

3rd. The parasitic growths vary but little in any case, and that only in degree, not in kind, some soils appearing to be better suited than others for their development, that furnished by the eruptive or secreting surface being in every way the most congenial; while diversity of form, in all cases, arise from growth taking place either upon a sickly plant, a saccharine solution, or an animal tissue.

Should there be fatty matter mixed up with the specimen, it will be necessary to remove the cover and add a drop of ether; then wash it with distilled water. Other reagents will, from time to time, be found requisite, and enable us to avoid errors in interpretation; as, for instance, on the addition of a drop of hydrochloric or acetic acid all earthy particles are dissolved out. Ether, chloroform, or alcohol, readily remove fatty matters. A solution of potash or soda will dissolve out pus, epithelium, &c., and more quickly so if the specimen be slightly heated, while fungus-spores are not affected thereby, but, on the contrary, are better seen. In some chronic cases of skin disease we find the epithelium-scales involved in a kind of *fatty degeneration*, minute fat-globules, which at first sight bear a very strong resemblance to spores; these must be got rid of by soaking in ether, and then washing with strong liquor potassæ. Like other vegetable cells, spores sometimes require the addition of a drop of iodine, which renders them distinctly visible. View all specimens, first, with monochromat light, and afterwards with polarized light. The latter shows up the starch-granules, if present, and distinguishes the granular particles of earthy matters. For mounting and preserving the specimen, use glycerine jelly, or glycerine diluted with one third of camphor water.

4th. That fungi generally excite chemical decomposition in the soils on which they feed, and that it is the exclusive province of a certain class, when spread on the surface of an albuminoid, saccharine or alcoholic, or slightly acid liquid, to develope and grow, and during growth to give rise to either the alcoholic, acetic, or putrefactive fermentation.

Notes *on the* Gregarinida.

By E. Ray Lankester.

(With Plate V.

(Read Dec. 13th, 1865.)

Though the minute organisms known as Gregarinida are remarkable for the great range of their distribution, appearing in various animals, both terrestrial and aquatic—from the Turbellarian worms up to the Brachyourous Crustacea and Mollusca, and even in Vertebrata—very little indeed has been added to our knowledge of their structure, development, or habitats, during the last few years. This is a matter not only for surprise, but also for regret, inasmuch as there are some important points in the history of these parasites still to be examined, and doubtless many new and interesting forms to be discovered. There is nothing to be recorded as having been ascertained with regard to Gregarinida since the short article which I published nearly three years ago in the 'Quart. Journ. Mic. Sci.' The researches of Lieberkühn * are generally accepted, and the great difficulty now is to discover the true sexual reproduction of these animals.

Probable sexual reproduction.—The encystation of a single or of two Gregarinida, and their gradual resolution into a number of minute cells, at first circular, and afterwards, in the case of *Monocystis Lumbrici,* at least, assuming a navicula-like form, are well known. The pseudo-naviculæ issue from the sac, and become free organisms. They have been formed by a process analogous to *gemmation* in the cyst; and it is in *their* history, I believe, that the *sexual* reproduction of Gregarinida must be sought. It was formerly considered that the pseudo-naviculæ individually developed into Gregarinæ by a single process of growth; Lieberkühn† showed that they undergo certain changes, their contents becoming con-

* Since writing the above I have seen a short paper by Lieberkühn, in 'Muller's Archiv' for the last quarter of 1865. An abstract of it will be found in the "Chronicle."

† 'Mém. de l'Acad. Roy. de Bruxelles,' 1854.

centrated towards the centre, after which the envelopes of the pseudo-navicells become flaccid, and allow their contents to escape, which grow into Gregarinæ, passing through an amœbiform stage. As far as Lieberkühn ascertained, the whole process was simply one of gemmiparous reproduction, or analogous to it. The pseudo-naviculæ were produced by gemmation, and the young amœboid Gregarinæ were produced from the pseudo-naviculæ also by gemmation. The pseudo-naviculæ of the Gregarinæ of the earthworm, which are the only species readily attainable for study, are so minute that there is great difficulty in defining their contents, even with a powerful objective, and it is impossible at present to ascertain satisfactorily the structure of those contents. I have, however, observed that many pseudo-naviculæ have, when they have passed some time in the free state, an apparently viscid substance occupying the greater part of the cavity enclosed by their thick enveloping membrane, while the finely granular substance (which is aggregated near the centre in most pseudo-naviculæ) is deficient. The gradual formation of this nucleus of protein matter is described by M. Lieberkühn, but he does not seem to have observed that in many cases it is absent, and that there appear to be two forms of these bodies. Is it not probable that the contents of these two forms of pseudo-naviculæ respectively play the parts of male and female elements? It appears that in no other phase of the existence of the Gregarina is there a possibility of sexual reproduction taking place. The large parent Gregarinæ have been so carefully watched, and the process of encystation so attentively observed, that it may be confidently stated that under these aspects the Gregarina presents no phenomena comparable to those of true sexual reproduction, and hence some observers have been led to suppose that the pseudo-naviculæ pass from the "bearer" in which they are produced and attain a sexual form in some other habitat. Lieberkühn's observations, however, which I have confirmed, seem to indicate that in the case of *Monocystis Lumbrici* the changes in the pseudo-naviculæ which he has recorded are the only ones which take place, and that these occur without the intervention of a fresh host. If this view of the case should be true the Gregarina which is developed from the amœboid young might be considered as the parent-stock, the pseudo-naviculæ as sexual zooids, and we should thus have a case very easily classed with the other instances of alternation of generations. I would, however, merely wish to offer this as a suggestion, since at present we have not, nor, I believe, can we have, proof that the contents of the pseudo-naviculæ are to be regarded as male and female elements.

Large size of some species.—It appears that the *Monocystis Lumbrici* has an almost indefinite power of growth, limited only by the cessation of the supply of nutrient material. In Pl. V, fig. 1, is drawn a specimen from the posterior portion of the perivisceral cavity of the earthworm, which was found floating there with two others, being of unusually large size. One of the specimens was the $\frac{1}{25}$th of an inch in diameter, the contained vesicle of proportionate size, and the granules also much more conspicuous than is ordinarily the case. In the same worm the seminal vesicles and testicular sacs were found to be occupied by several individuals of Monocystis of enormous size, the whole of the cavities appeared to be filled by them, and the nourishment diverted to their use which should have been employed in the development of the seminal secretion. One of the largest of these Monocystes was $\frac{1}{5}$th of an inch in length, being of a linear form (fig. 2). When it is remembered that the ordinary length of a *Monocystis Lumbrici* is $\frac{1}{120}$th of an inch or less, the strangeness of this large growth will be admitted. It appears that, when free to develop equally in all directions, the Gregarina assumes a more or less spheroidal form, as in the first instance, but that when growing in a confined space in company with other individuals a linear increase is induced.

The granules in the elongated form were much fewer than in the spheroidal one, and poured freely about in the interior. A considerable amount of activity was shown by this specimen, and the tunic or enveloping membrane was thick, and occasionally showed striations, while in that from the perivisceral cavity the membrane appeared much thinner and there was no movement. As a rule, it seems that the granules are developed in the Gregarinæ at the expense of the investing tunic, and that the larger the bulk of the granules the less is the activity of the Gregarina.

Structure and function of the investing tunic.—I was induced some time since to believe, with Dr. Leidy, that the investing membrane of the Gregarinida is double, inasmuch as an appearance tending to prove that such was the case was witnessed both by him and myself in the *Gregarina Blattæ.* I have now, however, reason to believe that the striations visible in the posterior sac of that species are produced merely by the contraction of a portion of the viscid material which fills it; in fact, the investing membrane must merely be regarded as a dense layer of the same sarcodic material which forms the whole creature. The membrane which invests the whole Gregarina appears to be excessively thin and ill-defined, and more or less continuous with the viscid substance contained by it, which is denser nearer the exterior, and, in fact, seems to form a layer beneath the investing tunic, intermediate in density as well as position, which in one or two cases becomes considerably developed. This occurs in the Monocystis of the annelid Nereis (figs. 4, 5), where the granules occupy a smaller portion of the sac than is usual, and the sarcodic substance in which they are imbedded becomes very remarkably differentiated, so that there is a broad fleshy prolongation of the sac at one extremity, exceedingly mobile, which indicates the direction in which progression is always made. Distinct striations, giving the appearance of fibrillation, may be detected in the substance of this prolongation. It seems that here that portion of the viscid material filling the sac which is nearest to the enclosing membrane is denser than is usual, and has much of the character of sarcode, while the granules, which are excessively fine, float closely packed together in the *inner* portion of the same viscous material, which is less dense. This species of Monocystis, it should be remarked, is very active. This, again, would tend to show that the development of granules is in opposition to the activity of the animal, which is further borne out by the fact that young Gregarinæ, in which there are but very few granules, are always by far the most active. The striations on the investing membrane, which are noticeable in many species, such as *M. Serpulæ, M. Sabellæ,* &c., are similar to those occurring on the tunics of many Infusoria. In some species they occur in immature specimens only, and are not traceable in fully grown individuals. This is the case in *M. Terebellæ,* and in an undescribed form abundant in *Cirratulus borealis* (figs. 8, 9), while in certain stages of the development of *M. Lumbrici* a series of filamentous processes, or sometimes of small conical bodies, appear to be developed from the exterior of the investing membrane and afterwards cast off.* The prolongation of part of the sac into a proboscis provided with hooks or a broad flattened extremity, as in *G. Sieboldii* and *G. Heerii,* also shows the plasticity of this portion of the saccule constituting a Gregarina. The movements of a Gregarina do not depend on the mere elasticity of the envelope, but on the contractions of the dense portion of the viscid sarcodic substance contained by it, which is continuous with it, and the development of which is opposed to the development of the granules.

Specific distinctions.—It is a matter of very great difficulty to decide on specific differences in higher animals possessing many more points of character than can be found among Gregarinida, and, indeed, among these latter it becomes almost

* These filamentous bodies do not form part of the Gregarina, but are sperm-cells of the *Lumbricus,* in M. Lieberkühn's opinions.

impossible to speak of a species with that definite meaning which zoologists attribute to the word. A difference of habitat is all that can be understood, generally speaking, from a specific name, among the Gregarinidæ. Nevertheless, there are many forms which are very definite in their character, and appear to confine themselves to the same host. Such are *M. pellucida, M. Aphroditæ, G. Sieboldii, G. Heerii, G. Blattæ,* &c. There can be little doubt, however, that very many species have been named which are identical with others previously known, but are merely found in a new bearer. The form which is met with in *Ommatoplea* and *Convoluta* (Turbellarians, figs. 6, 7) occurs in many other Annelids, and I was surprised to find one of these in a specimen of *Aphrodita hystrix,* whilst in twenty or thirty specimens examined by me in Guernsey not a single individual contained any other Gregarina.

Gregarinida observed in Guernsey.—Having devoted some study to the Annelida obtained while with the dredging committee of the British Association in Guernsey this year, I have a few additional notes to offer on the Gregarinida which infested some of the species.

Monocystis Cirratuli, n. sp. (figs. 8, 9).—The perivisceral cavity of specimens of *Cirratulus borealis,* which were abundant in some muddy shores, was invariably infested by large numbers of a simple form of *Monocystis.* No Gregarinida have been previously observed in this Annelid, and hence I name the form after its bearer. The largest specimens were $\frac{1}{40}$th of an inch in length. The young forms showed a striation of the investing membrane, and did not present that anterior enlargement which was noticeable in the more fully grown specimens. The length of the smallest observed, which was almost entirely free from granular matter, was $\frac{1}{160}$th inch (fig. 9).

M. Nemertis, Kölliker.—In *Ommatoplea* and *Convoluta,* and once also in *Aphrodita hystrix,* I met with a form of Monocystis which may be referable to Kölliker's species (figs. 6, 7). The most marked characteristic was the very frequent enlargement of the anterior extremity into a circular or spheroidal form; this, however, was not persistent. The contained granules were coarse, and the vesicle distinct; its average length was $\frac{1}{120}$th of an inch. Kölliker describes *M. Nemertis* from a Nemertian worm. It seems inadvisable to complicate the nomenclature by using a different specific name for the Gregarina of each genus of Nemertians, and hence I retain Kölliker's name, though this form appears to differ somewhat from that which he figures. It is remarkably abundant in the very common Nemertians, *Ommatoplea gracilis* and *O. rosea.*

M. pellucida, Köll., *Nereidis,* Leidy.—In *Nereis pelagica* I observed several fine Gregarinida in the intestinal canal (figs. 4, 5). Kölliker's *M. pellucida* appears to be a young form of this same species, since he obtained it in Nereis and observed its paucity of granules and small size. The larger individuals which I have observed have a very dense mass of fine granules, which, however, does not appear to occupy so much of the cavity as is usual. There is a broad semi-transparent margin of contractile sarcodic substance, which appears to give this species a greater activity than is observable in other well-grown forms. The vesicle is small, but clear and conspicuous; the largest specimens noticed had a length of $\frac{1}{120}$th of an inch.

M. Eunicæ, n. sp.—In the intestine of *Eunice Harassii* I noticed the Gregarina drawn in fig. 10. Its length was $\frac{1}{100}$th inch; the contained granules were coarse, and the tunic was produced posteriorly into a somewhat pointed wedge-shaped body.

M. Phyllodocæ, Claparéde.—M. Claparéde figures Gregarina from Phyllodoce in his 'Recherches sur les Annelides, Turbellaries, &c.' The form, however, which I observed in several species of *Phyllodoce* differs much in appearance from that which he figures (fig. 12). Its usual length was $\frac{1}{120}$th of an inch, the granules pale and indistinct, and the vesicle elongated.

It is extremely difficult to point out any characters by which any two of the forms of Gregarinida above noticed could be distinguished, excepting as regards that found in *Nereis,* which differs materially from the others. There are, however, small indications in the general appearance and habit of these creatures which at once appeal to the observer, and enable him to recognise some of the more dubious species as distinct from each other. I was thus easily able to recognise the Monocystis of *Ommatoplea* when occurring in the intestine of *Aphrodita hystrix* without any hesitation; the sea-mouse had probably taken it in with food, since Turbellarians are remarkably common in the same locality in which the Aphrodita occurs. It is a fact worth noting, that only one instance of this was observed in various examinations of more than thirty specimens of Aphrodita. *Aphrodita aculeata,* which has a peculiar form of Monocystis,* did not occur off Guernsey.

* 'Quart. Journ. Mic. Science,' April, 1863.

TRANSACTIONS.

On a Method *of* Dry Mounting. By James Smith, Esq., F.L.S.

(Read December 13th, 1865.)

(Abstract.)

The object of this paper was to show how to prepare cells for mounting dry objects, so as to be ready for use at any time, and capable of an immediate application to glass slides.

The author proposes to take a piece of card-board of six or more inches square, according to the number of cells required, and rule a series of perpendicular and parallel lines $\frac{5}{8}$th of an inch apart, so as to divide it into squares. The centre of each square is then to be perforated with a $\frac{1}{2}$ inch punch, and both surfaces of the card-board covered with a cement formed of shellac or marine glue dissolved in naphtha; one to three coatings of this cement being usually sufficient, care being taken that one is perfectly dry before the next is applied. The cells being thus prepared, they can be cut off, and by the application of heat and slight pressure are easily attached to a glass slide. The object being placed in the cell, a thin glass cover may be heated and so fixed, or this and the edges of the cell itself covered with a coating of cement. The author concluded by stating that leather or thin wood might be readily converted into cells in the manner described, but that for all ordinary purposes, those prepared of card-board would be found quite efficient.

A short Description *of an* Acarus *and its* Agamic Reproduction.* By Richard Beck.

(Read December 13th, 1865.)

After keeping one or two species of acarus for a very considerable time, and having no difficulty in increasing or diminishing their number according to the treatment I pursued, it was much to my surprise when about the middle of last summer they began rapidly to disappear, and in a comparatively short time I was quite unable to obtain from the whole of my stocks any living specimens.

On one occasion, when making a general search to see whether the acari had merely moved their quarters, I found in the thread of a spider's old cocoon a species of acarus, so entirely different from those I was looking for, and presenting to me such novelty in appearance that I lost no time in carefully securing this and one other specimen which were all I could find; one of these, however, was injured in its capture, and died immediately.

The general appearance of the one still left was that of a female, but without a male I thought there would be no chance of obtaining any reproduction of its species, and I had moreover no clue to the food it required. Instead, however, of following the often too hastily adopted plan of merely making a mounted preparation of my specimen, I determined to preserve its life as long as possible, and I am now not only enabled to prepare a specimen whenever I like, but also to supply some facts as to its life-history which could only have been obtained by keeping it for some considerable time in a living state.

The question of food puzzled me for some time, as I naturally confined myself to obtaining supplies from the locality where I found the acarus, but a part of the cocoon, the eggs of a spider, and their first cast skins, were all alike refused. It was only as a last resource and judging from the remarkable size of its falces, together with its peculiar movements, that I gave it some living acari of a different species, these I soon saw were quickly seized, the disappearance of my colonies of acari which I have mentioned was at once explained, and I continued to supply my new specimen with food, hoping it would turn out to be an impregnated female.

In a few days it laid some eggs, and these duly hatched,

* Since reading this paper Mr. Bockett has shown me a specimen of the same acarus, mounted by J. Bourgoine, of Paris, which he names "Cheyletus des pilleteries (rare)."

and many subsequent generations have been produced by them. I am now able to supply the following facts connected with this acarus, which I believe are new.

The eggs as compared with those laid by other species of acari with which I am acquainted are rather small in proportion to the parent; they are of a bluish-white colour, transparent, and adhere to the substance they are laid upon by a short thread at one extremity. At the age of two or three days in summer time, the young may easily be detected inside the egg, which hatches according to my memoranda in five, six, or seven days from the time it was laid; the variation in this and other periods of development being due I believe in great measure to the temperature of the atmosphere.

The young as it comes from the egg has only six legs, it is white, perfectly transparent, and very active, wandering about in every direction. At the age of seven days it casts a skin, and then acquires eight legs, at a further interval of seven or eight days it casts a second skin, and then arrives at maturity; before each of these moultings the individual remains sometimes for one or two days perfectly stationary and apparently dead; I mention this circumstance so that any one who likes to repeat these experiments may not disturb the acarus in this important operation.

This acarus soon after arriving at maturity assumes a yellowish-green colour, and I will endeavour to describe some of its more remarkable features at this stage of its life.

That which strikes one at first sight is the size of the falces, for I presume they cannot be correctly termed mandibles; they are largely developed, apparently very powerful and move in a horizontal direction; the two when spread out forming a complete semicircle. The free extremities of the falces are somewhat complicated in structure; on the outside edge is a strong claw, with two short spurs at its base, and immediately within this or the inner side are two combs, very similar in general appearance to the pectinated claws at the extremities of some spiders' feet; the inner one is smaller than the other, but the two move simultaneously and independently of the outer claw. There are also a few strong hairs situated near the combs.

When this acarus seizes another one of a different species, which it does by its falces, laying hold of a leg or any other part indiscriminately; the prey after a lapse of about fifteen or twenty seconds becomes poisoned or paralysed, the legs bend up under the thorax, and no part of its body makes any resistance to the pulling backwards of the devourer, who, when she finds this passive condition of her prey, deliberately seeks out the fluids with an apparatus at the mouth, and does not leave it until it is entirely empty and shrunken. The poisoning process, however, does not occur when this acarus feeds, as it frequently does, upon one of its own species. In this case the prey continues to move and show signs of life as long as any fluids appear to be left in its body, and even, when a very small one has been devoured, I have noticed a movement of the legs full half an hour from the time of its first seizure.

The parts of the mouth project from the bases of the falces and two sharp pointed and close fitting lancets, answer the double purpose of piercing and conveying the fluids, which appear to be sucked up by a muscular movement at the base of the piercers. The acarus is sufficiently transparent for the process to be watched under the microscope, and the fluids may be distinctly traced in their passage from one acarus to the other.

The external structure of this acarus appears to be very simple, and there are but few features to notice besides those of the head. Two rows of short hairs, about twenty in all, run in parallel lines and a short distance apart, leaving a broad central band, underneath which a large vessel is easily detected, and appears more or less filled with white floculent matter. In no part can I detect any spiracles or tracheæ.

Of the legs, the first pair are during life constantly raised and lowered in a vertical direction, and from this peculiar action, combined with their two unusually long terminal hairs, I presume they are employed as feelers. The last joint of each tarsus is furnished at its extremity with two hooks and two longitudinal and parallel rows of delicate tenent hairs; by the aid of these this acarus walks with some little hesitation in an inverted position upon glass.

The anus I believe to be represented by two slightly projecting flaps at the free extremity of the abdomen, immediately below which is a longer aperture, from which I presume the egg is emitted.

Wherever this acarus in a natural state deposits its eggs, in that part it takes up its quarters and remains for a considerable time; this is in fact necessary for the protection of its eggs, which would otherwise be devoured by acari of the same and probably other species. They will frequently destroy their own eggs themselves when disturbed, or when pressed for food.

Having these acari now well established in a cupboard, I mostly find them partially concealed in some small cavity, and when in a mature state standing over a quantity of eggs in every stage of development; the empty egg shells from their extreme thinness reflecting a brilliant blue light, which catches the eye more quickly than the acarus itself.

My object from the first in securing this acarus, and in keeping it alive was to obtain specimens of both sexes, but I have never yet been able to detect a male. I was much surprised to find that every specimen I selected laid eggs, all of which duly hatched, and to make sure whether this was really a case of agamic reproduction, I determined to isolate some individuals very carefully, and I obtained the following results. In all these experiments I have employed the "live traps" which I described in the last number of the Microscopical Journal of Science, and they have answered perfectly, not only in completely isolating the specimens, but also enabling me to put them under the microscope, or to supply them with food at any time without disturbing them in the least.

On July 10th, of this year, a young acarus of this species was taken from a trap in which there was only a mature female; it was completely isolated, and on the 29th of the same month it laid eggs, which hatched on the 4th of August. One of these on the day it was hatched was removed to a trap and also completely isolated; by the 13th of September it had laid eggs, and some had hatched. On the 19th of September two of the young from the last mentioned trap were separated and secured; these I now have living and in a mature state, neither have as yet laid eggs, but I fully expect they will do so unless the approach of colder weather retard the process of reproduction, which I think is very probable, or it may perhaps stop the increase altogether.*

The securing a succession of three generations, including some accidents, have with me extended over a period of about five months, and I am quite prepared to admit that the proof of agamic reproduction in this acarus would have been more satisfactory if continued through a longer period, but after reading Professor Huxley's Paper on the Agamic Reproduction of Aphis, in part of which he states that "in Myriapoda and Arachnida the process is not known,"† I have thought that the few facts I have just given were of sufficient value to bring before your notice.

* (March 16, 1866.) Since writing the above, one of the specimens last referred to was killed; the other laid eggs which hatched on the 29th of December, and one of these young ones is still alive, but isolated in the same way as its predecessors. The cold of the winter has retarded the development of these acari very considerably, and so much so as to allow the other colonies of acari to appear again in their wonted numbers.

† 'Linn. Trans.,' vol. xxii, part 3, p. 216.

I am, moreover, in a position now to supply a limited number of living specimens to any one who is anxious or willing to investigate the subject, and I can at any rate promise a certainty in the supply of food, for I find that they are perfectly satisfied with the common cheese-mite.

A further investigation, therefore, into this subject, only requires the expenditure of a moderate amount of time and care, and the importance of agamic reproduction may be estimated by the attention it has already received from the most scientific naturalists.

An Improved Growing Cell.

By Richard Beck.

(Read December 13th, 1865.)

I was shown by Mr. Suffolk at our last meeting a new growing trough contrived by Mr. Smith, of Kenyon College, U.S. A description of this piece of apparatus has been given in 'Silliman's American Journal of Science,' September, 1865, and it has also been republished in the last November number of the 'Annals of Natural History.'

I think every one will admit that the principle on which the growing trough is contrived is very ingenious, and that it will prove of no little importance in many microscopical investigations.

The few suggestions which I shall make refer to the construction only, and to make them intelligible I must first quote Mr. Smith's description which is as follows:—

"The whole slide, as I have constructed it, is a trifle more than $\frac{1}{8}$th of an inch in thickness. It consists of two rectangular glass plates, 3×2 inches, and about $\frac{1}{25}$th of an inch thick, separated by thin strips of glass of the same thickness, cemented to the interior opposed faces, as shown in the figure.

"The upper plate has a small hole, *a*, drilled through it. One corner of the upper glass is removed, as at *b*, and a small strip of glass cemented at *c* serves to prevent the thin glass cover placed over the edge from sliding. To use the slide, fill the space between the two plates with clean water, introduced at *b* by means of a pipette, and also place a drop on *a* to remove the air. The object being put on the top of the slide and wetted, is now to be covered with a large square of thin glass, *c*, at the same time covering the hole, *a*. The slide can now be placed upright, or in any position, as no water can escape. It is, in fact, only a new application of the old principle of the bird fountain. As the water evaporates from under the cover, more is supplied through the hole, *a*, and from time to time an air bubble enters at *b*; thus a constant circulation is maintained."

This arrangement has, I think, one or two disadvantages. When the water sinks as low as the position of the object, the water line may become a considerable annoyance in viewing the object, and in those cases when it is necessary to use impure water there must be a considerable obstacle to the best illumination. I also think there will be a difficulty under some circumstances in cleaning the trough thoroughly. The plan I now propose is as follows:—An annular glass cell (fig. 1), formed by cementing two glass rings (*a* and *b*) upon a circular piece of glass (*c*), with a central aperture (*d*) the size

Fig. 1.

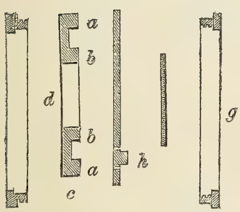
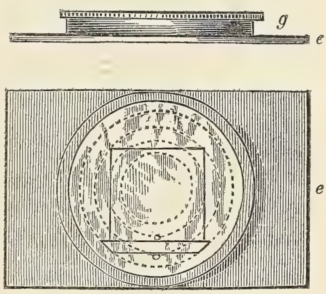


Fig. 2.



of the smaller ring, is securely fastened into a brass plate (fig. 2, *e*), which has a projecting ring, on which a screw is cut; upon this a cap (*g*) screws and fastens down an upper circular glass plate, which is provided with the two necessary holes, and a ledge (*h*) for the thin glass. By this arrangement there is no more than the ordinary obstruction to the illumination. The supply water can never come across the field of view, and the piece of apparatus can be taken to pieces in a minute, either for adding fresh water or for thoroughly cleaning the cell.

Mr. Smith only mentions the suitability of the "growing trough" for small objects such as can be retained under the ordinary thin glass, but by employing a cell of between one and two-tenths of an inch in thickness, or more, upon the upper plate, a considerable quantity of water may be preserved; his contrivance is therefore equally well adapted to comparatively large objects, and it is impossible to tell at once how far its sphere of usefulness may extend.

January 10*th*, 1866.

An extract from a letter from Professor H. L. Smith, of Kenyon College, Gambia, Ohio, U.S., was read by Mr. E. G. Lobb, giving a description of the method of using a new illuminator for opaque objects. The apparatus sent over by Professor Smith was exhibited by Mr. Lobb, a description of which is given in 'Silliman's Journal' for September, 1865. The apparatus of Professor Smith, which consisted of a metallic reflector to be fitted between the object-glass and the compound body, he requested might be placed in the hands of Messrs. Powell and Lealand, as he had no doubt they might improve upon it, and these gentlemen, as well as Messrs. Smith, Beck and Beck, have invented a plan for substituting a glass plate for the metallic reflector, which obviates many of the difficulties in the illumination to which the metallic reflector is subject.

The Object-Glass *its own* Condenser; *or, a* new kind *of* Illumination *for* Opaque Objects *under* High Powers. By Richard Beck.

(Read January 10th, 1866.)

This method of illumination has been recently introduced by Mr. Smith, of Kenyon College, U.S.;* but I believe the best effect may be obtained by the following exceedingly simple plan:—

A piece of thin glass (fig. 3, *b*), attached to a small brass milled head, fits into the side of an adapter (fig. 1), and when in position, as in figs. 1 and 2, the light coming through a small circular aperture (*a*) may be reflected down and through the object-glass, by the thin glass which makes no obstruction to the rays passing upwards again from the object-glass to the eye-piece, nor even affects the definition to any perceptible degree.

The adapter (fig. 1) is used, as shown in section (fig. 2), between the nose-piece (*c*) and the object-glass (*d*); it has a rotating fitting at the milled ring, and this movement, in combination with that of the small milled head to which the thin glass is attached, is sufficient for the nicest adjustment of the illumination.

* 'Silliman's Journal,' Sept., 1865.

By means of a slot (*e*, fig. 1) in the side of the adapter the thin glass may be readily removed for the purpose of being wiped, as its perfect freedom from dust or smear is most essential.

I don't know of any illumination connected with the microscope that requires more care and thought in its use than this. We have to consider, in the first place, that all the light thrown upon the object passes through the object-glass, which consequently regulates the direction of the illumination, and thus the obliquity can never exceed the angle of the pencil of light admitted by the aperture of the same

FIG. 1.

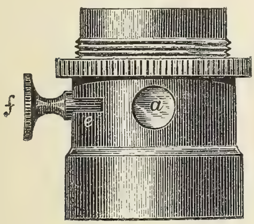


FIG. 2.

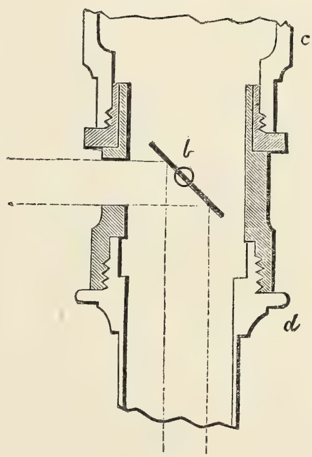
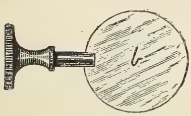


FIG. 3.



object-glass; and, secondly, it must be remembered that an object, or any part of any object, that lies in a plane at right angles to the axis of the body of the microscope, and possesses a reflecting power, will merely return the light into the instrument, not only giving a more or less milky appearance to the picture, but also a very deceptive representation of the specimen.

A striking illustration of this fact is given when a piece of thin glass is over the object, this so thoroughly reflects the light that little can be seen beyond it, and especially so with object-glasses of large aperture. With this illumination therefore all objects should be uncovered, and even then success is not always certain. I have tried to get a view of the tracheal vessels in the flea by this method, but the horny plates reflect so much light that hardly anything can be seen beneath them. The proboscis of the blow-fly, when simply expanded by pressing the head between the forceps is very remarkable, so much so indeed that I made a rough sketch of the appearances, which are nevertheless perfectly unintelligible to me, unless we have here an entire reversion of the correct appearance, or that those parts which appear light should be dark. The definition, however, with this object is perfect, and the deceptive appearances must be due to our not understanding the illumination. I have seen the fly's eye with this piece of apparatus in a way that I have never seen it before; but by slightly varying the direction of the illumination the surface of each lens might easily be made to appear, either concave or convex, and the same may be said of the glands in fractured specimens of coniferous wood.

The Diatomaceæ supply admirable proofs of the efficiency and perfection of this illumination, and the markings may clearly be seen upon *Pleurosigma formosum, angulatum,* and *fasciola;* but such specimens are best viewed when mounted on some dark absorbing material, and not on glass. The plan should also admit of the specimen being moved accurately into various positions. In looking at a valve of *Heliopelta,* for instance, the raised portions show decided hexagonal walls, the depressed portions giving merely dots or points of illumination; but one cannot find out where the two structures merge into each other without tilting the specimen so as to get a view of the otherwise vertical plane.

Perhaps the most striking objects are the scales from lepidopterous and other insects; they can be seen by this method in a manner not to be approached by any other. I must confess to only a casual glance at a few specimens for their general beauty; but I noticed how remarkably well the long vertical and short transverse ribs could be seen on the scales of *Morpho menelaus,* and from what I have yet been able to see of the Podura scale, there is no reason for altering the description I have already given of it.

We have been so long accustomed to the examination of objects that either are or have been made flat, that some persons hardly appear to understand the condition of many unprepared specimens.

With this illumination, especially suited as it is for the highest powers, we often cannot expect to have more than a very small portion of the object in view at once, and in such cases the parts out of focus cannot be prevented from reflecting light, and giving a kind of indistinctness to the picture. In using this illumination I have generally found it best to put the light about eight inches from the microscope, and the reflector will then give an image of the flame upon the object.

The illumination of the whole field, or the throwing of the light more or less on one side, can easily be accomplished by the use of a small condensing lens placed about the distance of its own focus from the lamp, and slight alterations in its position will, so far as I have tried, produce quite as good results as any diaphragm with small apertures at the side.

I feel confident that this method of illumination will prove a valuable addition to the microscope. It is a subject of great importance and interest; but it requires, so far as we know at present, careful and thorough investigation.

Note *on* Illuminating Objects *with* High Powers. By E. G. Lobb, Esq.

(Read January 10th, 1866.)

There are several methods of illuminating with high powers. The late Professor Quekett, in his treatise on the microscope, recommends oblique light with the mirror and lamp, removing all appliances under the stage; then after much patience and perseverance *Grammatophora subtilissima* and the Amician test may be resolved.

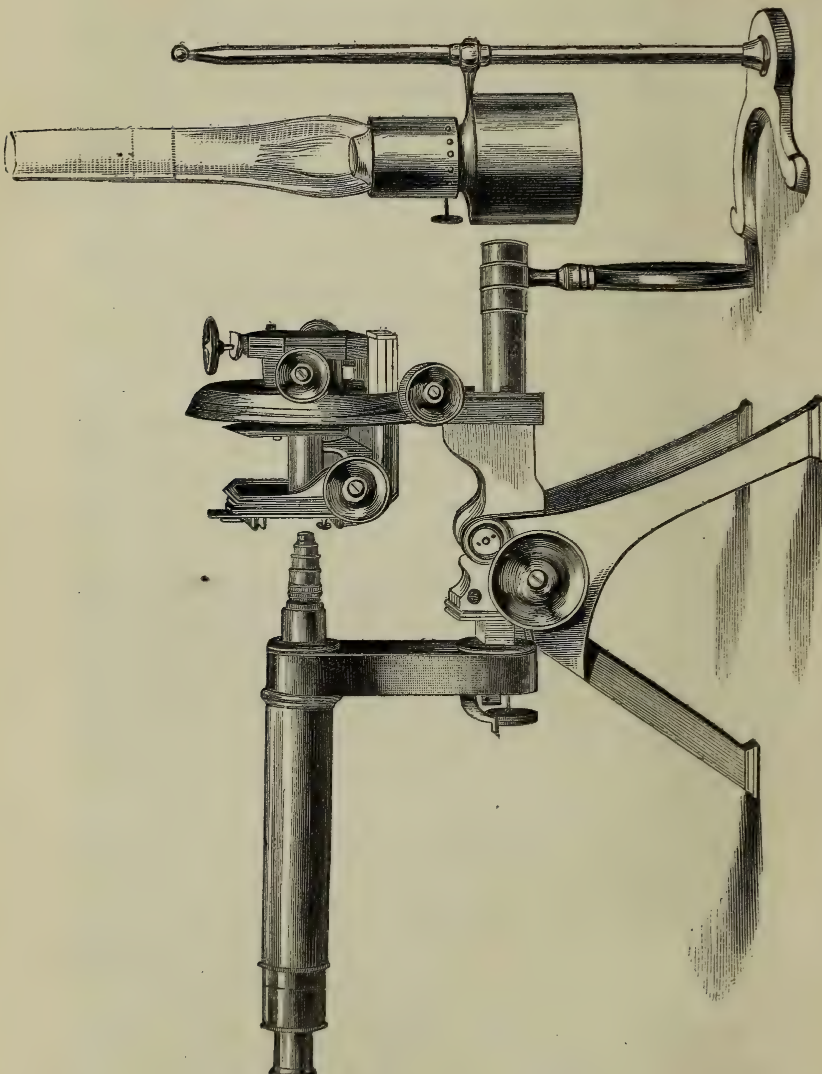
Another plan is to use the flat mirror, the achrômatic condenser and a paraffin lamp, daylight not being so easily managed, or even so good for the $\frac{1}{8}$th or higher objectives.

Some use the mirror and a prism, so placed that the light may be thrown on the object at right angles. Others use two prisms and two lamps for the same purpose. Others use the Rev. J. B. Reade's kettle-drum. In fact, multifarious are the methods adopted by different parties, and very successful have been the results obtained.

My own method is as follows, which does for all descriptions of objects, whether lined or not:—

The microscope is placed in the horizontal direction, and a small camphine lamp so adjusted that its reservoir may be close against the end of the rack-tube; having the A eyepiece, the one-inch objective, and the achromatic condenser of 170° aperture, place No. 1 aperture of the wheel of diaphragms in the field, then, looking through the eye-piece, centralize the aperture; this done, put No. 11 aperture in the field, then centralize the lamp flame; everything will now be in the axis of the pupil of the eye.

Should it be wished to examine hairs, scales, or morbid structure, use No. 3, 4, or 5 apertures of the wheel of diaphragms without any stop, the $\frac{1}{8}$th, $\frac{1}{12}$th, $\frac{1}{16}$th, $\frac{1}{25}$th, or $\frac{1}{50}$th object-glasses, and the A, B, or C eye-piece as may be



thought proper; now bring the object into focus, and by merely racking the condenser for the best light, very clear and satisfactory definition will be obtained. Nothing more is required in examining these objects than in selecting the most desirable aperture, and focussing the condenser for that illumination which defines the best; too much and too little light being equally bad.

If it be wished to examine objects such as *Pleurosigma formosum, P. quadratum, P. angulatum,* and their allies, put No. 11 aperture in the field, rack up the condenser until the field is very bright, then put on No. 1 stop, rack up the condenser until the stop disappears, and if the desired effect is not produced try No. 2 stop; the condenser will then require to be racked up still higher, and the dots will come out admirably.

If it be wished to examine *Navicula cuspidatum, N. rhomboides, Pleurosigma fasciola, P. macrum,* or their allies, still use No. 11 aperture, and stop No. 2, which will have to be altered a little in position, when the checks will distinctly appear.

For the Amician test use the slots instead of No. 2 stop; and as regards very difficult lines, such as those of the Acus, the condenser must be so arranged (when focussed up till the field becomes exceeding bright) that a shade be thrown on the object from the left hand, and No. 1 or No. 2 stop used, so as to darken a little the right hand side of the field; the effect will be to bring out these delicate lines. The $\frac{1}{8}$th and $\frac{1}{12}$th object-glasses I have generally found the best for this object with the B eye-piece; in fact, the B eye-piece is mostly to be preferred with high powers.

In the foregoing remarks I have been compelled to allude to my own apparatus; still, no doubt, the same effects may be produced by the use of condensers of different construction, as long as the aperture is considerable.

See Engraving for the arrangement of the microscope and lamp.

MICROSCOPICAL SOCIETY.

Anniversary Meeting.

February 14th, 1866.

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

The minutes of the preceding meeting were read and confirmed.

Various presents were announced, and the thanks of the meeting returned to their respective donors.

Certificates in favour of J. Bockett, Esq., 10, Willingham Terrace, Kentish Town; J. E. Mayhew, Esq., Hove Place House, Brighton; H. G. Westcar, Esq., Royal Horse Guards, Hyde Park; were read and ordered to be suspended in the usual manner.

J. Lovibond, Esq., was balloted for and duly elected a Member of the Society.

Reports from the Auditors of the Treasurer's accounts and from the Library and Object Committees were read.

Report of the Council.

The Council have to make the following report on the progress of the Society during the past year.

Since the anniversary, held February 6th, 1865, twenty-six persons have been elected members of the Society; 2 members, J. G. Appold, Esq., F.R.S., and Joseph Gratton, Esq., have died; 9 members have resigned, and 3 have been removed during the past year.

The number of members reported at the last anniversary was	348
There have been since elected	26
Making a total of	374
This number has to be reduced by—deceased, 2; resigned, 9; removed, 3	14
Leaving a final total of	360 as

the present number of members of the Society.

Showing an increase of 12 during the year.

The Library has had additions to it from time to time, as shown by the report of the Library Committee; and the collection of objects has been increased, as will be seen by Mr. Lobb's report.

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

AUDITORS' REPORT. *From February 6th, 1865, to February 14th, 1866.*

Receipts.

	£	s.	d.	£	s.	d.
By Balance from previous year				77	10	7
Admission Fees of 22 New Members				23	2	0
Compositions				42	0	0
Dividends on £753 6s. Consols				22	4	4
Sundries—						
Sale of Transaction	1	1	0			
,, Catalogues	2	0	0			
				3	1	0
Annual Subscriptions—						
For the year 1862	3	3	0			
,, ,, 1863	10	10	0			
,, ,, 1864	30	9	0			
,, ,, 1865	172	4	0			
,, ,, 1866	36	15	0			
				253	1	0
				£420	18	11

Payments.

	£	s.	d.	£	s.	d.
To Salary of Assistant Secretary				21	0	0
,, Curator				5	0	0
Editors of the 'Microscopical Journal'	157	10	0			
Postage and Delivery of ditto	12	6	2			
				169	16	2
Rent				25	0	0
Expenses of Soirée—						
Fittings, Gas, &c.	8	19	8			
Refreshments	18	0	0			
				26	19	8
Book-case				5	13	0
3 Quekett Medals				3	9	0
Reporter				3	3	0
Printing and Stationery—						
Printing	22	18	0			
Books	1	12	6			
				24	10	6
Assistant Secretary, Collection of Subscriptions				15	19	0
Ditto, Petty Expenses				5	8	9
Lamp Oil, &c.				8	3	10
Subscription Ray Society				2	2	0
Balance in hands of the Treasurer				104	14	0
				£420	18	11

We, the undersigned, have examined the Treasurer's accounts, with the documents and vouchers, and found the same to be correct. The amount of Stock in the Consolidated Three per Cents. being £753 6*s.* 0*d.*, and the balance in favour of the Society being £104 14*s.*

HENRY LEE.
W. H. HALL. } *Auditors.*

Report of the Library Committee.

Since the last report the Committee, by the desire of the Council, have procured a new book-case, which with that already in use, will, they consider, afford accommodation for all the books belonging to the Society.

The books already in the printed catalogue have been called in and examined, and with the exception of those mentioned at foot, which have been borrowed and not returned, have been handed over to the custody of the new curator.

The additions, since the last anniversary to the Society's Library have been 6 volumes, and 103 pamphlets, of which 1 volume and 7 pamphlets have been purchased.

List of books not returned by members :—'Burmeister's Organization of Trilobites,' (Ray Soc.) ; 'Grew's Anatomy of Plants ;' 'Pritchard's Microscopic Objects ;' 'Quekett's Lectures on Histology,' Vol. I; 'Kölliker's Human Histology.'

F. C. S. Roper.

Report on the Cabinet of Objects during the past year.

At the last Annual Meeting, February 6th, 1865, the Cabinet contained 1315 objects . . .	1315
The following have since been added :—	
Presented by Dr. Carpenter, June 14th, 1865, eight slides of Eozoon Canadense	8
Presented by Mr. W. H. Hall, October 8th, 1865, twenty-five slides, Animal and Vegetable . .	25
Presented by Mr. John T. Tupholme, November 8th, 1865, eighteen slides of Diatomaceæ . . .	18
Presented by Mr. John Hepworth, December 13th, 1865, eleven slides of Injections	11
Presented by Mr. W. M. Bywater, January 10th, 1866, twelve slides of Parasitic Fungi . . .	12
Objects now in the Cabinet	1389

Being an increase of 74 during the year.

Ellis G. Lobb.

The President delivered an address, showing the progress of the Society and of microscopical science in general during the past year.

The President's Address *for the year* 1866.

By James Glaisher, Esq., F.R.S., &c.

Gentlemen,—It sometimes happens that one finds himself in a position which requires explanation; such is my own case this evening.

Your rules require an Annual Address from your President, an address which should speak with authority of the advance in Microscopical Science, and indicate as far as possible its future prospects, by one well versed by practical experience and the devotion of much thought and care. Hitherto on these occasions you have listened to such Presidents, the accredited Representatives and Leaders in Microscopical Science, but my usual avocations are not microscopical, and they are so engrossing I have no time to devote to these researches, and therefore my sense of unfitness for this task would have precluded my appearance before you as the exponent of your views.

I am here, however, at your command, and I should be unworthy of your confidence did I not endeavour to comply with your rules by collecting information from all persons and all sources, and giving to our proceedings that completeness which the founders of this Society contemplated.

It is not, however, expected that an annual address should take the form of a scientific paper, but that it should embrace a wider field, and include more varied subjects; tracing the progress of Microscopical Science in the year, and therefore including the results of the labour of many individuals; in attempting this, should I omit anything which I ought to have included, I beg you to excuse me.

The objects of this Society, as laid down in the constitutions, are varied. They are, however, emphatically the advancement of Microscopical Science. In this two things are implied—firstly, that Microscopical Science is a worthy object of pursuit; and secondly, that combined efforts are necessary.

A few moments' consideration of these points may be interesting:—

To say that Microscopical Science is worthy of our pursuit is a proposition to which every one assents. But what do we mean by Microscopical Science? Is it the mere collection of detached facts? Is it to ascertain the purity, or otherwise, of commercial products? Is it to be chiefly valued for its utility and its practical applications? Even in the view of utility alone, the microscope claims a high place, and for an instance we need but refer to our transactions for the past year.

In a case of poisoning by means of corrosive sublimate maliciously substituted for the proper medicine, and in which there was a doubt, which it was of the utmost importance to remove, as to the source of the poison, rendering it uncertain whether the child had met with its death by accident, carelessness, or otherwise, Mr. Deane, by the aid of the microscope, determined in the most unequivocal manner that the poison was derived from a small parcel of the same substance kept in a piece of rag in the house of the child's parents, where it died, thus rendering it quite certain that the death of the child was premeditated, and at the same time removing every trace of suspicion from innocent parties, whose care and common sense had been called in question.

In a social as well as a medico-legal point of view, every one must see from the above recorded illustration how impossible it is to over-estimate the scientific application of the microscope as an element in Medical Jurisprudence.

There is everywhere a pressing demand for what is practical, and often the profoundest speculations of science or adventurous experiments in science are met with contempt when they do not immediately pay back to the experimentalist a return for his labours in marketable value.

The scientific investigator rejoices as warmly as any one in every addition of science to the arts, or to the practical wants of the day; but he emphatically denies that the whole value of science is to be estimated by its present application.

In the narrow sense of utility it may be asked, Of what use to know the forms of some of those beautiful diatomacea drawn by Dr. Greville, or of those beautiful organisms delineated by Dr. Maddox, so minute that many to the naked eye are invisible; but what educated man can be indifferent to them, or who can say to what a more extended knowledge of these atoms may lead?

Take for example the investigation into those remarkable forms *Eozoon Canadense*. In the May number of the 'Intellectual Observer' is a paper on the Structure, Affinities, and Geological Position of this remarkable fossil, by William Carpenter, M.D., F.R.S., &c.

The researches into its structure and character belong partly to the present year, and afford proof of the services which the microscope is able to render to geology and palæontology.

During the Canadian Geological Survey large masses of what appeared to be a fossil organism were discovered in rocks situated near the base of the Laurentian series of North America. Dr. Dawson, of Montreal, referred these remains to an animal of the foraminiferal type; and specimens were sent by Sir W. Logan to Dr. Carpenter, whom we are proud to claim as a former President of this Society, requesting him to subject them to a careful examination.

As far back as 1858 Sir W. Logan had suspected the existence of organic remains in specimens from the Grand Calumet limestone, on the Ottawa river, but a microscopic examination of one of these specimens was not successful. Similar forms being seen by Sir William in blocks from the Grenville bed of the Laurentian limestone, were in their turn tried, and then revealed their true character to Dr. Dawson and Dr. Sterry Hunt.

The masses of which these fossils consist are composed of layers of serpentine alternating with calc spar. It was found by Drs. Dawson and Sterry Hunt that the calcareous layers represented the original shell; and the siliceous layers the flesh, or *sarcode*, of the once living creature. These results were arrived at, through comparison of the appearance presented by the *Eozoon* with the microscopic structure which Dr. Carpenter had previously shown to characterise certain members of the foraminiferal group. The *Eozoon* not only exceeded other known foraminifera in size, to an extent that might have easily led observers astray, but from its apparently very irregular mode of growth, its general external form afforded no help in its identification, and it was only by careful examination of its minute structure that its true character could be ascertained. Dr. Carpenter says:—"The minute structure of Eozoon may be determined by the microscopic examination either of thin transparent sections, or of portions which have been subjected to the action of dilute acids, so as to remove the calcareous shell, leaving only the *internal casts*, or *models*, in silex, of the chambers and other cavities, originally occupied by the substance of one animal."

Dr. Carpenter found the preservation of minute structure so complete that he was able to detect "delicate pseudopodial threads, which were put forth through pores in the shell wall, of less than $\frac{1}{10,000}$th of an inch in diameter."

Dr. Carpenter exhibited some beautiful specimens of the Eozoon at the last *soirée* of this Society, and which he afterwards presented to the Society; and though his results have been controverted in some quarters, they have been fully accepted by naturalists best acquainted with the microscopic structure of the family to which the Eozoon has been assigned.

In a paper read last month at the Meeting of the Geological Society, Dr. Carpenter stated that he had recently detected Eozoon in a specimen of ophicalcite from Cesha Lipa in Bohemia, in a specimen of gneiss from near Moldau, and in a specimen of serpentinous limestone sent to Sir C. Lyell by Dr. Gümbel, of Bavaria, all these being parts of the great formation of "fundamental" gneiss, which is considered by Sir Roderick Murchison as the equivalent of the Laurentian rocks of Canada.

There can be little doubt that a rich field of research is now opened to those who will undertake the examination of rocks of various ages, which present the appearance of analogous structure; as it is, the microscope has been the means of demonstrating the existence of animal life at a very ancient geological date; and in the words of Sir W. Logan "we are carried back to a period so far remote that the appearance of the so-called *Primordial Fauna* may be considered a comparatively modern event."

Such are some of the objects of microscopical scientific research over and above its practical utilities, and are its claims upon our services.

Let me now say a few words upon my second proposition, viz., that combined efforts are necessary to its full development.

Microscopical science advances by observation, by the accumulation of facts, by patient research, by improvements in the object-glass, its mode of illumination, &c. Now, here the co-operation of observers scattered over the world is necessary, and these should include all classes, for so universal are the objects scattered which we wish to study, that a large co-operation is indispensable; so that results may be based upon the comparison and discussion of a wide range of observation. Co-operation and friendly rivalry are also needed with opticians, both in this and in other countries, so that the microscope may be as perfect as possible.

Turning now to our transactions of last year, we find no less than four papers by Dr. R. K. Greville "On New and

Rare Diatoms;" these papers are in continuation of those previously presented to the Society, and are numbered XV, XVI, XVII, and XVIII. These are all accompanied with exquisite drawings, clear descriptions, and are the results of much careful investigation.

Dr. Maddox has communicated a paper "On Photomicrography." It is well known to the members of this Society that for some years attempts have been made to add the application of photography to microscopy, for the delineation of microscopic objects.

Indeed, several papers on this subject have engaged your attention at various meetings.

As far back as April, 1853, in the Journal of this Society, was published a beautiful photographic illustration of microscopic objects. In the January number for 1855 Mr. Wenham wrote on the same subject, and showed how to make the actinic and visual foci coincident, and here and there during succeeding years we find a few scattered individuals endeavouring to rekindle the flame and keep alive this interesting art. Still it was not until Dr. Maddox, feeling fully persuaded that its application has advantages both of scientific and art value, and in the firm belief that it will ultimately materially assist the microscopist, determined to test its capabilities by the delineation of objects the most diverse in structure, colour, and size, and so tested more fully its range and applicability. He described his apparatus and the method he has adopted to overcome many difficulties; and Mr. How, of Foster Lane, exhibited on a screen nearly 100 of Dr. Maddox's results; these showed many minute organisms, with beautiful markings.

It is chiefly to the efforts of Mr. Highley and Mr. How we are indebted for bringing before the public the results of the labours of Dr. Maddox and others in this field of inquiry, and it is gratifying to know that at soirées and other places these illustrations have attracted a good deal of attention; and it is still more gratifying to know, that at exhibitions where their merits have been more carefully tested, they have been considered so well executed as to command the award of medals; one has been awarded to Dr. Maddox from the London Photographic Society, and a second also to Dr. Maddox, from the recent International Exhibition, Dublin; thus showing an appreciation which will furnish me some excuse, were any required, for directing attention to the past, present, and future of this branch of Microscopy. Unfortunately in this branch, so far as I know, there have been but few labourers in this country.

Mr. Thomas Davies has employed photography to render the beautiful specimens of artificial microscopic crystallization which were engraved as illustrations in our Journal, and Dr. W. Bird Herapath, in his valuable papers on the anchors and plates of various synaptæ, and the pedicellariæ of the echinodermata, has likewise had recourse to photomicrography; the photographs being reproduced as engravings and valuable illustrations in the Society's Journal.

In the person of Count Castracane we have the promise of the subject being more fully worked out. He has started with the assistance of a Dubosc's heliostat and prism mounted so as to employ monochromatic light; possibly this may have its actinic advantages, as it occasionally has its optical, for we find both Mr. Wenham and Dr. Maddox calling attention to the use of coloured glasses over the eye-piece. Still, I learn from Dr. Maddox that in his trials with monochromatic light, as derived from the use of Abraham's condensing prism without heliostat, that he did not obtain any advantage, but rather, in some instances, the reverse; the field and object (when the latter is very transparent) being more or less of the same tint, which neutralized the contrast too much; at least he found it did so for the reproduction of transparencies for the lantern.

Mr. Sorby, I believe, also employs photography to illustrate the appearance of fractured surfaces by reflected light.

Probably many others are quietly at work on the subject, with the results of whose labours, sooner or later, perhaps this Society will be favoured.

Abroad it has largely extended its influence, and it remains with ourselves to see whether we shall lose or retain our position. The hindrance to its being fully utilized appears to me greatly to arise from the expense attending the publication of such illustrations as photographs, more especially in scientific literature. Possibly we are on the eve of being able to produce such (which seems highly probable from papers recently read at the meetings of the Photographic Society) by means more nearly allied to the ordinary methods of printing, and then we may expect its future will be as rapid as its past has been tardy.

In a paper on the structure and affinities of the Polycystina Dr. Wallich has furnished us with an elaborate account of this obscure family of the Protozoa, and a classification based, as he believes, on the only constant characters it exhibits, viz., those involved in the mode of development and growth of the siliceous framework within and around which their soft part, or sarcode, is sustained. This is an important step in our knowledge of the Polycystina; for, although long familiar to the microscopist as most beautiful and prized objects of study, they had not previously received anything like a natural and systematic arrangement. But Dr. Wallich's paper claims notice on other grounds, inasmuch as it treats not only of this single family, but of the Rhizopods generally, and recommends for adoption a revised classification of the entire group, based on personal examination of the several families, and supported by a large number of original and highly interesting observations.

Whilst speaking of Polycystina, I wish to direct attention to the drawings of Mrs. P. S. Bury, who has most kindly favoured me with copies of her drawings of Polycystins, which are evidently, as she tells me, the honest representation of the objects as conveyed to her eyes and mind by attentive contemplation of the objects seen in a good binocular microscope.

These drawings illustrate how ladies may assist us in our pursuits, and at the same time, I feel sure, give to themselves great pleasure in dwelling over and recording faithfully some of the variations of forms of growth which are so numerous, sometimes whimsical, and often exceedingly beautiful, as are shown in Mrs. Bury's drawings of those curious organisms.

The subject of the generative productions in invertebrata does not seem to have been much taken up by naturalists. The paper by Mr. A. Sanders is therefore the more valuable. He says, as far as his researches have extended, he has only met with two papers treating especially on the development of Zoosperms; they are in De Quatrèfage's series of papers on the Annelida, in the 'Annales des Sciences Naturelles;' there is indeed a paper by Von Siebold in 'Müller's Archiv,' 1835 and 1836, in which the zoosperms of different classes of animals are described, but there is nothing about their development. In this inquiry there is a great deal of physiological interest; but perhaps it would be somewhat too audacious to hope that it would throw any light on the mysterious changes which the physical forces undergo in their passage through organic matter, which we call vitality.

In the Pulmogasteropoda, to which his paper was more particularly devoted, the subject is complicated by another factor, viz., Hermaphroditism; and the older naturalists disputed as to whether the zoosperms and ova were generated in the same or in different glands: the balance of evidence inclined in favour of the former view, and such is the modern received opinion; but it was open to objection, and was objected to in a paper by Dr. Lawson, and until the actual development of zoosperms could be demonstrated in the gland going on at the same time as the ova, it could not be said to be proved. This Mr. Sanders's paper was intended to do, and if the facts he gave are considered sufficient, the question may be considered settled. There is, Mr. Sanders believes, no instance in nature, except in the case of Gasteropoda, in which the two zoosperms and ova are produced in the same gland; in all other hermaphrodite animals there is a separate gland for each.

Mr. Sanders tells me his paper is but an instalment, and he proposes from time to time, as materials offer, to send to the Society notes on the process in different classes of animals.

Mr. Jabez Hogg has contributed a valuable paper on "The Vegetable Parasites of the Human Skin;" the object of which was to show that vegetable parasites do not produce the different varieties of skin disease; but that when certain diseases already exist, the fungi finding a suitable soil, greatly aggravate and often change the type of disease; that these diseases are always associated with neglect of person, dirt, bad air, want of light, and sufficient nourishment; that the spores of fungi are always floating about in the atmosphere, and thus ever ready to be deposited and take root in a favorable soil. Of this Mr. Hogg gave many illustrations, and showed that although yeast, penicillium, aspergillus, and some other fungi, had been separately classed, nevertheless they could be made to pass through the same changes, and produce ferments that could not be recognised one from the other, and therefore difference of form he believed to be entirely due to the soil or nourishment supplied, and dependent on such circumstances as whether the growth of the fungi takes place in a sickly plant, a saccharine solution, or an animal tissue.

Mr. Erasmus Wilson, F.R.S., who has devoted much thought to this subject for a number of years, entertains different views on this subject, and views which commend themselves to the attention and inquiry of microscopical observers. He states that in an unhealthy state of the body and skin the epidermis is produced unhealthily; that one of the forms of unhealthy condition is their persistence of the nutritive granules of the epidermis in the crude and fœtal state, and that in this state they take on the process of proliferation, by means of which the substance of the rete mucosum is converted into a phytiform tissue, composed of cylindrical shafts, simple and branched, and granules, and that it is to the granules that the term sporules has been applied. According to him, therefore, the parasite theory of cutaneous disease has no existence; in fact, the phytiform structure does not come from without, but is developed where it is found, and that, in essential nature, it is a perversion of a normal process, a degradation of vitality of the cell-elements, and a transformation of an animal structure into a lower form of organism, into one which is usually regarded as a vegetable tissue. He further states that this morbid change occurs beneath the epidermis without breach of the latter, and in the substance of the rete mucosum, and that the morbid tissue moves to the surface only by progressive growth. Mr. Erasmus Wilson believes the perforation of the horny layer of the epidermis by a mucedeinous sporule impossible, and regards the cause of the development of the phytiform tissue, and consequently of the disease, as coming from within, dependent only upon the vitality and health of the individual, and independent of personal cleanliness and exterior conditions of every kind.

A more intensely interesting field can scarcely be found for the labours of the micro-physiologist than that chosen by Mr. Hogg.

The most important novelty of the year has been the successful application of the spectroscope to the microscope. In Mr. Sorby's first experiments of this class ('Quarterly Journal of Science,' 1865, p. 198) he used such an arrangement as could be made with a simple triangular prism. This was placed below the achromatic condenser, so that a minute spectrum of any transparent object could be examined, and the particular rays which it transmitted easily seen. Shortly after the publication of Mr. Sorby's paper, Mr. Huggins sent a paper to this Society,* in which he proposed to adapt a spectroscope to the eye-piece of the microscope, so as to enable us to view the spectra of opaque as well as transparent objects. After this meeting, Mr. Browning suggested to Mr. Slack and myself that a direct-vision spectroscope would be the most convenient form for this purpose; and on the 14th June he read a paper in which he showed how a compound direct-vision prism could be applied to the microscope as an eye-piece. The exact form of prism finally adopted was determined after communication with, and experiments by, Mr. Sorby. The slit may be either in the focus of the object-glass, or in that of the eye-piece or of one of its lenses.

One of Mr. Sorby's arrangements was to have the slit in the focus of the object-glass, and the compound prism between them. In using a binocular microscope, this form enables us to see the spectrum with both eyes, and also to use a micrometer to measure the position of any absorption bands. It is

* 'Quart. Journ. Mic. Sci.,' July, 1865, p. 85.

adapted for the study of coloured solutions in test-tubes, but cannot be employed with objects less than $\frac{1}{10}$th of an inch in diameter.

For this reason it is more generally advantageous to employ a form of apparatus with the slit in the focus of the upper lens of the eye-piece, made achromatic; and it is also very much better to have such arrangements that two spectra can be compared side by side, as described in his paper in the January number of the 'Popular Science Review,' 1866, p. 66.

With the Sorby-Browning spectroscope, the spectra of very minute bodies can be seen to great advantage either by transmitted or reflected light; and their being only partially transparent and of considerable thickness does not signify much. Of course, the use of such an instrument is almost entirely restricted to coloured bodies, though in some cases the colour may be very faint; but whenever colour is an important character, it appears that such a method of investigation should not be neglected. The value of the results depends very much on whether the spectra do or do not give well-marked absorption bands; and there are many cases in which the facts are unfortunately very indefinite.

As far as can be judged at present, the chief use of the instrument will be in forming a more definite opinion respecting the nature of solutions, coloured either naturally or by the addition of tests; to the study of blowpipe beads, and of natural and artificial crystals; and, in some cases, to the determination of the nature of the minerals met with in the sections of rocks and meteorites in which chemical analysis cannot be employed.

There are also some branches of natural history and physiology to which it might be usefully applied; but hitherto Mr. Sorby has been more anxious to bring the instrument itself to perfection, and to establish its fundamental principles, than to employ it extensively in deciding any other practical question than the detection of minute blood-stains in cases where ordinary microscopical examination could not yield decided results. As I have previously stated, Mr. Huggins and Mr. Wenham adopted an opposite course to Mr. Sorby: instead of applying the microscope to the spectroscope, which was Mr. Sorby's plan, they applied the *spectroscope* by using it as an eye-piece to the microscope; and, in addition to the examination of solutions or transparent objects, they were enabled for the first time to investigate the spectra afforded by small and strongly-illuminated objects that were opaque.

The spectroscope first employed in this way was that with which Mr. Huggins made his remarkable discoveries in the new science of Celestial Chemistry. Such an apparatus, however, was far from convenient, and Mr. Browning turned his attention to the subject with his accustomed skill, and soon produced the "Sorby-Browning Spectroscope," which we have already described as in the highest degree effective and convenient.

Mr. Sorby succeeded, at an early period of these inquiries, in obtaining characteristic spectra with exceedingly small quantities of blood: but with Mr. Browning's apparatus, and with the use of Messrs. Smith and Beck's $\frac{1}{20}$th, or Messrs. Powell and Lealand's $\frac{1}{25}$th, a distinct spectrum can be easily obtained from the third or the fourth of a single human blood-corpuscle.

The size of such a corpuscle will vary, according to Mr. Gulliver, from $\frac{1}{3200}$th to $\frac{1}{3500}$th: thus, if we take $\frac{1}{12000}$th of a square inch of a human blood-corpuscle, we find that it contains enough of that peculiar substance *cruorine* to give a characteristic result. For such delicate experiments the blood must be quite fresh, and a red-coloured corpuscle selected.

In the 'Proceedings of the Royal Society,' July 19th, 1865, and in the July number of the 'Popular Science Review,' Dr. Beale published a paper on the "Highest Magnifying Powers, and their uses." In this paper Dr. Beale speaks of the difficulty of using the $\frac{1}{50}$th and other high powers complained of by practical men, and points out very clearly that success in their use is dependent upon training. Dr. Beale says, "It is necessary to begin by studying the simplest things in the easiest and simplest manner, and proceed only by degrees to the more complex." This is the only process by which observers can hope for success; and it is this patient labour proceeding step by step, from the lowest to the highest, that constitutes, in fact, the difference between a trained and an untrained observer, not only in Microscopy, but in all minute and accurate investigations. In the ordinary occupations of an observatory the trained eye can see distinctly, and the educated hand measure accurately, that which the uneducated eye cannot see at all. So, doubtless, it is with the use of high powers as applied to the microscope: many beautiful details can be seen by the carefully-trained eye, and traced by the trained hand, of which not a trace is even suspected by observers wanting in this educated eye and equally important educated hand.

In the September number of 'Silliman's Journal,' Professor

Smith, of Kenyon College, Ohio, U. S., described a new condenser he had devised for the opaque illumination of objects under high powers. It has long been felt that it would be immensely to the advantage of microscopic anatomy if such small bodies as the blood-globules could be viewed as opaque objects with high powers. Hitherto there have been great and insurmountable difficulties in the way, but Professor Smith has at length contrived an illumination which promises to effect good service.

In this instrument a pencil of light is admitted above the objective and thrown down through it on the object, by means of a small silver mirror placed on one side, and cutting off a portion of the aperture. Professor Smith sent an instrument of this kind to Mr. Lobb, with a request that he would place it in the hands of Messrs. Powell and Lealand. These gentlemen devised what they considered to be an improvement, and substituted for the small silver mirror, to which Professor Smith had given a preference, a flat glass placed at an angle of 45°, across a tube interposed like an adapter between the objective and the microscopic body. A pencil of light entering by a side aperture striking against this flat glass is partly reflected down through the objective and on to the object, the magnified image of which is viewed through the glass.

If the flat grass is ground so as to have parallel surfaces, no noticeable error is introduced even with the highest powers. About the same time, or a little later, that Messrs. Powell and Lealand were thus at work, Mr. Richard Beck devised a similar arrangement; but he employed a circular disc, such as used for covering microscopic objects, instead of the more solid glass of Messrs. Powell and Lealand.

At the December meeting of the Society Mr. Beck exhibited his new mode of illuminating opaque objects under the highest powers. It consisted of a disc of thin covering glass set at an angle of about 45° in the optic axis of the microscope. This was placed close behind the setting of the object-glass in a special adapter, having a suitable aperture for admitting light from a lamp, the rays from which were reflected downwards. The object-glass thus served for its own achromatic condenser. The definition of the object is not injured by the transmission of rays through the thin glass.

The idea of employing the object-glass as its own condenser was suggested by Mr. Hewitt upwards of five years ago. In consequence of his communication Mr. Wenham was induced to give the plan a trial. A concave speculum was fitted at an angle into the body of the microscope, having a central hole sufficiently large to admit the full pencil from the object-glass, through the back of which the rays from a lamp (passing through a hole in the side of the body) were reflected downwards. The object was strongly illuminated, but there was so much glare from the internal fittings, and from reflection from the back of the object-glass lenses, that the experiment was abandoned, and an unfavorable opinion given of its practicability. It is now demonstrated that the light was too intense, and the most useful or central portion of the rays were wanting. The simple disc of thin glass and its partial reflection meets these objections. If such a disc is used with a little care it is found to be quite as accurate as the other plan, and the natural surface of the glass is more reflective than any artificial one. It has, however, the disadvantage of extreme fragility. By making the object-glass its own condenser, and examining diatoms as opaque objects under high powers, we can now hope to solve the much vexed question as to the true nature of their markings. Mr. Browning has employed the apparatus in a form much more nearly resembling that of the original inventor, only substituting a small glass-reflecting prism for the metallic reflector. Some advantages are gained by the adoption of this arrangement, which, I believe, Mr. Browning will describe in a short paper at our next meeting.

Mr. Hewitt exhibited, at a recent meeting of the Society, a plan in which *one tube* of a binocular instrument was surmounted by a small flat mirror which sent a pencil of light vertically down one tube, and then, by means of the prism employed in the binocular arrangement, down through the other.

The objections to this plan are, first, that the prism cuts off a large portion of the aperture; secondly, that it cannot be used when binocular vision is desired; and, thirdly, that it is not adapted to very high powers, as microscopists are agreed that when a prism is used with great powers it must be placed close to the optical combination, and not at the distance from them in which it occurs in the ordinary binocular arrangements. This plan may, however, be liked for its simplicity by many who do not desire extreme magnification, and who operate with highly reflective objects.

These new modes of illumination bid fair to correct many errors of interpretation resulting from an exclusive use of transparent illumination, and we hope that in the hands of the members of this Society they will reveal many peculiarities of structure as yet unknown.

Since the arrival in this country of the condenser sent by

Professor Smith to Mr. Lobb, American opticians are stated to have improved the details of the instrument, and it will be interesting to see it in what the inventor may consider its most perfect form.

Some time last year Mr. James Brooke and Dr. Beale spoke of the advantage of using a Kelner eye-piece as a condenser for the illumination of certain delicate transparent objects. Since then Mr. Webster introduced a condenser bearing his name. He employed an achromatic combination of considerable curvature, with a bull's eye in front of it, and he also devised a novel form of stops in the diaphragm which he employed. This apparatus yields approximately good results with objects of various depths from one inch upwards, and with those of small apertures it gives, when required, a dark ground illumination. Mr. Highley introduced a variation which seems to be an improvement in the optical part of this apparatus; he employed an achromatic combination, of which the inner lens is a bull's eye of very great curvature. This instrument is well spoken of by those who have tried it, and like that of Mr. Webster's, it is adapted to a considerable range of powers. With very difficult and delicate objects it does not, however, quite satisfy the requirements of observers, and Mr. Highley is now engaged in devising a further modification, which he expects will offer a combination of advantages not yet presented by any single instrument.

In the January number of 'Popular Science Review,' at page 116, mention is made of Collins-Webster's condenser. It consists of a double concave lens cemented to a very deep convex lens, and capable of being fitted beneath the stage of any ordinary microscope. Of this I will only briefly remark that I learn that it performs well, and gives some results that have only hitherto been obtainable by using much more expensive apparatus.

A very ingenious diaphragm has been also introduced by Mr. Collins, by the use of which power is given to the observer to graduate the aperture of illumination with great accuracy, and without losing sight of the object; this is done by the use of a screw, withdrawn or driven by a milled head, causing a lozenge-shaped aperture to gradually open and close till it is reduced to a mere point.

For very many subjects of research this diaphragm is a great improvement on any diaphragm furnished with a number of holes.

Messrs. Powell and Lealand have introduced into their large-angled condenser a new stop, consisting of two slits at right angles to each other. This arrangement is very convenient for the display of both sets of lines in that difficult object, the Amician test. A similar plan, I believe, exists in the Rev. J. B. Reade's hemispherical condenser.

Mr. Richard Beck's "Sorby Illuminator" well deserves mention. It was specially constructed for those examinations of metallic and other mineral bodies, the structure of which has been elucidated by Mr. Sorby.

It consists of a large parabolic reflector attached to the objective. This affords a brilliant illumination of an *oblique* character; and by turning a milled head, a second small flat mirror becomes so placed as to stop all action of the parabolic mirror, and substitute for it an illumination which is nearly *vertical*. The effect is very striking, and often exceedingly instructive. If, for example, we have a transparent mineral under inspection, slanting illumination gives one information to be obtained by a very *penetrating* view, while the vertical one almost destroys penetration, and brings out minute scratches and markings on the surface. This apparatus is best adapted for powers varying from $1\frac{1}{2}$ to $\frac{2}{3}$rds inch.

Messrs. Smith and Beck have introduced, during the past year, a new-pattern cheap microscope, called the "Popular Microscope." The chief arrangements of this apparatus have been devised for the purpose of giving many of the advantages of higher class instruments at a reduced cost, and this object appears to have been gained. The mechanical stage adapted to it is very simple and flat. Two milled heads work concentric spindles, as in Messrs. Powell and Lealand's form. One of these spindles has a friction hold upon a plate which it carries up and down, while the second spindle pulls the first backwards and forwards horizontally, and the movable plate is so attached as to go with it. Thus, rectangular motions are very simply obtained.

Considerable attention has been recently given to various forms of aquatic boxes for maintaining a continuous supply of fresh water to objects under constant observation, which thus sustain their vital growth for a long period. The employment of these is strongly to be recommended, for there is yet much to be discovered concerning the metamorphoses which some of the lower microscopic forms of plant and animal life pass through, and a patient investigation will probably show that many which are now classed as distinct species are merely different phases of the same type, and which alternate in a higher or lower scale of development according to the varied conditions of temperature and nutrition under which they are grown.

In the September number of 'Silliman's Journal,' Professor Smith, of Kenyon College, has furnished us with a better means of watching the growth of a plant under the microscope. He described a very useful invention for the purpose, which he called a *growing slide*, or trough, one of which, constructed by Mr. Suffolk, was shown to the Society, and is doubtless a cheap and useful contrivance.

It consists of two pieces of thinnish glass, cemented together; in one corner of the upper cover a small hole is bored, and through this a fresh supply of water is introduced without in any way disturbing the plant or living object under inspection. This can be constructed for a few pence. Mr. Beck has given us an improvement upon this: a description of this gentleman's may be found in our 'Transactions.'

During the past year no improvement has been made in the construction of microscopic object-glasses. But we would call attention to the application of the single-front lens to the highest powers, in place of the triple combination usually employed by the different makers. A simple anterior lens transmits more light, gives clearer definition, with any desired extent of aperture, and, from its simplicity and comparative freedom from errors of workmanship, is worthy of recommendation. The chromatic and spherical aberrations may be perfectly corrected in this form; and Mr. Wenham informs me that there are now object-glasses existing, of various powers, having only a single-front lens, that will challenge comparison with the best of the usual form.

It is suggested by Mr. Wenham, who has made practical investigations in the optical branch of Microscopy, that further improvements may be anticipated in the performance of object-glasses by discoveries connected with the quality of the glass employed.

It is generally supposed that the dispersive power of flint glasses increases with its density: this, however, is found not to be the case. The best glass for the highest powers that has been made is a Swiss flint having a density of 3·686. A few years back, Messrs. Chance made some beautiful clear and colourless flint glass not liable to tarnish, and which polished well, having a density of 3·867. Mr. Wenham availed himself of the opportunity and procured a quantity, but found, on trial, that the dispersive power was less than in the Swiss flint, at the same time that its refractive power was greater: these combined faults being in the wrong direction, rendered the glass quite inferior for the construction of the higher powers.

It thus became evident that some material had been added which diminished the length of the spectrum and increased the refractive power.

In trying experiments on the manufacture of glass for optical purposes, the drawback has hitherto been the necessity of operating on large quantities with expensive furnace arrangements; for it is useless to attempt to make small samples in the usual forms of glass furnace, on account of the intrusion of a larger proportion of impurities which impair the quality of the glass.

With the aid of the now well-known forms of gas furnace, test-samples not exceeding an ounce in weight may be fused without the encroachment of extraneous matter; and thus, if combinations of all the known materials that can be employed in glass-making were worked into equilateral prisms, and their spectra measured, we should probably arrive at valuable results, and obtain a flint and crown glass of greater and less dispersive power than at present known, and thus be enabled to employ longer radii in the contact or cemented surfaces of microscopic object-glass.

The subject of a Royal Charter of Corporation has specially occupied the attention of the Council during the present Session, and it is the opinion of your Council that this Society should make application for a Royal Charter.

The Society, as now organised, possesses no legal existence. In the infancy of the Society no great inconvenience would arise out of this; but now that we have acquired property to some amount,—that is to say, a large and increasing Library, a large and increasing collection of Microscopes and Microscopic Objects, &c., and a considerable sum of money, at present invested in Government Stock, in the names of Trustees,—it appears to your Council that it would be the duty of the Society, as well as an act of prudence, to present a petition to the Crown, humbly praying that Her Majesty would be graciously pleased to grant a Royal Charter for incorporating into a Society the several persons who have already become Members.

The Society, as a corporate body, would be better able to promote a general spirit of inquiry on Microscopic researches; the Council and Members would be more closely connected together, and more closely connected with all who had preceded them; and the lawful contracts or engagements made by our Council would be binding on their successors. We are possessed of certain property, but it would not be easy to establish legal ownership for what we have acquired. The present Members are in no degree successors by law to past Members who accumulated the said property, and it would be difficult to establish a legal claim to the then proceeds. We cannot appear in a corporate form in a court of equity; we cannot sue or be sued. Our Members can pay or not their subscription, as it seems good to them. We have no power to deal with any Member who may fall into arrears, to recover the money. Should we fall into debt, they are not the debts of the Society, but are the debts of the individual by whose order they were incurred.

Your Council, for these reasons, and for many others, consider it would be for the benefit of all Members, and to all who may hereafter be elected Members, to endeavour to acquire legal power to act and do in all things as fully and effectually, to all intents and purposes whatsoever, as any other body politic and corporate can act and do, and that every other person and other bodies politic and corporate might be able to negotiate legally with this Society.

The necessary fees are considerable; but the Council hope they will not be compelled to charge the expense either to the ordinary revenue account or to the money invested in the Funds. They hope to raise the necessary amount by subscriptions among the Members. Several names of subscribers have already been given in; and in the event of this Annual Meeting approving of the propositions that will be placed before them, no time will be lost in taking the preliminary steps.

In the event of a Royal Charter being granted, the distinctive title of the proposed corporate body would have to be selected, and the initial letters should be those of no other corporate body. The natural title would be "Fellow of the Microscopical Society," with the letters "F.M.S.:" but these letters are already in use. But if we elect to keep our present title, "Fellow of the Microscopic Society of London," the distinguishing letters of the Society would be "F.M.S.L."—a distinction not in use by any other Society.

A good deal of time has been devoted by a Committee, consisting of myself and the Secretaries appointed by your Council, to revise the rules of this Society previous to reprinting them, and your Council have given great attention to this matter. On looking over the rules as they at present stand, it will be found that the Council have no power to call a Special Meeting of the Members, should circumstances arise rendering such a meeting necessary, and this power will be asked of you to-night. It is likely that at an early meeting the results of the deliberation of the Council will be laid before you.

The Quarterly Journal continues to publish our proceedings with the same features by which they have been characterised for several years past; these scarcely meet the wants of the present day; for instance: Papers read last December will not appear till the beginning of April, and I have not the advantage of their perusal in preparing this address; I cannot but feel that as this Society increases in importance, some change in the publications must take place. There must be some more easily accessible channel of publication, so that the proceedings at one meeting may be read and thought over before the next meeting. Of what interest can many papers have four months old, excepting historical, or what influence can they exercise on many investigations which are varying from month to month—the history of the spectroscope last year in its early stages, for instance. Should even a slight addition to the expense of publication be incurred, I think it would be amply compensated by the more general diffusion of the Society's proceedings, and their far greater usefulness. I candidly confess I am not satisfied with the mode of publication at present, and feel certain that if the number of members of this Society increase, and particularly if we should become "Fellows," that the officers of this Society must take such steps that quick publication of its proceedings under their own superintendence, untrammelled by the present arrangements, will follow every meeting of the Society.

It remains only for me to observe that we have skilful observers with increased and increasing optical power, and improved instruments generally; we have members who are careful analysers, as shown by our papers of this year. We have others who can delineate whatever they see. What may justly be expected from such men in advancing their chosen science?

It remains for us to assist and encourage young observers, to assure them that all criticism on their labour will be friendly, that our justice will be impartial. We want the co-operative assistance of numbers. Every eye that can see, every hand that can record or delineate, and every intellect that can arrange, combine, or analyse, may contribute to the results we seek; and these results, it must be borne in mind, are intimately connected with the advance of Geology, of Mineralogy, of Palæontology, of Physiology, indeed, of all the departments of Natural History. Our united efforts for success are necessary, and surely if we are united the result will be success.

Proposed by Mr. Browning, seconded by Mr. Gray, and carried unanimously—"That the thanks of the meeting be given to J. Glaisher, Esq., President, for his address, and that the reports and address now read be received, and that they be printed and circulated among the members without delay."

The following motions, arising out of that part of the President's address which related to the incorporation of the Society, were then put and carried :

Proposed by Mr. Allen, seconded by Mr. Hilton—"That this meeting is of opinion that to be incorporated by Royal Charter would advance the interests and increase the usefulness of this Society."

Proposed by Mr. Lobb, seconded by Mr. Brand—"That the Council be requested to take steps necessary for obtaining a Royal Charter of Incorporation."

Proposed by Mr. Brooke, seconded by Mr. Ince—"That a private subscription be opened for meeting the expense connected with procuring a Charter, and that the Secretaries issue circulars for that purpose."

Proposed by Mr. Tyler, seconded by Mr. Hill—"That in the event of a Charter being granted by the Crown, the Society be incorporated under the style and title of 'The Microscopical Society of London,' and that the Members use the distinctive letters F.M.S.L.

Proposed by the President, seconded by Mr. Roper, and carried unanimously—"That in the clause in p. 15 of the Bye-Laws the following addition be made. After the words 'Annual Meeting,' to insert 'or at a Special General Meeting to be convened for the purpose by the President with the sanction of the Council.'

The Society then proceeded to ballot for Officers and Council for the year ensuing.

Mr. R. Beck and Mr. Hogg were appointed scrutineers of the ballot.

Upon the scrutineers making a report of the result of the ballot the following gentlemen were declared duly elected ;

President—James Glaisher, Esq., F.R.S.

Treasurer—C. J. H. Allen, Esq.

Secretaries { George E. Blenkins, Esq.
F. C. S. Roper, Esq.

Four Members of the Council—

W. L. Freestone, Esq.	Dr. Millar,
R. Mestayer, Esq.	S. C. Whitbread, Esq.

In the place of—

Dr. Beale,	R. Hodgson, Esq.
H. Deane, Esq.	J. N. Tomkins, Esq.

Who retire in accordance with the Bye-Laws.

Proposed by Mr. W. H. Hall, seconded by Mr. Browning, and carried unanimously—" That a vote of thanks be tendered by the Members of the Microscopical Society of London to their President, Secretaries, and Council, for their valuable services during the past year.

Notes *on a* Brass Slide Clip.

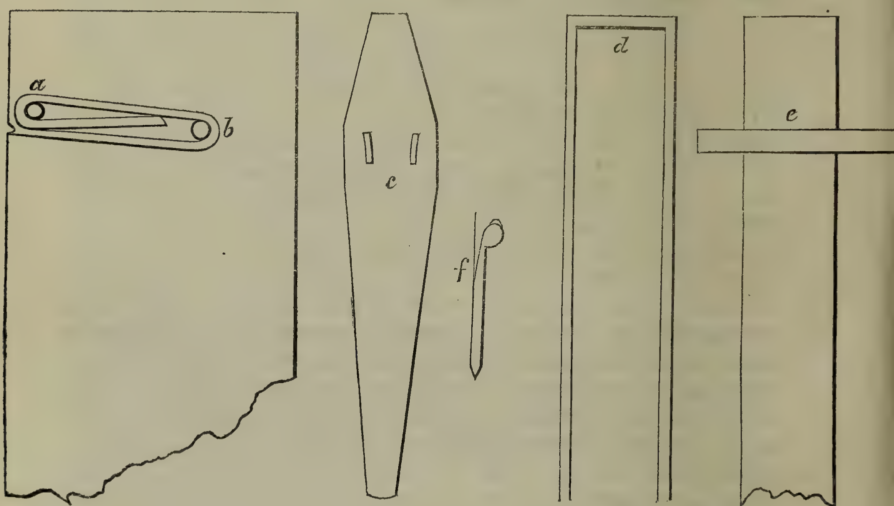
By R. L. Maddox, M.D.

(Read March 14th, 1866.)

When photographing very minute objects with high powers, as the $\frac{1}{8}$ or $\frac{1}{12}$, I generally mounted them between two thin glass covers, and then fixed these to a card stiffened with black varnish, and pierced in the centre with a small circular punch, the little glasses being held in place by two narrow bands of paper gummed at each end and fastened across the card, so that the covers could be slid in any direction to bring objects not in the centre into view, or to shut out others on the same mounting. This plan answered, and was adopted to prevent injury to the object-glass in case of any slip with the focussing rod. Having occasion to re-examine some of the objects, and also wanting some simple method for holding the covers on the usual slide, or a pierced slide of glass, metal, wood, ebonite (as the one sent) or card, I devised the accompanying, which answers well, costs comparatively nothing, and can be made by any one in a few minutes. It also answers to form a live trap and growing slide if required. It must only be regarded as a "country expedient," when more perfect plans, such as my friend R. Beck's, are not at hand.

The mode of making is the following. Procure a few feet of brass wire, the number, I think, is 18, or about the size figured; cut several seven-inch lengths; also obtain some thin sheet brass (called, I believe, laten brass), about the thickness of an ordinary address card; cut off some strips five inches by half an inch, place these singly on a flat piece of iron, or the ordinary flat iron, and run the head of a hammer heavily along them several times to furnish some degree of spring; divide these in the middle into two-and-a-half inch lengths, then with a stout pair of old scissors or small shears cut them into the shape of fig. *c*, and punch with a small turnscrew two cuts, as shown in figure at the shoulder; run a fine file along the edges to take off the burr.

These ready, take a piece of hard wood any suitable length,



one and a half inch wide and half an inch thick; file a small notch on one of the narrow sides, and about the tenth of an inch above it; drill through the wood a hole the size of an ordinary bradawl, as in the fig. *a*, *b*, and another on a line from the notch distant three quarters of an inch; cut two stout wires one and half inch in length to pass into these holes; one is seen in section in fig. *e*. Set the wood in the vice, notch from you, and bend one of the slips of brass through the two cuts with a piece of the wire bent at double right angles, as in fig. *d*, and place it, wire fitting, into the notch of wood; now with the pliers turn both ends of the brass wire under the wire *b* at each side, then over the wire *a* each side one and half turn, bring the ends backwards in a straight line, and cut off the portion held by the pliers about a quarter inch or so; withdraw the wires *a*, *b*, remove the clips, and finish by turning up the narrow end at half an inch over one of the stout wires, and double it on itself, to form a fulcrum from the spring (see side view *f*.) The wire part may require a little pressing together to set nicely on the slide. One suffices for holding a cover to the slide, two when placed one above and one below a pierced side for a live trap. If the nicks are conveniently chosen the slide, when reversed, will be in the same plane from the object-glass.

As a growing slide, or for keeping Confervæ or Algæ a short time, use a full-sized square cover, and with it attached by one of the clips, the end of which should be platinized, place the slide on a weighted bung, which has a hole bored or burnt through its diameter about midway, and a small hole from above to below through the centre of the cork; with a saw cut two slightly slanting saw cuts through the cork into the large cross hole, less than a quarter of an inch apart; set two pieces of glass about one inch by half an inch into these cuts, so that they nearly touch at the top, then place the slide and object between them and float the bung on a basin of water, seeing that the liquid can enter at the side holes as well as from the smaller one below. The water rises by capillary attraction, and keeps up a supply to the cover.

Trusting the above may be found useful to others, may it form an apology for trespassing on your notice?

On the STRUCTURE *of the* EGG *in* SCATOPHAGA.

By TUFFEN WEST, F.L.S., &c.

(Read March 14th, 1866.)

THE leg of the yellowish-brown fly, *Scatophaga stercoraria*, is a favourite object with microscopists, on account of the large size of the pulvilli, the transparency of the cushions, and the distinctness and exquisite regularity of arrangement of the tenent hairs.

The egg of the same fly has, I believe, not been *minutely* described, though the remarkable structure presently to be named, has been briefly alluded to by Mr. Westwood in the following terms*:

* Introduction to Modern Classification of Insects,' vol. ii, p. 572.

"The species of Scatophaga revel upon excrement, in which also they deposit their eggs, which are of an oval form, but have two broad divergent appendages at the upper end; the object of which appears to be to prevent them from sinking in the matter in which they are deposited."

The eggs (figs. 1, 2, Pl. VII) are about a line in length, of a long elliptic form, somewhat arched backwards, the ventral surface being much the most convex. The top may be described as cut off obliquely from before backwards; covering the opening thus formed is a lid or small door, of a somewhat triangular shape, which is articulated behind. A little beyond the centre of this lid, on its under side, arises at tongue-shaped process, by which the aperture is completely covered. From the upper fourth of the egg shell, where the cover is joined to it, arise with a gentle curve, and pass out obliquely on each side, two arms or processes, about two thirds the length of the entire shell. The obliquity with which these pass off, as well as the amount of their curvature forward, vary in different examples, but in what may be considered typical specimens the angle formed with the axis of the shell is about 45°.

There can, I think, be no doubt as to the purpose served by these remarkable appendages, and that it is as suggested by the author above quoted.

Investing the larva, and left behind after its exit, is a membrane, represented at *m*, in fig. 3.

The egg-shell, which is of a horny texture, is covered with hexagonal reticulations, the interspaces minutely punctate with elevations (fig. 4). The processes are mere cuticular derivations, solid throughout, and finely elevato-punctate (fig. 5). That portion of the lid which covers the actual opening is of a rich, deep red-brown colour, and of a somewhat different structure from that named above, being mapped with lozenge-shaped or 5-sided areæ; in the centre of each area is a rounded transparent spot, the space around very finely punctate (fig. 6).

The eggs are deposited on the same material by different flies, and at different periods, so that larvæ may be met with growing rapidly at the same time that others occur in the most rudimentary condition. Fig. 7 represents two broad toothed processes, from a larva gently pressed out of one of the cases; the anterior pair of spiracles was distinctly seen in this individual; but little else of structure could be traced in the granular mass of which it was composed. Larvæ already hatched, and three lines in length, were obtained at the same time.

Description *of the* Skin *cast by an* Ephemeron, *in its* "Pseud-imago" Condition. By Tuffen West, F.L.S., &c.

(Read March 14th, 1866.)

The following observations appearing to have some bearing on the disputed question as to the exact nature of the penultimate change in the Ephemeridæ, are brought before the notice of the Microscopical Society with the hope that they will prove to be a small contribution towards our knowledge of a subject confessedly requiring further elucidation.

In wandering near water in the country on a summer's evening, some of the members of our Society may have found themselves speedily covered by small whitish looking flies, with two or three long tails a piece, which after alighting on some portion of the dress, remain quiet for a brief period, and then fly off, leaving behind them an alter ego, in shape of a perfect cast of their integuments. These casts may sometimes be found on railings, branches of trees, &c., in the vicinity of water.

On Frensham Common are two considerable pieces of water, known in these parts by the names of the "Great" and the "Little Pond," which are favoured resorts of numerous aquatic insects, and from the latter of which on a fine summer's evening, clouds of a small species of May-fly arise, and settling on the hat and upper portions of the dress, soon cover him with their exuviæ.* So rapidly does the operation take place, that it was not till the sight had become educated by attempts on several occasions to observe the whole, that I became able to witness the entire process, whilst the (to the naked eye) complete disappearance of the pellicle covering the wings left a mystery on the mode of their reaching me which I was long unable to solve. The distance from the water at which the clouds that so thickly covered one occurred was considerable; I counted 230 paces from the water's edge to the boughs of a Scotch fir, which was fairly whitened with them, the tree being the nearest of a clump growing on a neighbouring hill.

From their extreme delicacy the bringing home uninjured of these cast-skins for microscopic examination is a very difficult matter; but an individual of a larger species having

* In Westwood's 'Introduction to the Modern Classification of Insects,' vol. ii, at p. 27, is a graphic description of the process, and in a foot-note on p. 28 a discussion of the nature of the metamorphosis.

settled and undergone its final ecdysis on the muslin curtain of one of the windows in the house in which I at present reside, tidings were quickly brought to me, and I succeeded in obtaining the specimen in beautifully perfect condition, which forms the subject of the following notes. I regret much that the fly, which was also obtained in first-rate order, and which lived with me nearly twenty-four hours, was afterwards accidentally destroyed, so that I am unable to give the species.

The entire cast measures eight lines in length, nearly five of which belong to the tails (Pl. VI, fig. 8). The three divisions of the thorax are well indicated; the integument of the legs and of the antennæ (*a, a,* fig. 9) are very perfect; the reticulate corneal covering of both the sessile and the columnar pairs of compound eyes is left, the areolation being most distinct on the latter.

Behind the slit on back of the thorax through which the creature's body was extricated, is a mass composed of the pellicle from which the wings were withdrawn (*a. p.*, fig. 8); and (if I mistake not) the investments of the puparial gills.

The most noticeable feature, however, is the presence of the two main tracheary tubes (*tr, tr,* fig. 9), which appear to arise at either side from the anterior part of the pro-thorax. Doubtless by dissection the spiracles whence they arise would be found, and the true nature of the mass at the hinder part of the thorax could be ascertained by floating in water, but I am unwilling to sacrifice so perfect a specimen for the sake of these details, which may perhaps be obtained from other examples in the coming season.

The larvæ of *Lepidoptera,* in changing their skin, cast also the lining membrane of the great tracheal trunks; it seems fair to infer, therefore, from the specimen now under consideration, that in the so-called pseud-imago condition of the Ephemeridæ, we have merely the pellicle forming the inner investment of the pupa, carried out by the fully-formed insect in its first flight, and shortly got rid of.

As a small contribution to the history of "minute markings," which will some day, and that probably before long, have to be considered in its extended bearings, it may be mentioned that the tegument of the May flies is thickly covered with a minute elevated punctation.

On the True Reading *of* Measurements *with the* Cobweb Micrometer. By Capt. J. Mitchell.

(Communicated by F. C. S. Roper, F.L.S.—Read March 14th, 1866.)

It is now some two years since I forwarded to the Editors of the Journal some remarks on the true zero position of the filaments in the cobweb micrometer. The paper does not appear to have reached the Editors. The mail steamer having been wrecked, it was probably either destroyed or rendered illegible by the salt water.

I have been so much engaged since that I had no time to return to the subject. In doing so now I have thought it would be preferable to request you to do me the favour to bring the subject before the Society. I hope your rules do not exclude communications from a non-member, at least from one residing abroad.

The late Professor Quekett, in his 'Treatise on the Microscope,' 2nd ed., p. 221, says, "the cobwebs should exactly coincide when the graduated head of the micrometer is at zero," and the same directions are repeated at p. 223. It appears from this that he did not take into consideration the thickness of the filaments, supposing, perhaps, that they were too fine to affect the measurements, which, however, is not the case.

I assume that, in ascertaining the value of the divisions of a screw micrometer, we should endeavour to make the axes of the cobweb filaments coincide with the centre of the grooves ruled on the stage-micrometer, and that in measuring the distance between the striæ of diatoms the same method would be pursued. In both these cases the true distance is that between the axes of the filaments; and as these are supposed to coincide, when the micrometer head reads zero, the measurement will be correct. But the measurement of the interval between lines is neither the sole nor the chief use of a micrometer; on the contrary, the greater number of objects require to be placed *between the filaments,* and when this is the case the quantity shown by the micrometer head will be the diameter of the object plus twice the semi-diameter of the filaments, or, which is the same thing, the diameter of one filament.

Now, with the same micrometer this excess is a constant quantity with all powers alike. With my micrometer a negative eye-piece, one by Powell and Lealand, with four filaments, amounts to two divisions of the micrometer head.

It is evident, therefore, if the value of the divisions had been obtained with the micrometer adjusted to zero when the axes of the filaments coincided, the reading would be too great by two divisions for every object placed *between* the filaments. But though the *quantity* is constant, the *error is not,* for it becomes greater as the object is smaller, *i. e.* as it occupies fewer divisions of the micrometer head. For instance, with my $\frac{1}{12}$th objective one division of the micrometer is equal to $\frac{1}{523,233}$rd of an inch, measuring *from the axes of the filaments.* If I place *between the filaments* an object that is measured by one hundred divisions, the true measure is evidently but ninety-eight, and the result is too great by one fiftieth; but if the object be measured by ten divisions, the correct measure is but eight, and the error amounts to one fifth! Thus, the error is always in inverse proportion to the magnitude of the object, the *smallest* readings giving the *largest* errors. In the case last supposed an object that measured $\frac{1}{65,404}$th of an inch would appear to measure $\frac{1}{52,333}$rd of an inch, *i. e.* if, as I presume is generally the case, the thickness of the filaments be not allowed for.

The means of obtaining exact measurements is readily applied; thus, if the filaments coincide when the micrometer head is at zero, a deduction equal to the thickness of one filament must be made whenever the object is placed *between them,* or after the value of the divisions has been obtained with the filaments coinciding at zero the micrometer head may be shifted until it is at zero, when the filaments are parallel. The reading will then be correct for all objects placed between the filaments, but an addition equal to the diameter of one filament must be made to the measurement of all intervals between lines, striæ, &c.

The thickness of the filaments is easily obtained by placing the movable filament in contact with the fixed one, first on one side, then on the other; half the number of the divisions passed over by the micrometer head is the distance which it must be set back to place the filaments in contact when the reading is zero.

No stage micrometer that I have seen is ruled sufficiently fine for the higher powers. With a one-twelfth the grooves are inconveniently wide. A large number of measurements will probably give a mean not very far from the truth; but it would be more satisfactory to have such lines as the filaments would just cover, as is the case with the lower powers. The $\frac{1}{2000}$th of an inch would also be a more convenient division for the higher powers than the $\frac{1}{1000}$th, which occupies too much of the field.

It has been said, not only that the measurements afforded by the cobweb micrometer are unnecessarily delicate, but, which is a contradiction, that they are also not so exact as they appear to be, and that Jackson's glass micrometer is sufficiently accurate for all purposes. To this I beg to reply, first, that measurements, to be of any scientific value, should be made with the most perfect instrument which science and manufacturing skill have placed at our disposal. Secondly, that any one who will take the trouble to obtain the mean of a number of carefully made measurements of the best stage micrometer he can procure can always get a reading, certainly and easily, within one division of his micrometer; I can always do it within half that quantity, when I desire to be very exact; in this method nothing is obtained by estimation, it is a simple mechanical operation. Thirdly, in Jackson's glass micrometer the divisions are fixed, and no object is measured exactly that does not exactly reach from one division to the other. Such cases form the exceptions, and in the majority of cases there is something left to be estimated, which means simply guessed at. There should be nothing left to guess that can be measured, as it undoubtedly can with the cobweb micrometer. I have heard of such guessing of the diameter of blood-corpuscles when a man's life was in the balance.

TRANSACTIONS OF THE MICROSCOPICAL SOCIETY OF LONDON.

A New Adjustable Diaphragm. By Sidney B. Kincaid, Esq., F.R.A.S.

(Communicated by F. H. Wenham, Esq.)
(Read March 14th, 1866.)

The desirability of possessing a means of adjusting the illumination of transparent objects under the compound microscope within closer limits than those allowed by the ordinary wheel of diaphragms placed beneath the stage, has been patent to microscopists almost ever since the study of the more minute forms of nature under high magnifying power has claimed to rank as a science. But although practical opticians have proposed various aperture-limiting shutters for attaining that object, no contrivance, as far as I am aware, has hitherto been described which fulfils the condition of affording an easily adjustable aperture, which constantly preserves its centricity, and approximates more nearly to a circular figure than a square or diamond.

When I turned my attention to the subject a short time since it appeared to me that the adaptation of the Iris diaphragm (which was designed some years ago to be applied to the astronomical telescope for the purpose of observing variable stars) beneath the stage of the microscope would at once furnish the wished-for desideratum; and the experiment has proved so satisfactory that, in the hope that it may be of service to others engaged in microscopic pursuits, I would beg leave to lay a description of it before the Microscopical Society.

The arrangement, of which a sectional view is shown in Fig. 1, consists of a brass tube, A, screwing beneath the stage of the microscope at B, and within which a second tube, C, of less length, works friction tight; this latter is sprung and furnished at one end with a milled edge, D, projecting beyond the outer tube, and affording the means of rotating the inner one. To the opposite extremities of these is attached by brass rings, E, fixed with small screws, a tube of vulcanized india-rubber, F, equal in length to A, but rather less in diameter than the interior of C. By turning the milled edge while A remains fixed, the rubber is made to extend inwards, and when half a rotation is accomplished, it completely closes the aperture, which remains constantly central, and nearly circular, being, indeed, a polygon of a great

Fig. 1.

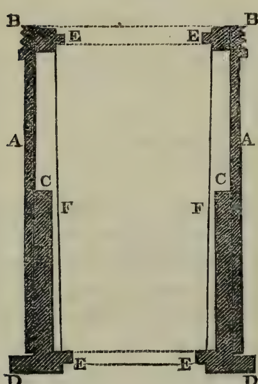
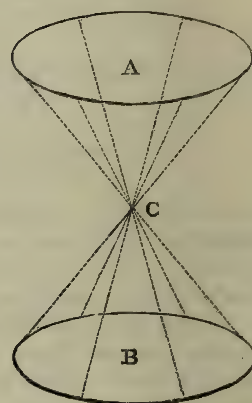


Fig. 2.



number of sides. The principle of the contrivance will, perhaps, be more readily understood by a reference to Fig. 2; for if two rings, A and B, be supposed similarly divided in any number of points, and those points connected by parallel lines forming a skeleton cylinder, it will be seen at once that if one of the rings be turned half way round, every line will pass through the centre, C, of such cylinder, the general figure resembling an hour-glass. The india-rubber tube must evidently be considered as composed of an infinite number of such threads.

In Fig. 2 is given a sketch of the appearance presented by the rubber when the opening is nearly closed, only six folds, however, being taken for the purpose of illustration.

In conclusion, I would remark the necessity of making the tube C sufficiently long in proportion to its diameter, to allow of the rubber quite closing the aperture. The cement commonly used by opticians in the construction of electrical apparatus seems well suited for fixing the rubber to brass, and a solution of caoutchouc in mineral naphtha may be used to join the surfaces of rubber.

Descriptions *of* New *and* Rare Diatoms. Series ~~XX.~~ XIX

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

(Communicated by F. C. S. Roper, F.L.S., &c.)
(Read March 14th, 1866.) plate VIII, IX.

Plagiogramma.

Plagiogramma orientale, n. sp., Grev.—Minute; valve panduriform, with central costæ and shortly produced apices; puncta very minute, impervious decussating lines. Length, ·0012″. (Pl. VIII, fig. 1.)

Hab. Zanzibar; Professor Hamilton. L. Smith.

Almost as minute as *P. atomus*, and resembles it in form, only not so deeply constricted. The chief difference, however, lies in the absence of costæ at the ends.

Gephyria.

Gephyria constricta, n. sp., Grev.—Valve with obtuse, crenate ends, and deeply constricted in the middle; costæ 5—6 in ·001″. Length, ·0055″ to ·0072″. (Fig. 2.)

Hab. Monterey deposit; L. Hardman, Esq.

A noble species, of which, through the kindness of Mr. Hardman, I have seen a number of examples. The constriction is so remarkable that, while the widest part of the frustule is nearly ·0020″, it is often only ·0007″ across the middle. The relative proportion, however, of the two parts varies to some extent. Between the costæ the valve has a minutely punctate appearance; but on a careful examination this seems to arise from a subjacent very minute cellulation. In Mr. Hardman's cabinet is the front view of a lower valve of a gigantic Gephyria, nearly ·0120″ in length; in which the base of the valve is punctato-striate.

Melosira.

Melosira costata, n. sp., Grev.—Pale; joints cylindrical, uninterrupted, longitudinally costate. Breadth of filament, ·0003″ to ·0007″. (Figs. 3—6.)

Melosira ?—Small form with longitudinal markings, Norman, in 'Annals of Nat. Hist.,' vol. xx. 2nd Series, p. 159. (1857.)*

* 'Notes on Diatomaceæ from the Stomach of Ascideæ.' By George Norman, Esq.

Hab. North Sea, off the coast of Yorkshire, in the stomachs of Ascidians; George Norman, Esq. Hongkong; J. Linton Palmer, Esq.

The diatom above indicated by my friend Mr. Norman I find, on examination, to be identical wilh the specimens kindly communicated to me by Mr. Palmer from Hongkong, where it appears to be abundant. The remarkable longitudinal costæ, seven or eight of which are sometimes visible at once, constitute an admirable character. Under a high power the costæ are seen to be dilated at their apices, and attached to those of the adjoining frustule.

CRESSWELLIA.

Cresswellia rudis, n. sp., Grev.—Valves convex, depressed at the apex, minutely cellulate, with a circle of numerous, short, obtuse spines towards the margin, and a row of similar smaller ones round the depressed apex. Diameter, ·0035″ to ·0040″. (Fig. 7.)

Hab. Monterey deposit; L. Hardman, Esq.; R. K. G.

Distinguished chiefly by the numerous, short, clumsy spines, which are nearly of the same thickness from their base to their apex, which is often encumbered with fragments apparently torn from the spines of the valve to which they have been attached. The outer circle is situated at some distance from the margin; then come a few very small, scattered spines, which are probably sometimes wholly absent; lastly, the inner circle crowning the flattened apex. The substance is somewhat thick, and the cellules nine in ·001″. Neither Mr. Hardman nor myself have been so fortunate as to find entire frustules; but this is of little consequence, as the valves in this genus are simply repetitions of each other.

COSCINODISCUS.

Coscinodiscus Lewisianus, n. sp., Grev.—Disc oval or oblong; granules conspicuous, forming an irregular central cluster, from which a few nearly straight, wide lines radiate to each end, and some very short ones to each side; margin striated, with an interior narrow band of minute puncta. Length, ·0024″ to ·0045″. (Figs. 8—10.)

Hab. Rappahannock deposit, United States; E. W. Dallas, Esq.; R. K. G.

I have not been able to find any description of this well-marked and beautiful species. The form renders it at once conspicuous, for it does not appear to be ever circular or even to approach towards it, but ranges between a true oval and elliptic-oblong. There is no umbilicus, but a loose irregular cluster of large, round granules, radiating in either slightly curved or straight lines to each end, diminishing gradually in size; the lines are so wide apart that four to seven fill up the space, and leave but little room for the few very short lines which radiate to the sides. Just within the striated margin is a very narrow belt of minute puncta.

CRASPEDODISCUS.

Craspedodiscus umbonatus, n. sp.—Disc hexagonally cellulate, the border nearly equal to half the radius, the centre rather sharply umbonate. Diameter, ·0035″. (Fig. 15.)

Hab. Barbadoes deposit, Cambridge estate; in slides communicated by C. Johnson, Esq.

Distinguished at once by its umbonate centre. Cellules near the margin of the border 8 in ·001″.

COSMIODISCUS, *n. gen.*

Frustules simple discoid; disc radiato-punctate or cellulate, with linear, blank radiating spaces extending from the margin inwards (no processes nor internal septa).

Whether the three diatoms I have here brought together are really generically allied I will not, in the present state of our knowledge regarding them, take upon myself to say. As, however, they agree in the most prominent character, a provisional union will be, at least, convenient. The genus is constructed specially for the disc first described, which for many years has perplexed me when called upon to examine the Monterey deposit. All these discs appear to be allied to *Aulacodiscus*, in having blank lines or channels radiating through more or less of their surface towards the margin; but being destitute of lateral processes they must be arranged among the *Coscinodisceæ*.

Cosmiodiscus elegans, n. sp., Grev.—Disc with a broad, smooth margin, and numerous very narrow radiating blank lines; intervening compartments filled with very minute puncta passing into striæ next the margin. Diameter, ·0035″. (Fig. 13.)

Hab. Monterey deposit; L. Hardman, Esq.; R. K. G.

Disc with an irregular, blank umbilicus; granules minute, somewhat scattered and irregularly arranged for some distance round the umbilicus, gradually becoming crowded and more minute, and ultimately passing into fine close striæ as they reach the circumference. Radiating lines numerous (24 in the example figured), commencing indefinitely, generally at about a third of the radius from the centre, so narrow as frequently to resemble dark striæ, but, on careful examination, are perceived to be exceedingly narrow blank spaces; margin or border pale, smooth, and somewhat broad.

Cosmiodiscus Barbadensis, n. sp., Grev.—Disc convex, with numerous linear blank lines, extending about one third of the radius from the margin; the portion of the disc so occupied forming a sort of broad, less convex border. Diameter ·0034″. (Fig. 12.)

Hab. Barbadoes deposit, Cambridge estate; in slides communicated by C. Johnson, Esq.; exceedingly rare.

Disc convex for about two thirds of the radius from the centre, then becoming somewhat flattened; umbilicus a small, circular, blank space; granules equal, minute, distinct radiating in straight lines to the boundary of the convex centre, then becoming larger, and diminishing gradually in size to the margin. In the flattened circumference are situated about fourteen blank, linear, radiating spaces, not produced by divergence in the lines of granules, but commencing and terminating abruptly.

Cosmiodiscus Normanianus, n. sp., Grev.—Radiating blank lines numerous, extending about half way from the margin to the centre, the intervening compartments filled with radiating lines of minute puncta; centre with scattered and much larger puncta. Diameter ·0024″. (Fig. 11.)

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

The central portion occupying as much as half the radius, containing large, remotely scattered puncta, and presenting a sudden contrast to the minute puncta between the blank, radiating lines, give a remarkable aspect to this disc, and may possibly lead to its separation when we come to be better acquainted with it.

EUPODISCUS.

Eupodiscus Hardmanianus, n. sp., Grev.—Large; disc with four circular marginal processes, hexagonally cellulate, with a broad, raised, remotely striate margin, and circle of teeth. Diameter ·0055″. (Fig. 14.)

Hab. Shell-cleanings from South America; L. Hardman, Esq.

A splendid and well-defined species, with four circular, not very prominent processes, placed just within the broad margin, which is furnished with a circle of numerous obtuse teeth. Within this margin or border is a narrow, irregular, somewhat dark line, apparently indicating a sudden depression of the surface between it and the marginal border. Hexagonal cellules 6 in ·001″.

BIDDULPHIA.

Biddulphia Chinensis, n. sp., Grev.—Large; frustules quadrangular; valves with the angles terminating in short, slender, obtuse, curved processes, and with a long stout spine springing from the swollen base of each process. (Pl. IX, fig. 16.)

Hab. Harbour of Hongkong; J. Linton Palmer, Esq.

A very fine diatom, with the colour, structure, and fragility of *Biddulphia Mobiliensis* (*B. Baileyi*, Sm.). At first sight the general resemblance is so striking that the observer might be excused for at once pronouncing it to be a large state of that species; and, considering the notoriously variable character of the valve in some *Biddulphiæ*, it would require very decided differences to separate it. I am, indeed, bound to confess that I have been deceived for a time by variations from normal forms in this genus, and, for example, that I am now convinced that my *B. Roperiana* is nothing more than one of the endless varieties of *B. aurita*. Nevertheless, in the case now under consideration, I venture to assume that really good diagnostic characters exist. Of *B. Mobiliensis* Mr. Ralfs remarks (Pritch. 'Infusor.,' p. 851, 1861): "There is no central projection of the valves, but two slight elevations, furnished with one or more bristles, and dividing the margin into three nearly equal portions. The elevations appear to be situated between the processes, but are really placed on opposite sides." This description is well illustrated in Smith's 'Synopsis,' vol. ii, pl. lxii, fig. 322 (front view); and in Roper's excellent article "On the Genus *Biddulphia* and its Affinities," in 'Trans. Mic. Soc.,' vol. vii, Pl. I, figs. 8, 9 (side views of valve). Now, in *B. Chinensis* this relative position of the bristles or spines with the processes is completely changed. The former do not divide the margin into three nearly equal portions, nor, indeed, divide it at all, nor are they situated on the margin. They arise from the swollen base of the processes themselves, on the inner side; so that, instead of being margined, they may be said to be actually on the median line (an imaginary one drawn between the processes). If these remarkable differences are not considered of value, I do not see how any character derived from the position of spines in any of the other species can be depended on. No approach towards an intermediate condition has been observed. It may also be remarked that the processes seem to be influenced by the position of the spines in *B. Chinensis,* for they are covered outwards, and are not straight, as figured by Smith and Roper in *B. Mobiliensis.*

Biddulphia ? podagrosa, n. sp., Grev.—Frustules quadrangular; valves with the angles prolonged into very thick processes, which are swollen and punctate near the base, then contracted, and again dilated into broadly capitate truncate, punctate apices; median space, with a hemispherical or subcapitate elevation. Length of perfect frustule ·0035″. (Fig. 17.)

Hab. Barbadoes deposit, Cambridge estate; in slides communicated by C. Johnson, Esq.

One of the extraordinary forms of the *Biddulphia* family only to be met with in the Barbadoes deposit. It is obviously allied to my *Hemiaulus ? capitatus* ('Trans. Mic. Soc.,' vol. xiii, pl. 6, fig. 24), which would have been more appropriately registered as a doubtful *Biddulphia.* The present diatom has a most whimsical appearance. The horn-like processes seem as if they had become proliferous; as if a second series had grown out of the first. The summits are large, inflated, almost cyathiform. The central projection is punctate like the processes, and in one specimen is so prolonged as to be almost capitate. The whole surface, with the exception of the punctate portions, is smooth and somewhat glassy. The processes are ·0020″ in length.

TRICERATIUM.

Triceratium lautum, n. sp., Grev.—Large; valve with straight sides, rounded angles, and large pseudo-nodules (processes); margin with a somewhat pectinate row of large cellules; granules rather remote, radiating from a central cluster, and increasing in size towards the margin. Distance between the angles ·0050″. (Fig. 20.)

Hab. Barbadoes deposit, Cambridge estate; C. Johnson, Esq.

This species bears a great general resemblance to *T. prominens,* but differs in the marginal cellules, in the angles being arched off and filled up with much larger processes, and in the absence of any central inflation.

Triceratium repletum, n. sp., Grev.—Small; valve with nearly straight or slightly convex sides and obtuse angles, and large ovate, minutely punctate pseudo-nodules (processes); surface entirely filled with small roundish granules, which become gradually smaller towards the margin, which is striate. Distance between the angles ·0030″. (Fig. 18.)

Hab. Barbadoes deposit, Cambridge estate; in slides communicated by C. Johnson, Esq.

Conspicuous for the very large processes which fill up the almost rounded angles, and extend over more than a third of the space between the angles and centre. Cellules near the centre, about 10 in ·001″.

Triceratium quinquelobatum, n. sp., Grev.—Valve with five obtuse lobes, the sides concave; cellules small, radiating from the centre, hexagonal, becoming less towards the margin. Distance between the angles ·0024″. (Fig. 21.)

Hab. Moron deposit, Province of Seville; Rev. T. G. Stokes.

This differs from the hexagonally-lobed *T. reticulatum*, not only in having only five angles (which might not prove of sufficient importance), but in the much smaller and more regularly hexagonal cellulation, which at the angles passes into very crowded, minute puncta. The lobes are also much less rounded.

Triceratium picturatum, n. sp., Grev.—Valve with slightly concave sides and obtuse angles containing a few minute puncta in the extreme apices; margin giving off a number of very short veinlets, and in the middle of each side a roundish impression reaching nearly to the centre. Distance between the angles ·0032″. (Fig. 19.)

Hab. Barbadoes deposit, Cambridge estate; in slides communicated by C. Johnson, Esq.; extremely rare.

A species somewhat akin to *T. denticulatum*, but differing essentially in the three middle impressions. The general surface has remote, scattered puncta, with smaller and more numerous ones between the marginal veinlets and on the impressions.

SYRINGIDIUM.

Syringidium dæmon, n. sp., Grev. — Frustules smooth, central portion quadrangular; one of the valves contracted into an elongated conical process, the other globose, with two truncate, spine-bearing horns and an intermediate spine. (Figs. 22—28.)

Hab. Harbour of Hongkong; J. Linton Palmer, Esq.

In general aspect, this whimsical-looking diatom comes nearest to *S. Americanum,* but is more minute, has a smooth surface, and the capitate valve is furnished with a spine or bristle between the processes. The frustule is subject to considerable variations, which may probably be accounted for by its progress toward the period of self-division. In its early stage the diatom is filamentous, specimens in my possession showing three frustules *in situ* (Fig. 22); and it will be perceived that the capitate ends of the frustules are opposed to each other within the tube, the horns meeting, and the terminal spines overlapping each other, as in the genus *Hemiaulus.* It appears that the frustules become fully developed within the tubes before they escape, for although, in the figure just referred to, the conical process is not yet visible, it is mature, or nearly so, in Fig. 24. When perfect, the frustule may be described as comprised of two valves, rather sharply quadrangular (as viewed in the microscope); the one suddenly contracted and passing into a long conical process terminating in a minute spine; the other contracted into a short, thick neck, supporting a spherical head furnished with two short, conical, truncate horns, each tipped with a spine at its inner angle, while a slender, short spine is also situated in the intermediate space. The relative proportion of the two valves varies greatly, as will be seen by consulting the figures; but this seems to be of no momemt in a diagnostic point of view. A very remarkable deviation from the typical structure of the genus occurs in *S. simplex,* Bail.* A very minute species, in which the valves are described as "nearly symmetrical," and "both gradually tapering into pyramidal cones."

It is to Mr. Palmer that we are indebted for specimens in so perfect a state as to indicate distinctly their affinity with *Hemiaulus.* Nevertheless, we cannot but agree with Mr. Ralfs in his observation, that, "although it is not difficult to point out differences between the *Chætocereæ* and other groups, yet, on account of the variety in their forms, we confess our inability, in the present state of our knowledge, to give a concise definition which shall include its own members and exclude all others."†

NAVICULA.

Navicula spectalissima, n. sp., Grev.—Elongated, deeply

* "Notes on new species of microscopical organisms, chiefly from the Para River, South America." By Loring W. Bailey. 'Boston Journal of Natural History,' vol. vii, p. 343, fig. 65.

† Pritchard, 'History of Infusoria,' 4th edition, p. 860.

constricted, with ovate-cuneate lobes, minutely punctate; margin composed of a single series of large, linear-oblong cellules, which, as well as the puncta, disappear opposite the central nodule. Length ·0050″. (Fig. 29.

Hab. Zanzibar; Professor Hamilton. L. Smith.

One of the most exquisite diatoms which have ever come under my observation, and for which I am indebted to the kindness of my excellent correspondent, Professor H. L. Smith, Gambier, Ohio, who is prosecuting original and important investigations into the structure and development of the diatom frustule. The present new species belongs to the extensive group of *Naviculæ,* in which the valves are more or less constricted at the middle, constituting the exploded genus *Diploneis* of Ehrenberg. Its nearest ally appears to be *N. marginata,* of Lewis,* in which there is also a minute inner structure, and a single row of large marginal cellules. In *N. spectalissima,* however, this contrast of structure is carried much farther, for the puncta next the median line are more minute, and the marginal cellules form a band nearly as broad as the punctate portion itself. These cellules are 7 in ·001″, and at the widest part of the valve are ·0004″ in length, and so regular as to give the margin a pectinate and crenate character. They gradually diminish in length, and disappear near the apex, and opposite the central nodule.

STAURONEIS.

Stauroneis rotundata, n. sp., Grev.—Small; valve linear, or very slightly dilated in the middle, rounded at the ends; stauros broad, linear, reaching to the margin; striæ parallel, exceedingly fine, not quite reaching to the median line. Length ·0033″. (Figs. 30, 31.)

St. rotundata; Grev. MS.; Dr. L. Lindsay. 'Journ. Linn. Soc.,' vol. ix, p. 134 (name only).

Hab. Otago, in New Zealand, in fresh water; Dr. Lauder Lindsay.

This seems a well-marked species, with its parallel sides (sometimes slightly dilated at the middle) and very rounded ends, where the margin is broader than at the sides.

Stauroneis scaphulæformis, n. sp., Grev.—Small; valve linear; lanceolate somewhat contracted and produced at the sub-acute ends, which are arched over by the thickened

* 'Notes on new and rarer species of Diatomaceæ of the United States' seaboard.' By F. W. Lewis, M.D., 1861, p. 6, pl. ii, fig. 1.

margin; stauros broad, dilated, reaching to the margin. Length ·0036″. (Fig. 32.)

St. scaphulæformis, Grev. MS.; Dr. L. Lindsay. 'Journ. Linn. Soc.,' vol. ix, p. 134 (name only).

Hab. Otago, New Zealand, in fresh water; Dr. Lauder Lindsay.

Very similar in general appearance to the diatom figured by my friend Dr. Lewis,* as a variety of *St. Legumen,* of Ehrenberg; but it differs in having a very broad, dilated stauros, instead of a very narrow, simple one; and in the contraction of the valve below the apices.

On the so-called PACCHIONIAN BODIES.

By H. CHARLTON BASTIAN, M.A., M.B. Lond., F.L.S.

(Communicated by W. H. INCE, F.L.S.)
(Read March 14th, 1866.)

CERTAIN granulations or minute polypoid excrescences in connection with the membranes of the human brain, now familiar to so many anatomists and pathologists, were first described in 1705 by Antonius Pacchionius,† and regarded by him as rounded glands, secreting a clear pellucid fluid, from which lymphatics proceeded to the pia mater. Succeeding anatomists, for a time sharing in this opinion, spoke of them as 'Pacchionian glands,' and by this name they were known till a comparatively recent period, when a growing doubt as to their nature gradually resolved itself into a pretty firm conviction that they had no real claims to be included in the category of glandular structures. Now almost all anatomists prefer to speak of them as 'Pacchionian bodies.'

Although these growths have received a very fair share of attention since the date of their first discovery, still many of the statements made concerning them are quite conflicting, and the accounts to be found in English text-books more especially are meagre and inexact as to their real nature and mode of origin. Seeing that they are found in several situa-

* "On extreme and exceptional variations of Diatomaceæ in some White Mountain localities," &c. By F. W. Lewis, M.D. 'Proceedings of the Academy of Natural Sciences of Philadelphia,' Jan., 1865, pl. 2, fig. 14.

† Dissert. Epistolaris de Gland. conglobatis duræ meningis Humanæ, indeque ortis Lymphaticis ad Piam meningem productis. Reprinted also at p. 103 of his 'Dissert. Physico-Anatom. de dura meninga Humanâ.' 1721.

tions in connection with the skull and membranes of the brain—occasionally in great numbers as well as much enlarged—it is a matter of some interest to know in what situations they may be found, how they come to occupy these positions, what is their precise histological structure, whether they are normal or abnormal growths, and, if the latter, what is their pathological significance.

In text-books they are principally referred to as existing on the surface of the dura mater, on one or both sides of the middle line and subjacent longitudinal sinus, and causing more or less marked depressions in the corresponding region of the skull. It is also generally stated, however, that their presence is uncertain, that they are most frequently met with in persons dying at an advanced age, and that they are occasionally seen in the longitudinal sinus as well as on the arachnoid along the edges of the great longitudinal fissure separating the cerebral hemispheres; whilst, if anything at all is said concerning their seat of origin, this is represented to be in the pia mater beneath the arachnoid. Such a view as to their origin was held by Cruvelhier,* Andral,† and the late Dr. Todd,‡ and seems to have been adopted by other English anatomists, notwithstanding the observations of Luschka,§ who in 1852 clearly pointed out that they invariably arose from, and were direct continuations of the arachnoid membrane.

But even other situations have been indicated in which these growths may be met with; thus Dr. Todd wrote:—"Bodies somewhat similar are also found occasionally on the choroid plexuses of the lateral ventricles. Very frequently we meet with granulations of a like kind in the fringe-like processes of pia mater which descend from the velum interpositum to surround the pineal gland, and also upon the little processes of that membrane which go under the name of choroid plexuses of the fourth ventricle." Kölliker also states‖ that they are found in connection with the choroid plexuses of the ventricles. I have myself always failed to detect them in these situations, and on several occasions having cut off little opaque bodies from these vascular fringes, looking to the naked eye somewhat like Pacchionian bodies, have invariably found them to be, after inspection with the micro-

* 'Anatom Descript.,' t. iv, p. 537.

† 'Clinique Médical.' Translated by Dr. Spillan, 1836, p. 43.

‡ 'Cyclop. of Anat. and Physiol,' vol. iii, art. *Nervous System*, p. 645.

§ 'Über das Wesen der Paccionishen Drusen.' Müller's 'Archiv,' 1852, p. 101.

‖ 'Manual of Human Micros. Anat.,' 1860, p. 243.

scope, altered portions of the plexus only, rendered more opaque by the deposition in their interior of calcareous matter, in the form of 'brain sand.' Cruvelhier, moreover, altogether denies the similarity of the opaque granulations occasionally found on the choroid plexuses to Pacchionian bodies.

Agreeing with Rokitansky* and Luschka as to the fact of these bodies being invariably growths from the arachnoid, though differing from the latter observer as to the fact of their ever springing from its parietal layer, I will first speak of them as they may be observed on the visceral portion of this membrane.

When the dura mater is reflected we frequently see in more or less abundance a number of small, opaque, almost milk-white looking granulations, varying much in size, but seldom exceeding that of a rice-grain, situated on each side on the arachnoid along the median contiguous edges of the cerebral hemispheres. They exist most abundantly over the middle and commencement of the posterior third of the hemispheres, where the largest veins enter the longitudinal sinus, and are found principally at the angle and over the upper surface of the brain immediately contiguous to it, but are not met with on the vertical surface entering into the great median fissure. Occasionally, however, a little patch of these bodies may be seen over the upper surface of the hemisphere at a distance of an inch or more from the median line, and distinctly separated from those in this situation. The portion of arachnoid from which the Pacchionian bodies arise is invariably opalescent or opaque, and more or less thickened, and they are generally most numerous on the membrane over and covering the large veins as they leave the pia mater to enter the longitudinal sinus. They vary extremely in form, as may be seen by reference to Pl. X, fig. 1, which represents some of the shapes most frequently met with. Some are simple, others compound in various degrees, with ternary or even quaternary buds from the primary growth. Some are sessile and attached by a broad base to the arachnoid, whilst others are fixed only by comparatively long and attenuated pedicles, or may present all intermediate conditions between these two extremes. Luschka figures a compound growth resembling a small bunch of grapes, and so far as I have seen, this distinct pediculation, whether simple or compound, is most frequent in the early stages of these growths before they become very apparent to the naked eye.

Pacchionius also described bodies of a similar kind existing in large numbers in the longitudinal sinus, now well known

* 'Patholog. Anat.' (Syd. Soc.), vol. iii, p. 329.

as a very common locality in which these growths may be seen, when the sinus is slit open. The bodies projecting in this situation push before them the lining membrane of the sinus, instead of perforating it, and this was the covering probably alluded to by Pacchionius when he spoke of the assumed glands in the sinus as, "propriâ et tenuissimâ membrana, veluti in saculo conclusæ." Concerning them in this situation also Dr. Todd wrote :—" It has been supposed that these bodies are natural structures, destined to perform a mechanical office somewhat on the principle of a ball valve, but they are frequently absent altogether, and when present they have no constant relation to the venosus orifices." According to Cruvelhier,* Haller has found growths of this kind at the anterior extremity of the straight sinus, whilst he himself once met with "une petite masse pédiculée" of a similar nature in the horizontal portion of the lateral sinus. I have occasionally found them pretty plentiful in this latter situation.

In most cases where the Pacchionian bodies exist in any quantity it is found somewhat difficult to reflect the dura mater, on account of the adhesions between it and the arachnoid on each side of the median fissure, without tearing away portions of the latter with the upper membrane. Where this occurs, when the under surface of this reflected dura mater is examined, there is no difficulty in detecting the torn portions of arachnoid adherent to it, and if the edge of one of such portions be held with a forceps, and carefully pulled, it will be readily seen as the two membranes separate, that the adhesion is entirely due to an interlocking, by means of the Pacchionian bodies, which (still springing from the cerebral arachnoid) have pressed against the inner layer of the dura mater, destroyed its epithelial lining, and insinuated themselves into its substance by separating the interlacing fibrous bundles of which it is composed. Instead of its ordinary smooth appearance, also, the under surface of the dura mater in these parts will be found to have an open reticulated or cribriform aspect, owing to the separation of its fibres by the growths just dislodged from between them. After lodging themselves in the substance of the dura mater, these growths still increase in size, and are developed into the little pear-shaped bodies, which can then only be pulled backwards through its meshes by exerting a considerable amount of traction. Some few of these bodies which have thus lodged themselves take on a further increase of growth, and soon exceed in dimensions any of those to be found unattached on the surface of the arachnoid. When the skull

* Loc. cit., t. iv, p. 537.

cap is removed in such cases we see slight bulgings on the surface of the dura mater on either side of the middle line; at later stages these prominences would be more manifest, and at last the outer layer of the dura mater having become thinned and then eroded, portions of the growths protrude, differing, however, in appearance from that which they present when smaller and seen on the surface of the arachnoid.* They have now a less opaque and more pellucid aspect, and instead of being white in colour are seen to have a faintly reddish or even yellowish tinge. Sometimes several of these bodies, small in size and situated together in a little patch, may be seen on the surface at a slight distance from the middle line, the outer layer of the dura mater being absent over the area occupied by them. It seems a more probable supposition to imagine that this has been caused to disappear by pressure and erosion, than to account for its absence by a congenital defect, as some have suggested, seeing that this hypothesis is inadequate to explain why it should be that in preference growths should spring up on an independent subjacent membrane, precisely opposite those very parts where there is a deficient development in the one above it. Certain of the little tumours generally situated pretty close to the middle line, and mostly solitary in position, attain a morec onsiderable size still. They produce, as they increase in bulk, at first a mere depression in the corresponding region of the inner table of the skull, and at last an actual erosion of this, and even of the outer table, if their growth still continues. I have several times seen the outer table of the skull reduced to a plate of extreme tenuity, though never actually perforated. Dr. Ogle,† however, has lately described and figured cranial bones which have been perforated by these bodies, and mentions also that Mr. Turner, of Edinburgh, has once seen an actual perforation of the right parietal bone, in which the aperture in the outer table was large enough to give passage to an ordinary pea, whilst, as is frequently the case, the inner table was worn away over a

* This difference in appearance led me at one time to imagine that they might be structures of a different nature. In fact, knowing nothing very definite about them, I looked upon the little growths found on the dura mater as Pacchionian bodies, and in earlier autopsies was in the habit of looking upon the opaque granulations of the arachnoid as something quite distinct. This, however, I soon found to be erroneous. I now suspect that the opaque white appearance of the bodies seen on the surface of the arachnoid is partly a post-mortem effect due to the absorption of serum, since those found on the surface of the dura mater assume the same appearance after a short immersion in water.

† 'Brit. and For. Rev.,' Oct. 1865, pp. 502—4, figs. 21—23.

much greater area. In cases in which there has been lodgement only, but no perforation, by the Pacchionian bodies, the aperture through the inner table is often sharp and clearly defined.

Such being the appearances and positions occupied by these bodies, and arising in all cases as they do from the arachnoid membrane, it comes to be a matter almost of accident whether they are found on the surface of this membrane, on the external surface of the dura mater, or projecting into the longitudinal sinus. Those springing up on a portion of the surface of the arachnoid not in very intimate contact with the dura mater, have room and are enabled to grow without contracting adhesions; whilst those commencing on a portion closely in contact with the upper membrane (over the top of a convolution, for instance, instead of over a sulcus) penetrate between its fibres in the manner before stated, and if the portion of dura mater against which they impinge chances to be the wall of the sinus, they project into it instead of appearing on the outer surface of the dura. These latter in their growth push aside the reticulated fibrous bundles of the dura mater till they come in contact with the firm elastic membrane constituting the inner wall of the sinus. This they are unable to perforate, and instead, it slowly gives way before them, so that at last they come to project into the sinus in much the same way as an organ does into a serous sac. I have fully satisfied myself as to the nature of this covering over those bodies projecting into the sinuses, not only by recognising its microscopical similarity of structure to that which can be dissected off from other parts of the sinus, but also from the fact that I have frequently succeeded, by exerting considerable traction with a forceps upon a portion of adherent arachnoid outside the sinus, in pulling some of these bodies out, and leaving the little membranous caps with which they were surrounded—constituting the "propria et tenuissima membranâ," in which Pacchionius described them as being enclosed. The bodies projecting into the horizontal portions of the lateral sinuses, which are much less frequently met with than those in the longitudinal, would appear to rise from the arachnoid covering the posterior border of the cerebellum, and not from that on the lower surface of the posterior extremities of the cerebral hemispheres, since I have found them situated only along the lower angle of the base of the sinus.*

* Since this was written I have twice detected small Pacchionian bodies on the arachnoid over the posterior border of the cerebellum, as above suggested.

The description here given of the Pacchionian bodies differs to a certain extent from that advanced by Luschka, whose views also seem to have been received by Wedl* and Förster,† since, according to him, all the most important of these growths, pathologically speaking, namely, those which insinuate themselves into the dura mater, appear on its external surface, or project into the longitudinal sinus, take origin from the *parietal* arachnoid. But quite independently of the fact, that the only representative of this membrane now believed to exist by Kölliker and other leading histologists is a layer of epithelium,‡ I have fully satisfied myself, after the most careful examination, that so far as can be ascertained, all these growths which imbed themselves in the dura mater or project into the sinuses, as well as those which remain free, seem to spring from the cerebral arachnoid.§ This is an arrangement easily demonstrated when, as is so often the case, portions of arachnoid corresponding to growths imbedded in the dura mater are found adherent to the under surface of this membrane, having been torn off during its reflection, since, on pulling the two membranes asunder, as before stated, many of the growths still firmly attached to this fragment of the visceral arachnoid, emerge uninjured from between the fibres of the dura mater, whilst the more slender pedicles of others are ruptured. The same thing, of course, occurs in the original turning back of the dura mater—certain of the pedicles give way, instead of the ararchnoid in all cases tearing, in order to permit of the separation of the adherent membranes. In such cases, where rupture has taken place, whether the Pacchionian body be situated in one of the sinuses or on the surface of the dura mater, if we pass the point of a fine needle through the membrane as nearly as possible in the direction of its pedicle, we shall always find it emerge on its under surface at a point where the fibres of the dura mater have the characteristic open cribriform arrangement, and in most cases be able to discover the broken extremity of the fleshy-looking little pedicle.

Continuous as these bodies are with the arachnoid, so are their histological elements precisely the same. I have not been more successful than other observers in recognising

* 'Rudiments of Path. Histol.' (Syd. Soc.), 1855, p. 350.

† 'Lehrbuch der Patholog. Anatom.'

‡ See concluding note.

§ Virchow and many of the other German anatomists have now almost ceased to use the word arachnoid at all, believing that no distinct membrane exists to which this name can be applied. They regard the so-called 'parietal arachnoid' simply as the epithelial lining of the dura mater, and the 'visceral' layer as only the condensed superficial layer of the pia mater.

either vessels or nerves in them. Some of the statements at present in vogue concerning the histology of the Pacchionian bodies are very lax: thus, by Todd and Bowman* they are stated to be "whitish granules composed of an albuminous material found amongst the vessels of the pia mater," which in their increase push the arachnoid before them; whilst in another place† each of these bodies is said by Dr. Todd "to consist of a mass of minute granules enclosed in a membranous sac."

Luschka is, I believe, the only writer who mentions the existence of epithelium upon the surface of these bodies; he describes it, however, as scanty, and met with only in isolated patches. It is often not easily recognised without the aid of reagents, but when small growths of this kind, or portions of larger ones, are mounted in equal parts of water and acetic acid for microscopical examination, the structures swell and become more transparent, whilst a pretty uniform covering of roundish or elliptical cells can generally be discovered on the surface, lying close together, though not in contact (fig. 2). The use of the same reagent renders visible bodies precisely similar on the surface of the arachnoid itself, though they are somewhat difficult of detection when portions of it are immersed in water alone previous to examination. The examination of other serous membranes, such as the peritoneum, pleura, and pericardium, showed bodies of a similar nature on their surface, and it was after careful scrutiny of them that I convinced myself that these apparently distinct, elliptical, nucleated cells were in reality only the nucleolated nuclei of a pavement epithelium, just such as has been described by Henle, and similar to what I have represented in fig. 3. The containing cell on the arachnoid and its outgrowths must be extremely delicate and fragile, since, though scrapings with a knife from their surface yield crowds of nuclei, separate as well as aggregated, yet I have never succeeded in detecting the same tesselated arrangement of their containing cells as I have seen elsewhere, though I have occasionally seen isolated nuclei contained in a delicate and almost invisible cell (fig. 4), and all analogy would lead us to believe that the nature of the epithelium was the same on the arachnoid as on other serous membranes, more especially when bodies precisely similar to what are undoubtedly the nuclei of these are found on the former. The epithelium is generally best seen on the younger growths, or else on those older ones which have

* 'Physiolog. Anat. of Man,' vol. i, p. 255.

† 'Cycl. of Anat. and Physiol.,' *loc. cit.*

inserted themselves into depressions in the cranial bones. In bodies picked out from this last situation (where, perhaps, they are more protected from friction, as well as supplied with more nutriment from the cranial diplöe) I have found a large quantity of epithelium, evidently in multiple layers, accumulated on their surface. A tendency to this is sometimes seen also on the arachnoid itself, since cells may be recognised in different places lying over one another as though a double or even treble layer existed. In addition to this epithelial covering, the Pacchionian bodies are composed of fibrous tissue, which may be seen in all stages of development, either in the same or different growths. Everything I have observed during the examination of this tissue in these bodies tends to confirm the opinions of Henle and Virchow* —who are so far agreed as to the fact that the undulating fibres composing the bulk of its substance are derived from the direct fibrillation of a homogeneous, hyaline, and gelatinous-looking material—and lends no support to those of Schwann or even Reichert. In great part this homogeneous material seems to grow in the Pacchionian bodies in the form of a branched network, reticulating in all directions so as to produce a pretty compact sponge-like structure. A portion of these interlacing, structureless bundles, which was scraped from the surface of one of these bodies, together with epithelium,† is represented in fig. 5. In many parts of the interior of the growths an areolated arrangement of bundles may also be seen, apparently at a later stage of development, since their texture seems firmer, their outline more sharply defined, and in many of them, by a proper adjustment of light, faint linear markings can be recognised, which may be the first traces of fibrillation (fig. 6). A thin, transverse section of one of the more opaque bodies on the surface of the arachnoid reveals the full maturity of the tissue (fig. 7), and instead of a network of a homogeneous or faintly fibrillated aspect, we get one composed of ordinary areolar or fibrous tissue, the bundles of which present the same reticulated arrangement. Occasionally I have seen a spiral fibre of elastic tissue of the kind mentioned by Luschka twisted around a still homogeneous bundle (fig. 5*a*), and in portions of the surface fibrous tissue of these bodies which

* 'Cell. Pathology.' Translation by Chance (1859), pp. 41—45.

† The minute buds so frequently found projecting from the surface of a still growing Pacchionian body, and which are the origin of the various secondary and tertiary outgrowths, are small projections of a tissue of this kind, which gradually undergo differentiation and development as they increase in size.

frequently does not show the manifest reticulated arrangement of the fibrous bundles, elongating cells or nuclei may be seen of the ordinary kind (fig. 8). The elastic tissue in the Pacchionian bodies is represented by fine fibres, and is not very abundant, though I have not had time further to make out its mode of development and arrangement.

As is the case with the arachnoid membrane itself, these Pacchionian outgrowths, especially in old people, very frequently contain deposits of brain sand. Sometimes it exists in the form of the usual bright, highly refractive, and irregularly rounded nodules of various sizes, situated in the midst of the fibrous tissue, with no special envelope of any kind; whilst in others a deposition of the calcareous matter seems to occur in small separate granules, and a concentric arrangement of cellular tissue, in the form of lamellæ, appears to take place around them (fig. 9), which in some cases is very distinct. Occasionally a large calcareous nodule is seen, apparently simple and of the kind first mentioned, but which, on alteration of the focus, seems to be made up of concentric lamellæ, or at all events it presents a series of concentric markings. This appearance may perhaps be due to the subsequent calcareous infiltration of a concentrically arranged fibrous envelope developed around a primary saline deposit. All the forms seem to be intimately connected with one another, and according to Kölliker,* brain sand generally, "after the extraction of the salts, completely retains the form of the concretion, and appears as a concentrically stratified pale mass." Kölliker also speaks of *corpora amylacea* as sometimes existing in the Pacchionian bodies; these I have never met with, unless some of the earthy nodules may be bodies of this kind which have undergone calcification.

Now we come to the question, are the Pacchionian bodies to be considered as normal structures, or as the results of pathological change? The investigations of the brothers Wenzel,† and even more, the later ones of Luschka, supply us with important data for the solution of this question. As yet these growths have been found only in the human subject, notwithstanding the diligent search made for them by the above-named observers in many of the lower animals. With regard to the ages at which they are found in man the brothers Wenzel came to the following conclusions:—"In children, from birth to the third year, these bodies, if they ever occur, must be very few. From the seventh to the

* Loc. cit., p. 243.

† De penitori hom. et brut. cerebri structurâ. Tubingæ, 1812.

twentieth year they sometimes are numerous. From the latter period to the fortieth year the number is considerable, and the nearer we approach the fortieth year the greater does it become. Lastly, from the fortieth to the one hundredth year these bodies are found in great numbers." Luschka, however, says he has never failed to find a certain number of these bodies on the arachnoid, at the borders of the great longitudinal fissure, at any period of life. Even in the new-born infants he has detected very minute outgrowths, which he considers as the rudiments of future Pacchionian bodies, though in them, as well as in other children dying during the first few years of life, their existence is easily overlooked, and they can only be detected by the most careful examination, since they are then minute pellucid structures of the same colour as the unaltered arachnoid. In individuals between sixteen and twenty years of age they are easily detected on account of their increased size and whiteness; and though at later periods of life they generally become more numerous and much larger, still there is a very great difference in this respect in different individuals, and in some persons dying even at middle age or beyond none of these bodies can be detected by the naked eye, though they may be seen by floating portions of the arachnoid in water, and then examining it with a lens. Luschka looks upon these growths as normal structures,* having a definite aim, which may be considered to be in a mature condition in individuals between the ages of twelve and twenty years, and to become pathological only by reason of their hypertrophy at later periods of life; and he accordingly names them 'arachnoidal villi.' But the old name seems to me a more desirable one, since it involves no implication as to their nature; and the possibility of any function performed by these bodies seems so doubtful that it appears more desirable to look upon them, with Rokitansky, merely as hypertrophic vegetations, or polypoid excrescences from the arachnoid, notwithstanding the fact that the rudiments of them are to be met with even at the earliest periods of life. Bearing upon this question, too, it is interesting to consider how far a pathological condition (assuming it to be such) so constant as the existence of these bodies in middle and advanced life, may, in the course of generations, through the influence of hereditary transmission, have at last tended to their rudimentary production, independently of the special causes at first potential in giving rise

* Andral and Dr. Todd regarded them as decided pathological products, whilst Cruvelhier, though in doubt as to their nature, was disposed to look upon them as of too frequent occurrence to be considered morbid growths.

to them in the original progenitors of the race. Or are we to suppose that the conditions instrumental in bringing about their increase of size in after life have already been in operation, during the intra-uterine period, to a sufficient extent to produce the early rudiments of these structures, ascertained by Luschka to exist in the new-born infant? At all events, it does not appear that these bodies can be looked upon as isolated structures of an exceptional nature, in the face of what we know as to the existence of similar hypertrophic excrescences from other serous as well as synovial membranes. According to Wedl,* "papillary new formations," with a covering of epithelium, have been found by Heschl on the pleura, and especially on that portion over the lower border of the inferior lobes of both lungs; whilst it is a well-known fact that in many cases the "white patches" of the visceral pericardium have a shaggy appearance when floated in water, from the presence of minute outgrowths, which would, in all probability, present, on microscopic examination, a fibrous structure, similar to that known to be presented by the opaque patch itself. On the other hand, the bodies developed from the synovial membranes of the larger joints, in cases of chronic inflammation, so well known to pathologists—often stalked and compound in form, but occasionally simple, smooth, ovate, compressed, and compared to melon seeds by Mayo—also present a fibrous structure, and may fairly be considered as having a close pathological relationship to the Pacchionian bodies.† Two causes seem influential in bringing about a fibroid thickening and opacity of serous membranes: undue amount of friction, on the one hand, which, as Dr. Jenner and other pathologists maintain, seems to be by far the most frequent cause of the 'white patches' of the pericardium; and hyperæmia on the other, whether from chronic inflammation or oft-repeated congestions, to which this condition of the arachnoid and synovial membranes seems most attributable. Repeated congestions alone are looked upon by Rokitansky and others as capable of producing opacity and thickening of the arachnoid, independently of any inflammatory process. Some amount of it is generally met with after the middle periods of life; and the same may be said as to the increase in number and size of the Pacchionian bodies;

* Loc. cit., p. 357.

† In a more recent work ('Die Halbgelenke,' 1858, p. 46) than his communication before referred to, Luschka has shown that the central part of each intervertebral disc is a synovial sac, the membrane of which is developed into processes almost precisely resembling the Pacchionian bodies. (*Note added June* 19*th.*)

and at any period of life their number and size seem to be in direct proportion to the frequency with which the brain and its membranes have been subjected to congestions; thus, even in youths or young adults, considerable enlargement of them is generally met with in those subject to frequent epileptic attacks, and less notably so in habitual drunkards. Startling exceptions occasionally exist, however, to this rule; for instance, I lately examined the brain of a man fifty-six years of age, who was known to have led an intemperate life, and who had in addition been insane, and perfectly incoherent in his conversation, for more than twelve months, and yet there was only the faintest opalescence of a small portion of the arachnoid, and no Pacchionian bodies to be seen with the naked eye. Such cases are, however, very exceptional; so that, leaving age out of the question, we may still look upon cerebral congestion and excitement as the causes most instrumental in bringing about the production or increased growth of these structures. This was also the opinion of Dr. Todd, who said: "In persons addicted to the excessive use of spirituous liquors, in those of irritable temperament, and who were frequently a prey to violent and exciting passions, they are almost uniformly highly developed."

Are these enlarged Pacchionian bodies of much pathological significance? It has been thought that they may give rise to dangerous symptoms by their pressure upon the brain, and by the impediment they may offer to the circulation of the blood through the great veins entering the longitudinal sinus as well as through the sinus itself. I know of no cases on record bearing out this assumption, and am disposed to think their effects are not often very serious in the first place, because, owing to the slowness of their growth, impediment to the flow of blood through any particular vein, if it should take place, would, without difficulty, right itself by an increased flow through the contiguous channels; and in the next, from the fact that no growths large enough to produce any appreciable pressure upon the brain are ever found between the membranes attached to the arachnoid only. Those so situated, being non-vascular themselves, receive plasma for their further increase only by absorption through the non-vascular arachnoid itself, and with which, oftentimes, they are only connected by means of a narrow pedicle, so that the conditions are by no means favorable to their attaining any notable size. Those, on the other hand, which have become imbedded between the fibres of the dura mater are enabled to absorb more nutritive pabulum directly from this more vascular membrane, with which to build up their structure, and they undergo a corresponding increase in size. Still their growth is slow, and the pressure exerted upon the cerebrum can only be insignificant, seeing also that the direction is *outwards* towards more vascular parts, causing them to press upon the inner table of the skull, and finally produce more or less deep erosions in the vault of the cranium. Here, indeed, is a source of danger, owing to the weakening of the bony case in which the brain is lodged, rendering it less able to resist the effects of blows or external violence of any kind. But the projection of these growths into the sinuses, and their increase in this situation, seem to be the course most likely to be attended with deleterious results, since, as foreign bodies, they may lead to a blocking up of the sinus, either from the deposition of fibrinous coagula upon them in certain states of the system, or from an actual increase in their own number and size. This latter effect would doubtless be of no very unfrequent occurrence were it not for the conservative influence of the tough, elastic lining membrane of the sinus, which, in all probability, impedes the growth of these bodies, partly by its strength and pressure, and partly because it does not give a sufficiently ready passage to the flowing pabulum afforded by the serum of the blood, in which these structures are immersed, and which, could it be assimilated more easily by the Pacchionian bodies, might cause them to grow so as almost invariably to block up the sinus, and hence lead to the most serious results.*

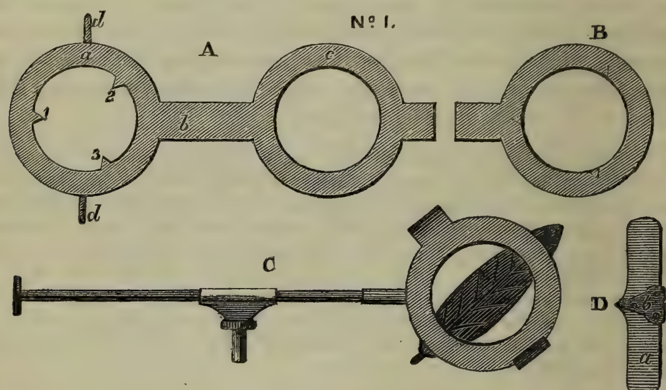
* Since this paper was written I have seen a communication on the Pacchionian bodies by Ludwig Meyer ('Virch. Archiv.,' vol. xix, p. 171 and p. 288), in which he not only insists upon the fact that these growths are invariably developments from the visceral arachnoid, but also has anticipated me in the recognition of the completeness of their epithelial covering. Dr. Cleland, however, I have also found, in spite of Meyer's statements, reaffirms that some of these bodies do arise, in the manner described by Luschka, from the internal surface of the dura mater (parietal arachnoid), in a paper in the 'Glasgow Med. Journal,' 1863, p. 148. (*Note appended June* 19, 1866.)

On a form of Leaf-holder *for the* Microscope, *and a* Revolving Slide-holder *with* Selenite Stage. By James Smith, F.L.S.

(Read May 9th, 1866.)

On a Leaf-holder for the Microscope.

The instrument to which I would this evening venture to draw the attention of the Society, and which I have called a leaf-holder, as indicating the class of objects for which it was designed and is best adapted, is intended to supply a want I have often felt in the examination of leaves, feathers, wings of moths, and other similar large flat objects which frequently require to be placed in a particular position, both as regards the microscope and the source of illumination. I have also found, in observing aphides or minute fungi upon the surfaces of leaves, very great difficulty in getting the object into a good position for examination, the ordinary stage forceps being in some cases almost useless for the purpose.



In the above set of drawings, A, shows the double ring forming the clip, made of a thin elastic yellow metal; B, the foundation ring, upon which the others work; C, the complete instrument with leaf inserted; and D, the small holder for such minute objects as could not be well held by the rings alone.

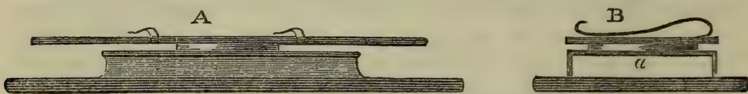
The ring B, which forms the foundation upon which the others rotate, may be made of somewhat stouter metal, the piece projecting at the side forming the socket to attach it to the stem, as shown in C. In A, the double ring forming the holder, the lower one (*a*) has three small projections on its inner margin, which being doubled over the inner edge of ring B (as indicated by the dotted points) form at once the means of attachment and rotation. The second or upper ring (*c*) is brought into its proper place, over, and lightly touching the first by bending the middle piece (*b*), which makes a sort of spring hinge, keeping the rings together, and retaining by its pressure the object in its place between them; D, the secondary holder for very small objects, consists of a flat piece of metal of sufficient length to be conveniently held by the rings forming the clip; in the centre of this flat piece a small watch spring joint (*b*) is fixed, the object being secured between this point and the projecting portion in the centre of the piece itself.

When a leaf or other such large object is to be examined it is placed between the rings, which by their tendency to come together hold it with sufficient firmness, and at the same time without injuring the specimen; and it can then be rotated upon its own centre by pushing the projecting portion forming the spring hinge, or the two small pieces (*d d*). The other rotation is of course effected by turning the milled head at the end of the stem; bringing the leaf examination at any desired angle with respect to the object-glass, while a half turn brings the underside into view without the necessity of disturbing the object itself; this facility of examination, which is given by the ring-like form of the instrument, will be found of some little value.

With respect to the size of the rings forming the clip, I may say that although in my own instrument they are about one inch in diameter, yet I think they might with advantage be made somewhat smaller; but as this is very much a matter of convenience, no precise size need be given.

On a Revolving Slide-holder for the Microscope, combined with Selenite Stage.

The accompanying diagrams show a very simple addition to the accessory apparatus of the microscope, which I would term a revolving slide-holder, and which will, I think, be found of use with some of the simple forms of microscopes. It consists (as will be seen in the drawings) of an upper plate, *a*, about 3 in. by 1, with two clips for holding the slide, a secondary one upon which the top plate revolves, an intermediate space (B *a*), and a lower plate somewhat larger and heavier forming the stage plate; further description seems scarcely needed. With many objects it is absolutely necessary to have them in a certain position with respect to the light to



Revolving Slide-holder and Selenite Stage.

see them at all, and with many more a slight change in position renders them far more distinct, and I am led to think that in such cases this slide-holder will be found both convenient and useful from the ease with which a slide placed upon it can be completely rotated; it might also be found useful in some cases of examining transparent objects by oblique light, and the hole in the lower plate might be made oblong, so as not to interfere with the oblique rays from the mirror.

A second and more general use to which this slide-holder might be applied is that of a selenite-holder for use with the polarizing prisms. In the 'Microscopical Journal' for July, 1860, pp. 203-4, I described a simple form of selenite stage having for its object a means of removing and replacing again the various selenites without disturbing the slide under examination or requiring to alter the focus of the microscope. In the revolving stage plate I now bring under the notice of the Society, it will I think be seen that by means of the intervening space between the lower and secondary plates, as shown in *a*, drawing B, the selenite plates can be slipped in and out without disturbing the object; and in the case of this holder there is the additional advantage obtained of having the object itself revolvable, while the polarizing prisms and the selenites remain in a fixed position with regard to each other —an arrangement which brings out some remarkable effects. It will also be apparent that when this secondary stage is used with a microscope that has a revolving stage plate of its own, the selenite plate and object under examination may be made to rotate in the same or in an opposite direction to one another; while the polarizing prisms remain fixed.

On a Binocular Microscope for High Powers. *By* F. H. Wenham.

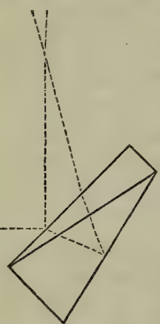
(Read May 9th, 1866.)

The common binocular microscope performs satisfactorily up to the $\frac{1}{4}$, but for powers above this a special arrangement is needed for the prism, which must be set close behind the posterior lens of the $\frac{1}{8}$th, $\frac{1}{12}$th, and upwards, in order to obtain an entire field of view in each eye. This it is found to accomplish perfectly when in that position; but still for very delicate test objects requiring the utmost extent of aperture for their definition, it will not resolve them as clearly as with the single body, from the fact that the aperture is divided and half only effective in each eye. It has therefore long been thought desirable to obtain the whole aperture in each tube. This has recently been effected by Messrs. Powell and Lealand by means of an inclined disc of glass with parallel sides; the partial reflection from the under surface is again reflected into the second eye by means of a rectangular prism. Assuming this surface to be placed at an angle of 45°, the amount of reflected light will be only 53·66 out of 1000 of the incident rays, or nearly $\frac{1}{19}$th part. To collect half the light the reflector would have to be set at $82\frac{1}{2}$°, but this would cause the glass plate to extend to such a length as to render the adaptation nearly impracticable, but even with the above-named enormous difference in the relative quantity of light, the arrangement as turned out by the hands of these clever mechanicians has surprised us with the fact that a good effect may be obtained by such means, and having thus started the principle it remains to be seen what improvements can be made with the view to increasing the quantity of reflected light, and if possible obtaining a more equal result in each eye.

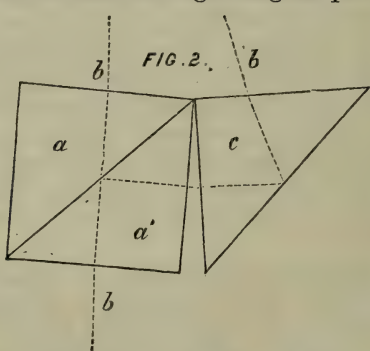
By slightly modifying the existing arrangement of Messrs. Powell and Lealand, light otherwise lost may be utilised. In order to prevent the image from the second surface of the reflecting disc from appearing at the eye, and overlapping and confusing the first, Messrs. Powell and Lealand make it of considerable thickness. The secondary image is thus so far separated as to be thrown beyond the reach of the rectangular prism, and practically this light is totally lost. As the disc is made thinner, so do the images approximate and the distance between them diminish. Therefore if the glass is made as thin as practicable, and a very slight angle given to the two sides, these may be so arranged that both images are ultimately combined at the eye-piece. There would be no difficulty in working the glass to a mean thickness of $\frac{1}{50}$th of an inch. In this form the angle between the sides would be so exceedingly small that the chromatic effect considered as a prism would be inappreciable in the direct eye-tube.

Another idea was to dispense with the rectangular prism and employ a wedge-shaped piece of glass, with the back silvered as shown by fig. 1, making use of the front and back surfaces for the two reflections and separation of the images. The wedge should be achromatic, and composed of angles of flint and crown as shown. But this could only be employed singly in such microscopes as have the object-glass set at right angles with the body. This plan might be of use for viewing sun-spots in a telescope where a diagonal eye-piece is seldom objectionable. In a microscope the increase of light obtained by removing the reflecting prism would not probably be very appreciable.

FIG. 1

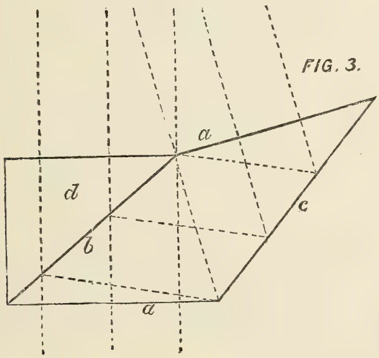


If two reflecting and transmitting surfaces be placed in close contact, both images will be combined at the same point. On this princple the following arrangement was tried: *a a*, fig. 2, are two similar right-angled prisms, with their



diagonals in contact: these are to be sufficiently tilted out of the plane of the microscope to throw the first reflecting surface out of the range of total reflection, and allow direct rays to be transmitted. The rays, *b b*, reflected from both the diagonal planes, after leaving the side of the prism *a*, were thrown into the second body of the microscope by means of another right-angled prism, *c*, while the transmitted rays passed through straight into the direct tube. The performance of this arrangement was very satisfactory, an equal amount of light being apparently obtained in each eye.

The next plan is to be preferred, shown in the diagram four times the full size. *a a*, fig. 3, in outline, resembles the now well-known form of "Wenham prism," but in order to transmit light the first reflecting angle, *b*, must be within the



range of total reflection. This for crown glass is when the ray makes with the surface an angle of 48° 11′, and allowing due margin for difference of density, the incident angle should not be less than 50° with the plane, consequently the angle, *b*, should be inclined 40°. The back angle, *c*, must be arranged in accordance with the inclination given to the bodies of the microscope, but as a rule *the difference between the angles of the front and back surfaces is half the angle of deviation of the ray from the perpendicular.*

In the microscope for which this prism was made, the bodies are set relatively at 15°; the back of the prism is, therefore, shown in the diagram 47½°. This also falling within the range of total reflection must have its surface silvered. On the first inclined surface of the main prism is adjusted the prism *d*, with two polished surfaces making an angle of 40°. With each other this brings the top of the supplementary prism parallel with the base. The rays from the object-glass are transmitted without any displacement into the direct tube. A portion of the same rays are reflected from both contiguous surfaces, and thence from the silvered back into the slanting body. The two prisms are fitted into a small drawer of the usual size which slides into the opening of the ordinary binocular microscope. The two prisms need not be pressed into contact—if so, Newton rings are formed; they may be set a visible distance asunder, but great care is needed in adjusting the small prism so as to get both reflections combined, otherwise a blurred image will be seen in the slanting body.

As to the performance of this arrangement the introduction of the prisms do not perceptibly interfere with the definition in the direct tube—delicate markings may be seen quite as well with the prism in place as out, and with proper workmanship the result is equally good in the other; and having the privilege of using both eyes, the observer is enabled to view diatoms and other minute objects more agreeably, and with a better idea of their structure, than with single vision. The great defect is a want of stereoscopic effect arising from the near similarity of the images. In this respect it falls far short of the common prism in the qualification of giving a perspective view with the lower powers.

In most arrangements constructed on the principle here described it is immaterial at what distance behind the object-glass the prism and reflecting surfaces are situated; the definition will be equally good, and the field entire, if fixed close to the eye-pieces.

The rectangular prisms arranged with their diagonals in contact may be otherwise made serviceable for the microscope. With some plan of modifying the light it may be used for a camera lucida and also for an illuminator in place of the glass disc employed where the object-glass acts as its own condenser for opaque objects.

On this principle of illumination the right system appears to be to obtain a very intense parallel ray of light, of as small a diameter as possible, thrown through a portion only of the object-glass.

With these prisms it is possible to obtain totally reflected light for the illumination, at the same time that the image of the object is transmitted. The light for the illumination must in this case be sent through the object-glass somewhat obliquely, and to reduce the diameter of the ray down to the small size required a stop of tinfoil may be atached to the lateral surface of the prism.

Constitution *and* Laws *of the* Microscopical Society *of* London.

(Revised May 9th, 1866.)

Presidents of the Society.

Richard Owen, F.R.S., &c.	1840
John Lindley, Ph.D., F.R.S., &c.	1842
Thomas Bell, F.R.S., &c.	1844
James Scott Bowerbank, LL.D., F.R.S., &c.	1846
George Busk, F.R.S., &c.	1848
Arthur Farre, M.D., F.R.S., &c.	1850
George Jackson, F.R.C.S.	1852
William Benjamin Carpenter, M.D., F.R.S., &c.	1854
George Shadbolt	1856
Edwin Lankester, M.D., LL.D., F.R.S., &c.	1858
John Quekett, F.R.S., &c.	1860
Robert James Farrants, F.R.C.S.	1861
Charles Brooke, M.A., F.R.S., &c.	1863
James Glaisher, F.R.S., &c.	1865

Objects of the Society.

The Microscopical Society of London is constituted for the promotion and diffusion of improvements in the optical and mechanical construction, and in the mode of application, of the Microscope:—

For the communication and discussion of observations and discoveries tending to such improvements, or relating to subjects of Microscopical observation:—

For the exhibition of new or interesting Microscopical objects and preparations, and for the formation of an arranged collection of such objects:—

For affording the opportunity and means of submitting difficult and obscure Microscopical phenomena to the test of instruments of different powers and constructions:—

For the establishment of a Library of standard Micrographical Works.

Constitution and Government of the Society.

The Microscopical Society of London shall consist of Ordinary and Honorary Members, and of Associates.

The Ordinary Members shall elect, out of their own body, a President, four Vice-Presidents, Treasurer, Secretaries, and Council, in accordance with the following Laws; to whom, subject only to the restrictions imposed by the Laws, all business relating to the Society shall be entrusted.

I.—*Of the Members.*

1.—The Society shall consist of Ordinary and Honorary Members, and of Associates; the number of the Honorary Members shall be limited to twenty.

2.—Every candidate for admission as an Ordinary Member of the Society must be proposed by three or more members, who must sign a certificate in recommendation of him, which must set forth the names, description, place of residence, and qualifications of the candidate, and state that he is desirous of becoming a member; and the proposer, whose name stands first upon the certificate, must have personal knowledge of the candidate. The certificate shall be read aloud by one of the Secretaries at the first Ordinary or Annual General Meeting of the Members next ensuing, and shall then be suspended in a conspicuous place appropriated for that purpose in one of the rooms of the Society. The method of voting for the election of Members shall be by ballot.

3.—The ballot shall take place at the Ordinary or Annual Meeting at which the certificate shall have been read the second time, and immediately after such reading. No such ballot shall be valid unless twelve or more members ballot; and when two thirds or more of the members balloting shall be in favour of the candidate, such candidate shall be declared to be duly elected.

4.—The Secretaries shall address, or cause to be addressed, to every person elected a member, a letter to inform him thereof, on the day following his election, together with a copy of the Laws of the Society, a List of Members, and a card announcing the days on which the Society will hold its meetings during the season.

5.—Each Ordinary Member on his admission shall pay an entrance fee of one guinea, and an annual subscription of one guinea for the current year, which subscription shall be considered as due on the 1st of January in every subsequent year. Members who shall be elected, however, in the months of October, November, or December, shall not be called upon for a subscription for the current year.

6.—Any member may on his election compound for his future annual contributions by a payment of ten guineas, in addition to his entrance fee of one guinea; or he may at any time afterwards (all sums then due being first paid) compound for his annual contributions by the like payment of ten guineas. Every such composition shall be invested in Government Securities, in the names of Trustees.

7.—No person elected a member shall be entitled to exercise any privilege as such, nor shall his name be printed in any list of the Society, until he shall have paid his admission fee and first annual subscription or composition; and unless these be paid within two months from the day of his election, or within such further time as the Council may grant, the election of such member shall be void.

8.—Associates shall be elected in the same manner as Ordinary Members, but the admission fee and annual subscription shall be remitted.

9.—The Ordinary Members shall have the right to be present and to vote at all Ordinary or Annual Meetings, and to propose candidates for admission to the Society. They shall also be entitled to the use of the instruments, books, and mounted microscopic objects in the Society's collection, under such restrictions as the Council shall deem necessary. They shall have the privilege of personally admitting one visitor to the Ordinary and Annual Meetings of the Society, whose name shall be entered in a book kept for that purpose, together with the name of the member admitting such visitor.

10.—No member shall have the privilege of voting on any occasion, or be entitled to receive the publications of the Society, if his subscription be twelve months in arrear.

11.—Honorary Members and Associates shall possess all the privileges of Ordinary Members, excepting those of proposing candidates, of voting, of introducing visitors, and receiving the Publications of the Society.

12.—The payment of the admission fee shall be considered as distinctly implying the acquiescence of every member elected into the Society, in all the Laws, regulations, and by-laws thereof.

13.—Any member who may be absent from the United Kingdom during the space of one year, shall, upon previously giving to one of the Secretaries notice in writing of his intention, be exempt from the payment of his annual contribution during such absence.

II.—*Honorary Members.*

14.—Every person eminent in Microscopical Science shall be eligible as an Honorary Member.

15.—Every such person proposed for admission as an Honorary Member must be recommended by three or more Members, all of whom must certify in writing that he is a person eminent in Microscopical Science, and that they have a personal knowledge of him, or are acquainted with his works.

16.—The mode of proposing and balloting for Honorary Members shall be the same as that prescribed for Ordinary Members; but no person shall be balloted for as an Honorary Member unless the Council shall have previously approved of him.

III.—*Withdrawal and Removal of Members.*

17.—No member shall be considered to have withdrawn from the Society until he shall have paid his arrears and given a written notice of his intention to resign to one of the Secretaries.

18.—Whenever it shall be proposed to remove any member from the Society, the same shall be done by a resolution of Council, which shall be read at three sucessive Ordinary Meetings, and be suspended in the intervals in the Society's room of Meeting; and at the last of the said meetings the proposition shall be balloted for, and if two-thirds of the members balloting shall vote for such member's removal, he shall be removed from the Society accordingly.

19.—The names of all members who shall be in arrear of their annual subscription for more than two years shall be publicly suspended in the Society's ordinary room of meeting, with the amount of subscriptions due from each; and unless the same shall be paid within three months after such suspension, their names shall be liable to be removed from the list of the members.

IV.—*Annual Meeting and Election of Officers.*

20.—An Annual Meeting of the Society shall be held in the place of the Ordinary Meeting for February, for the election of officers for the year ensuing, and for receiving the report of the Council on the state of the Society, or to enact, alter, or repeal Laws.

21.—Notice of the Annual Meeting shall be given from the Chair, at the preceding Ordinary Meeting of the Society in January, and also upon the cards of the Ordinary Meetings.

22.—The Council, at the Ordinary Meeting in December, shall declare the names of the four members whom they recommend to retire, and propose to the Society the names of four other members to supply their places in the Council: they shall also declare the names of the other Officers whom they recommend for election.

23.—At the Annual Meeting the officers and four members of Council, to replace those who retire, shall be elected. The mode of election shall be by ballot.

24.—In the event of any member of the Society being desirous of proposing other names than those recommended by the Council, a written list of the same shall be delivered to one of the Secretaries, on or before the Ordinary Meeting in January, and the same shall be read from the Chair, and publicly suspended in the Society's rooms, with the list recommended by the Council; and no member shall be eligible for election into the Council unless he has been proposed in the manner and form above specified.

25.—The President or other member in the Chair shall appoint two Scrutineers from among the members present, to superintend the ballot during its progress, and to report the result to the meeting.

26.—If in the interval between the two Annual Meetings the office of President, Vice-President, Treasurer, or Secretary, may become vacant, either by death, resignation, or otherwise, the Council shall have power to appoint one of their own members to fill such office until the next Annual Meeting.

V.—*Ordinary Meetings of the Society.*

27.—The rooms shall be open to members at the hour of 7 o'clock, for microscopical investigation. The Chair shall be taken at 8 o'clock precisely.

28.—The ordinary course of business shall be as follows:—

1st. The names of the visitors, and of the members by whom they are introduced, shall be announced from the Chair.

2nd. The minutes of the proceedings of the previous meeting shall be read, and submitted for confirmation;

3rd. The lists of candidates for election and for suspension shall be read, and the ballot for the election of members shall take place.

4th. Scientific communications shall be read and discussed.

29.—The Chair shall be vacated at 9 o'clock, or as soon after as may be convenient; and the Society shall resolve itself into a Conversazione.

30.—At the Ordinary Meetings nothing relating to the Laws, or to the enactment of new Laws, shall be introduced or discussed.

VI.—*The Auditors.*

31.—Two Auditors shall be appointed by the Society at the Ordinary Meeting in January.

32.—They shall audit the Treasurer's accounts, and produce their report to the Annual Meeting of the Society, to be held in February. They shall have the power of calling for all necessary accounts and vouchers.

33.—No member of the Council shall be eligible as an Auditor.

VII.—*Council.*

34.—The business of the Society shall be conducted by the President, four Vice-Presidents, Treasurer, and two Secretaries, who, with twelve other members, together with the past Presidents elected previous to the year 1866, shall constitute the Council; and at all meetings of the Council *five* shall be a quorum.

35.—Four of the twelve members of the Council shall retire annually, and four new members shall be elected in their places.

36.—The Council shall hold their Ordinary Meetings on the day of the Ordinary Meetings of the Society.

37.—Extraordinary Meetings may be held at the discretion of the President, who shall direct the Secretaries to issue especial summonses for the occasion.

38.—The ordinary mode of decision on questions before the Council shall be by show of hands, unless a ballot shall be demanded.

39.—Any member who shall be personally interested in the question before the Council, shall retire during the consideration and discussion of the same.

40.—The Council shall present, and cause to be read to the Annual Meeting, a report on the general concerns of the Society for the preceding year; and such report, or the substance thereof, shall be printed under the direction of the Council, for distribution among the members.

VIII.—*The President and Vice-Presidents.*

41.—The President shall be in virtue of his office Chairman of the Council, and shall take the Chair at all Ordinary, Annual, or Extraordinary Meetings of the Society; he shall regulate the order of proceedings, and shall, *ex officio,* be a member of all Committees appointed by the Council.

42.—In the absence of the President, one of the Vice-Presidents, or in their absence the Treasurer or one of the members of Council, shall take the Chair and conduct the business of the Meeting; and in the case of the absence of all those officers, the Meeting may elect any other member present to take the Chair.

43.—No member shall be eligible as President or Vice-President of the Society for more than two years in succession; and two of the Vice-Presidents shall retire annually.

IX.—*The Treasurer.*

44.—It shall be the duty of the Treasurer to receive all sums of money due to the Society, and to pay therefrom only such amounts as may be ordered by the Council.

45.—He shall keep an account of such receipts and payments, and shall produce the same at all Meetings of the Council.

46.—The Treasurer shall pay all moneys received by him into the hands of the Society's banker, retaining a sum not exceeding £30 for the payment of current expenses.

X.—*The Secretaries.*

47.—It shall be the duty of the Secretaries to attend all Meetings of the Society and Council.

48.—They shall take, or cause to be taken by the Assistant Secretary, minutes of the proceedings, and produce and read them at the ensuing Meeting; read the scientific papers presented to the Council, if requested by the authors; and conduct the correspondence of the Society.

49.—The Council shall be empowered to appoint an Assistant Secretary, and to assign to him such portion of the duties of Secretary as it may think desirable, at such remuneration as the Council may deem proper.

XI.—*Scientific Papers.*

50.—All scientific papers shall be submitted to, and approved by, the Council, previously to their being read at the Ordinary Meetings of the Society.

51.—They shall be read in the order in which they have been received, unless the Council shall otherwise direct; and the discussion of the subject of each paper shall immediately follow the reading thereof; but it shall be left to the discretion of the Chairman to take the discussion on two or more papers, on similar subjects, together.

52.—The papers and illustrative drawings to be considered the property of the Society, unless the authors shall stipulate to the contrary.

53.—Authors shall be at liberty to read their own papers.

XII.—*Publications.*

54.—The Transactions of the Society shall be published at such intervals, and on such conditions, as the Council shall think fit.

55.—They shall consist of a selection from the papers which shall have been read at the Ordinary Meetings of the Society; such selection to be made by the Council.

56.—The authors of such papers as may be published by the Society shall be entitled to twelve copies, free of expense.

XIII.—*Library.*

57.—The books in the possession of the Society shall be allowed to circulate among the members, under such regulations as the Council may deem necessary, but they shall be returned to the library on or before the next Ordinary Meeting following that on which they may have been taken out.

XIV.—*Microscopes and collection of Objects.*

58.—The microscopes and microscopic objects in the possession of the Society may be employed by the members during the period of the Ordinary Meetings, but shall not be taken out of the Society's rooms without the permission of the Council.

XV.—*Trustees.*

59.—The Council shall appoint three members of the Society to act as Trustees of the property of the Society, of whom the Treasurer shall be one; and may appoint others in their place, on any vacancy occurring by resignation or otherwise.

60.—The Council shall decide on the mode of investing the property of the Society, which investment shall be in the names of the Trustees for the time being.

XVI.—*Of altering the Laws.*

61.—No permanent alteration in the Laws of the Society shall be made, except at the Annual Meeting, or at a special General Meeting to be convened for the purpose by the President, with the sanction of the Council; and notice of any proposed change must be given on or before the preceding Ordinary Meeting.

On the SURFACE-FAUNA *of* MID-OCEAN. By MAJOR SAMUEL R. I. OWEN, F.L.S., F.A.S.L., Member of the Microscopical Society, and Associate of King's College, London.

(Read June 13th, 1866.)

No. 3.—*The Towing-net.**

THE time is now coming when we shall be distributed far and wide for the summer's vacation, and many will have the opportunity of using the towing-net, by being near the sea or upon its waters. I wish to say a few words on the subject of its use, and what may be expected from its assistance.

Towing-nets for short distances, and only in calm, fine

* Nos. 1 and 2, on the Surface-fauna of Mid-ocean, "*Recent Polycystina*" and "*Foraminifera*," were read before the Linnean Society, and will be found in their publications.

weather, is not all that is required. Nets should be made that will tow from even a steam-vessel, and thus be made to sweep the ocean-surface for several degrees at a time. By this course a satisfactory account may be given of our own and the neighbouring seas; and to such as take long sea voyages they will open out a vast field of interesting research.

I will begin by describing a simple form of net, such as may be rigged out at a few hours' notice. A grummet should be made for the mouth, to which three cords may be attached to connect it with the towing-line; that line should be a good stout piece of stuff, and capable of bearing a great strain. To the grummet should be attached, first, a bag, the upper part of which may be made of a thin canvas, the lower part of strong jean, ending in a piece of close calico or linen; the bottom must be left open, and tied round with a tape when used: this will be found convenient for taking out the contents; and by leaving it open and towing it so for a short time, it can be thoroughly washed. Over the whole an outer covering of the strongest sail-cloth should be put, the upper part, in like manner, attached to the grummet, the lower part left open, and a portion for a foot or eighteen inches of the seam left to be coarsely laced up with a piece of cord, the same being done for the bottom itself. If necessary, a third covering may be put between these of any strong but rather porous material; but this, in its turn, should be left open at the bottom, and only tied when required for use. Its length should be so adjusted, when tied, that the inner lining of calico may rest against it, and be relieved from the strain. The outer sail-cloth should, in like manner, be laced up to receive and support the whole.

For a net to be used when the vessel is under steam, or in heavy weather, the grummet may be three inches diameter in the clear. Any young nautical friend will explain how a grummet is made; and the whole of the apparatus may be sown down from a foot below the mouth to near the bottom with two seams, making it into three tubes. This will be found to answer in every respect all that can be required of a net, even in the roughest weather. A piece of strong fine net may be arranged at the mouth; this will prevent larger things from going to the bottom; they can be at once taken out on getting the net on board. For the removal of the finer contents, it will be necessary to unloose the outer cover, untie and turn up the second, then the calico bag, containing what is wanted, can be untied, turned inside out, and carefully washed into a bowl of salt water, where the material may be passed through a sieve of coarse muslin. The larger will thus be separated from the finer portions; by decanting each part so obtained the heavier will be separated from the lighter; thus, four divisions well adapted for examination will be in separate vessels. Each haul being thus treated, a register may be kept in bottles and on glasses of every portion of the ocean passed over.

Weak spirit, or a solution of bay salt and arsenic, will preserve things in a wet state; others may be allowed to dry on the glass slides.

Larger nets may be made on a similar principle for quiet sailing and finer weather. Nets with large openings, a yard wide, may be used in calms, and from boats. A bent cane and a straight deal lath make a very good mouth. The material nearest the opening should be of fine net; below this muslin should be used, and at the bottom the fine close calico bag, made open, and tied when used. A bag of coarse net should be attached to the mouth, penetrating it a yard or so, to intercept the larger things that may get into it.

To use these nets conveniently, a spar or bamboo should be rigged out on the quarter or side of the vessel, having a guy or two to support and steady it; a pulley or small block should be fastened at the outer end, through which the towing-line may pass and come in board some distance forward of the place from which the spar is projecting; this will relieve the spar, in a great measure, from the strain.

It would be found difficult to haul in such a net when the vessel is going ten knots an hour, but this difficulty is entirely removed by having a second thinner line attached to the side of the mouth of the net; by hauling on this the strain of the water is at once taken off and the net brought in board with the greatest ease, and, moreover, should the tow-line break the net is saved by the second line from being lost.

It will be found that the length of the towing-line must be regulated in some degree by the size of the net and the rate of sailing; if too short, the net will only touch and dance upon its surface without taking up the water; if too long, it may be carried under water, and so increase the strain as to endanger the line or spar. The length should be sufficient to allow the mouth to keep dipping in and taking up water when the vessel is going at great speed; but when a slower rate is to be adjusted for, then the mouth should keep at the surface, the grummet being generally nearly under water, but the waves of the sea will interfere with any great nicety in this respect. The line should be strong enough for any sudden jerk that might occur.

I need not here go deeply into the various interesting objects that may be met with by the use of such an arrangement. The Polycystina, with their interesting allies the Acanthometra; the Thalassicolla, &c. &c., about which so little is really at present known, might be found. I am persuaded that the genera Pulvinulina and Globigerina, of the family Colymbitæ of the Foraminifera, will be found on the surface of the ocean near home. Dr. Wallich found them in great numbers in the sediment forming the bed of the Atlantic. From 70 to 98 per cent. of this deposit in the deep seas is often composed of these Rhizopods. These two genera, together with the Orbulina of Dr. Carpenter, but which I have now proved to be a sub-genus of Globigerina, have been found to be surface-forms on every part of the ocean that I have sailed over. Different classes of creatures will be found on the surface during the night to those found in the day time; from sunset till daylight the Polycystina, Foraminifera, Acanthometra, Entomostraca, small Pteropods, and shelled Molusca, must be looked for; during the day the Crustaceans, Thalassicolla, Creseis, &c., will repay our endeavours.

I hope enough has been said to induce some to try the experiment on a scale that will bring great results.

When at sea I had not the chance of entering upon a field of observation that promises to be very fruitful and interesting. I had no spectrascope with me to examine into the nature of the light given off by the various phosphorescent forms that are at times met with in such profusion on the sea-surface. I would now make an appeal in their behalf. We shall look forward with interest to receive papers on this subject when we meet again at the close of the year. I hope that some of our correspondents abroad will take it up, and send us the spectra of the fire-fly, lantern-fly, and a host of other luminous creatures. At home the glowworm and phosphorescent sea-surface forms might all be attended to. Those who visit the Mediterranean and more southern parts of the ocean this summer might add the spectrascope to their scientific instruments for this purpose. I take much interest in this subject, but, as I am not likely to have an early opportunity of prosecuting the investigation, I have brought it forward for the benefit of others who may be more fortunate.

These spectra must be compared with those we shall get from such sources of phosphorescent illumination as phosphorus, heated fluor spar, and many others that I might name.

I have the pleasure to present to the Society a slide containing the most brilliant phosphorescent Entomostraca that I have met with. (See figs. 1, 2, 3.) When these were taken the sea was alive with them. When swallowed by or entangled with other creatures they in their turn appear to be also luminous. They also give luminosity to the water itself as it flows over them. When they are at rest they gradually cease to give out light; but as soon as they are disturbed or in motion, or the vessel containing them is shaken, they again become bright, even after many hours' confinement. Each of these specimens I picked out while phosphorescent, that there might be no mistake about the giver of light.

Fig. 1.

The nearest of the Entomostraca that I have been able to compare with these is the species Gibbosa, genus Cypridina, of the order Astrucoda, named and figured by Dana. He reports having found his specimens in the Pacific, in lat. 15° 20′ south,

Fig. 2.

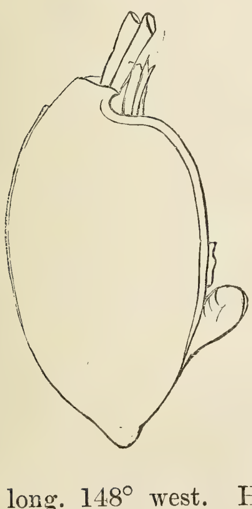
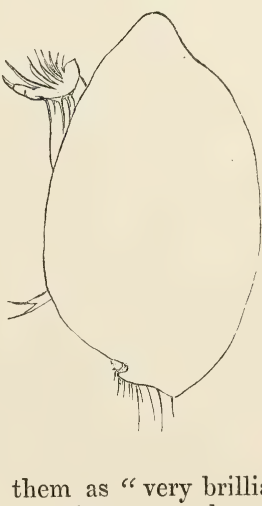


Fig. 3.



and long. 148° west. He notes them as "very brilliant." My specimens from which these drawings are taken were caught in the month of November, in the Bay of Bengal, in lat. 3° north, and long. 90° east. There is no reason why such things should not have a wide range. It may, therefore, be the same species.* It will be satisfactory to have more specimens of this from the Pacific, as we all know how an error might creep in, in labelling each specimen, when the collector passed over so many oceans during the same voyage.

I have seen the ship's decks running with liquid fire when the net containing this species has been taken on board. I must again express my regret that I had no spectrascope with me on my last voyage. I am therefore unable to lay before you the drawings of the spectra of the luminous Entomostraca that are on the table. I shall conclude by hoping that some of my zealous fellow-workers will take up the subject, and at an early day make up for my want of opportunity. It will end in more than a few interesting experiments. I look for results that may not only add to our chemical knowledge, but to such as may afford us some hints on matters that are at least the nearest akin to the nature of organic life.

* The difference in the form of the beak has since made me think it may be found entitled to be considered a distinct species.—S. R. I. O.

ERRATUM IN CAPTAIN MITCHELL'S PAPER ON THE SCREW MICROMETER.

Page 71, line 3 from bottom.

For—"With my micrometer a negative eye-piece (one by Powell and Lealand), with four filaments, amounts to the divisions of the micrometer head."

Read—"In my micrometer a negative eye-piece (one by Powell and Lealand), the thickness of one filament is equal to two divisions of the micrometer head."

TRANSACTIONS OF THE MICROSCOPICAL SOCIETY OF LONDON.

DESCRIPTIONS *of* NEW *and* RARE DIATOMS. SERIES XX. By R. K. GREVILLE, LL.D., F.R.S.E., &c.

(Communicated by F. C. S. ROPER, F.L.S. &c.)
(Read May 9th, 1866.)

(Plates XI and XII.)

PLAGIOGRAMMA.

Plagiogramma elongatum, n. sp., Grev.—Frustules elongated, with two central costæ; valve linear, narrower towards the rounded apices, generally very slightly contracted in the middle; striæ composed of rows of large, distinct, subquadrate granules. Length ·0074″. (Pl. XI, figs. 1, 2.)

Hab. In cleanings of shells from South America; Laurence Hardman, Esq.

In the character of the markings this noble species is allied to *P. tessellatum,* but it is twice the size, and the valve is of a different form, linear instead of elliptical, rounded at the ends, near which it becomes narrower and more strictly linear. It is the finest species of the genus hitherto discovered.

Plagiogramma? angulatum, n. sp., Grev.—Frustule in front view linear, with parallel sides, central and terminal costæ; the space between the terminal costæ and the apex oblique; striæ forming a very narrow band. (Fig. 3.)

Hab. Barbadoes deposit, Cambridge estate; in slides communicated by C. Johnson, Esq.; extremely rare.

All the specimens I have met with present the front view; and as the ends are distinguished from those of all the other species in being, as it were, sharply bevelled off on each side, some slight doubt may exist as to its generic position. The striæ are 16 in ·001″, and form a narrow marginal band. There is a remarkable angularity and squareness in the whole aspect of this diatom. Length about ·0040″.

Gephyria.

Gephyria gigantea, n. sp., Grev.—Valves much elongated, broadly cuneate and obtuse at the ends; costæ about $3\frac{1}{2}$ in ·001″ (Figs. 7, 8.)

Hab. Monterey deposit, California; Laurence Hardman, Esq.

A truly magnificent species. A lower valve now before me measures ·0120″ in length! A smaller example is ·0100″, in which the breadth is ·0017″ in the middle. Towards the ends the valve dilates a little, and then becomes broadly cuneate or elliptic-cuneate. Compared with this species, all those previously described are as dwarfs. In the largest of them (*G. incurvata*) the costæ of the valve are about 7 in ·001″, in the one now described they are only $3\frac{1}{2}$ in ·001″.

Omphalopelta.

Omphalopelta Moronensis, n. sp., Grev.—Small; disc with six compartments, filled with decussating striæ variously arranged, causing a play of colour; three of them pale, with a deltoid impression, the others darker, with a sort of triradiating nucleus and a marginal spinous process. Diameter ·0030″. (Fig. 14.)

Hab. Moron deposit, Province of Seville; Laurence Hardman, Esq.; extremely rare.

An exquisite little diatom, the markings of which cannot be satisfactorily reproduced by the artist, as they depend for effect upon the slightest change of focus. I have endeavoured to delineate what may be regarded as the most *peculiar* aspect. The play of colour is somewhat similar to that seen in *O. versicolor*, only not so brilliant. This effect seems to arise, not alone from the outer pellicle, the striæ of which are uniformly decussate, but partly from the undulation of the surface, and possibly from the subjacent structure. The marginal processes do not occur in all the compartments in accordance with the generic character, but only in the alternate darker ones. At the same time the diatom is too closely allied to *O. versicolor* to admit of its being removed. The presence or absence of spines, in many cases, at least, does not appear to be of much importance.

AULACODISCUS.

Aulacodiscus sparsus, n. sp., Grev.—Small; disc with 4 linear-oblong, submarginal processes; granules minute, coloured, so remote as not to be conspicuously radiate; umbilicus a subcircular blank space; furrows becoming gradually wider as they approach the processes; margin with a row of puncta. Diameter ·0030″. (Fig. 6.)

Hab. Barbadoes deposit, Cambridge estate; in slides communicated by C. Johnson, Esq.; extremely rare.

The only species with which the present very beautiful diatom can be compared is *A. Kilkellyanus*, which it resembles in the disc, having a general appearance of being sparsely filled with granules, while it is not much inferior in size. But in that species the lines of granules are conspicuously radiate, the sparse appearance depending upon the distance between the lines, the granules themselves being arranged in a pretty close series. The number also of processes in the same species is constantly three. In our new species the sparse character arises from the distance between the individual granules in the lines, which is so great that the radiation of the lines does not strike the eye at once, while the granules get disposed into half-concentric wavy lines, which have a beautiful effect. The number of processes is four.

CESTODISCUS.

Cestodiscus pulchellus, n. sp., Grev.—Disc circular, very convex, with minute, remote, radiating puncta, becoming irregularly crowded, and slightly less in size towards the margin; processes numerous; margin, as well as the space between it and the granules, striated. Diameter ·0030″. (Fig. 5.)

Hab. Nankaurie deposit, Nicobar Islands; in a slide kindly communicated by George Norman Esq.; very rare.

Distinguished by the remote punctation, which considerably neutralizes the effect of the radiating character. In the centre the granules are somewhat loosely disposed. Towards the margin the radiating granules pass abruptly into a band of others, crowded and irregularly arranged, from the outer edge of which band the processes arise, sixteen or more in number. Margin strongly defined and conspicuously striate.

Cestodiscus Stokesianus, n. sp., Grev.—Disc circular, with lines of very minute puncta, closely radiating from the very centre, and terminating towards the margin in a belt of still smaller irregularly crowded puncta; processes small, 6; margin striated. Diameter ·0030″. (Fig. 4.)

Hab. Moron deposit, Province of Seville; Rev. T. G. Stokes.

This species differs from *C. pulchellus*, with which it agrees in form and size, in the crowded character of the radiating lines which fill the disc, and in the very much smaller number of processes. The latter are somewhat inconspicuous. The puncta which form the band between the radiating lines and the striated margin are smaller than the others, and irregularly crowded. I am obliged to my indefatigable friend Mr. Stokes for having brought this addition to the genus under my notice.

RUTILARIA (char. amended).

Frustules very compressed, cohering into a short filament; valves slightly elevated at the angles, with a central glistening nodule prolonged into two short, linear, obtuse processes; the margin pectinate-ciliate.

The fortunate discovery of perfect frustules *in situ* enables me to determine the true position of this very interesting and curious genus, three species of which were published in the 'Quart. Journ. of Mic. Sci.,' Vol. III, New Series. At that time nothing more was known of them than what was afforded by a side view of the valve, which, however, was sufficient of itself to separate them from all known diatoms. The genus is unquestionably allied, as my friend Mr. T. G. Rylands suggests, to the *Biddulphieæ*. The angles of the valves are not prolonged into horns, but are only slightly elevated, and consequently the valves of opposite frustules, as seen in the front view, are brought so near together that the marginal ciliæ of each nearly cross the intervening space. The best view of the structure, showing its affinity with the *Biddulphieæ*, is to be obtained from the valve when so placed as to present both the front and lateral surfaces. (Fig. 10.) The genus, in fact, passes into *Biddulphia* through *B. fimbriata*, and especially through *B. spinosa*. Mr. Rylands, who with his usual kindness and acuteness examined, at my request, *R. elliptica* very critically, satisfied himself that of the two central processes one was straight and the other curved, as in the flexure of the forefinger; and that the processes of the opposing valves were interlocked, the straight process of the one passing mutually through the curved process of the other. Such an arrangement exhibits a remarkable analogy with that which exists in *Syndetocystis*, a MS. genus, to be described by Mr. Ralfs in his forthcoming supplement to the *Diatomaceæ* of Pritchard's 'History of Infusoria.' It was discovered in the Barbadoes deposit, and also belongs to the *Biddulphia* family. In that most wonderful genus the valves are nearly circular, fringed with ciliæ, and furnished with two intra-marginal rounded processes, and in the centre with another solitary process, erect, cylindrical, and elongated, and terminated by a laterally projecting ring. Looking at frustules *in situ*, in the front view, it is perceived that the stalk of the process of one valve passes through the ring of the process of the opposing valve, and, as this is the mutual position, the two frustules move freely as on pistons, and can be pulled asunder until the respective rings are brought into contact, but, of course, no further. Nothing but force can separate them. In the cabinet of my friend Mr. George Norman is a chain of four frustules so united.

Rutilaria elliptica, Grev.—Valve narrow-elliptical, raised at the angles into two short conical elevations. (Figs. 9, 10.)

Rutilaria elliptica, Grev.—'Journ. of Mic. Sci.,' Vol. III, New Series, p. 229, Pl. IX, fig. 3 (valve).

The figures which I am now able to offer will, it is hoped, render the structure quite intelligible. The front view exhibits four valves *in situ*, with the intermediate zone. The figure of the valve I formerly published was simply a side view. I now give the valve as seen under the most favorable circumstances for illustrating its relation to *Biddulphia*, viz., a partially front view.

Rutilaria superba, n. sp., Grev.—Large; valve elongated, oblong in the middle, gradually contracting towards each end into a narrow neck, which again dilates, and then suddenly terminates in a broadly elliptical, subacute apex. Length ·0065″. (Figs. 11, 12.)

Hab. Barbadoes deposit, Cambridge estate; in slides communicated by C. Johnson, Esq.

A fine species, with frustules almost as long as *R. epsilon*, but with a totally different diagnosis. The species to which it comes nearest is *R. ventricosa*; but it differs (so far as we know at present) in its far more elongated form and in the dilated ends of the valve. I have seen many specimens of *R. ventricosa*, none of which exhibit the last-named character; on the contrary, the prolonged extremities of the valve are sometimes more slender and attenuated than they appear in my figure ('Mic. Journ.,' Vol. III, N. S., Pl. IX, fig. 2). Nevertheless, these two diatoms may be ultimately found to be extreme forms of one and the same species. Fig. 11 exhibits a front view of two frustules *in situ.*

COCCONEIS.

Cocconeis armata, n. sp., Grev.—Small; disc broadly oval, with rather large, subremote, decussating granules, and distant marginal tubercles; median line straight, with a parallel row of very minute close puncta on each side. Length ·0021″. (Fig. 13.)

Hab. Barbadoes deposit, Cambridge estate; in slides communicated by C. Johnson, Esq.; extremely rare.

A brilliant and well-marked little diatom. The median line very slender. The granules arranged in intersecting curves, 8 in ·001″. Marginal tubercles, about 8 on each side.

NAVICULA.

Navicula strangulata, n. sp., Grev.—Valve elongated, deeply constricted at the middle, and composed of two ovato-cuneate subacute lobes, very minutely punctato-striate, with a narrow border of larger, more remote striæ (or cellules). Length ·0042″. (Fig. 24.)

Hab. In marine dredgings, Nassau, West Indies.

Among the multitude of described *Naviculæ* I can find no trace of this or the following well-marked species. The present diatom is evidently allied to *N. marginata* of Lewis, not only in form, bnt in the contrast between the minutely punctate striæ of the general surface and the row of larger cellules which constitute the margin. In the diatom before us these cellules are relatively much smaller than in *N. marginata,* but they are, nevertheless, evident. The general striæ are almost parallel, becoming slightly oblique only towards the ends. These striæ, taken near the median line, are 20 in ·001″, while those at the margin (cellules) are 10 in ·001″.

Navicula Jamaicensis, n. sp., Grev.—Elongated, with a deep constriction, dividing the valve into two oblong-elliptical lobes, somewhat produced and obtuse at the ends; structure minutely punctate, the puncta (cellules) arranged quincuncially, with a row of still smaller puncta along the margin. Length ·0040″. (Fig. 23.)

Hab. Jamaica; obtained by washing seaweeds.

This diatom has no immediate affinity with the preceding. There is no edging of larger cellules, but, on the contrary, a row of smaller puncta. The general structure, too, is unlike what is usually seen in the genus, the punctæ, which increase in size towards the margin, being not primarily so arranged as to produce the effect of striæ, but in quincunx fashion. Near the margin they are 15 in ·001″.

Navicula Egyptiaca, n. sp., Grev.—Elongated, narrow, convex, with elliptical subacute ends, and very gradually and slightly constricted at the middle; a linear lanceolate band of short broad costæ midway between the margin and median line, interrupted opposite the nodule, and a partial view of a second band of costæ at the margin. Length ·0050″ to ·0065″. (Figs. 16, 17.)

Hab. Stomachs of Holothuriæ; in slides kindly communicated by W. J. Baker, Esq., and George Norman, Esq.

My friend Mr. Ralfs has justly remarked in his observations on the genera *Navicula* and *Pinnularia*, that, "were the costæ always plainly developed as in *Pinnularia nobilis* and its allies, no difficulty could occur in determining the genera; but in many of the more minute species it is often very difficult to distinguish between striæ and costæ;" and he adds very truly, "that it is impossible to say to which genus a large number of Ehrenberg's species should be referred. He resolves the difficulty by merging for the present, at least, *Pinnularia* in *Navicula*. The very elegant diatom now under consideration would be, according to the late Professor Smith, an unquestionable *Pinnularia*, and it is too well marked to be mistaken for any other species. Costæ about 10 in ·001″. This Holothurian material is rich in many species, and there can be no doubt that collections from the stomachs of the *Holothuriadæ* generally, especially in the warmer parts of the world, would amply reward the diatom hunter.

Navicula permagna (Bail.), Ralfs.—Large, lanceolate or turgid-lanceolate, with somewhat obtuse apices; striæ fine, close, an intramarginal line, and a second shadowy line between the margin and the median line, and generally a rather broad, longitudinal, median blank space. Length ·0060″ to ·0108″. (Figs. 18—21.)

Navicula permagna, Ralfs, in Pritch. 'Infus.' (1861), p. 907. —Lewis, 'Notes on Diatom. of U. S. Seaboard,' p. 12, pl. ii, fig. 11 (var.).

Pinnularia permagna, Bail., 'Mic. Obs.,' p. 40, pl. ii, figs. 28, 38.

Hab. Abundant in the Hudson River at West Point, and occurs of a smaller size in Lake Monroe, at Enterprise, Florida; Bailey. In most of our large Atlantic rivers and brackish marshes; at Cape May, saltmarsh near Cold Springs, abundant; Dr. Lewis. Mouth of the River Berbice, West Indies, at half tide; Dr. Abercrombie.

Having had occasion some years ago to notice that this species exhibited a remarkable range of variation, I have endeavoured to ascertain to what extent it may be traced. In taking the original figures of the late Professor Bailey as our starting-point, we find the longitudinal median space so large that the striæ are regarded as forming a mere marginal band, constituting, in fact, the salient feature in the specific character of Bailey, and subsequently of Ralfs. In the smaller of the two figures given by the former the median space is equal to half the entire breadth of the valve. The next American authority is my friend Dr. Lewis, of Philadelphia, who publishes a figure of a singular variety, which, he says, is more common on the Delaware River and its tributaries than that represented by Bailey, and which, he thinks, may be the *Navicula Esox* of Kützing. (Fig. 21.)

In this variety the breadth of the median blank space is diminished nearly one half. In my two larger figures (18, 19), drawn from Berbice specimens, the breadth of the same part is again considerably reduced; and in the small figure (20), from the same locality, the blank space has become a mere line. Thus, although the extremes present an extraordinary difference, we have the discrepancy reconciled by intermediate conditions. In a dry state the valve of the Berbice examples exhibits very gorgeous colouring, the general hue being fine blue, while a broad, bright, crimson streak extends down each side midway between the median line and the margin, passing into orange-yellow towards the ends. It is to be regretted that there should be no reference to this in the American notices of the species. Another character which is prominent in the Berbice specimens is not mentioned by Bailey or Lewis. I refer to the shadowy lines, one of which passes down the whole length of the valve on each side between the margin and the median line; the other, close to the margin itself, is indistinctly given in Dr. Lewis's figure. The former seems to be uncertain as to its position, being much nearer the median in my figure 20 than in figures 18 and 19. These lines appear to be caused by superficial ridges, the intermediate spaces being generally concave; and if so, the character is an important one. With regard to the striation in some large valves, I have counted 16 in ·001″. In some small varietes 25, or even more, in

·001″. They are generally less close opposite the nodule, being 15 in one specimen, while in other parts of the same valve they are 20 in ·001″. The fact is, however, that no dependence can be placed on characters of this description. Besides the examples already referred to, I have some from Long Island agreeing with the intermediate form of the species, and a slide containing a large series from a salt marsh at Cold Springs, Cape May, U.S., all the specimens being small and intermediate. In a drawing copied by my friend Mr. Roper from a specimen obtained by Professor Bailey from drift ice on the Hudson River the leading characters are very prominent, especially the longitudinal ridge-like line; and the median space is nearly as broad as in Professor Bailey's figures.

Navicula Zanzibarica, n. sp., Grev.—Large; valve elliptical, with the apices obtuse, somewhat produced; striæ minutely moniliform, divided by a blank line into two series, the one linear, very narrow, parallel with and next the median line, the other containing a sort of irregular spot opposite the nodule. Length ·0074″. (Fig. 22.)

Hab. Zanzibar; in slides kindly communicated by Professor H. L. Smith, of Kenyon College, Gambier, Ohio.

A noble diatom, and, beyond dispute, an excellent species. The striæ are obviously moniliform, slightly oblique, interrupted by a narrow blank line, not contracted opposite the nodule, gradually attenuated towards the ends, and disappearing before reaching the apex. On each side the median line, and parallel with it, is a narrow line or band of striæ; and these two bands, along with the median line itself, as they approach the ends become somewhat elevated and produced, and terminate in what may be regarded as a broad keel. Opposite the nodule, and midway between the margin and median line, is a curious spot composed of an irregular cluster of punctæ, puckered, as it were, in the middle, while the surrounding striæ are for a small space thrown into confusion. The first specimen which I found conveyed the impression that this singular appearance was the result of some accidental malformation; but all the valves which have been subsequently discovered present the same character. The striæ are 17 in ·001″.

Navicula rimosa, n. sp., Grev.—Elliptic or elliptic-oblong, with a band of fine striæ less than a third of the semi-diameter in width, a second very narrow band close to the median line, and a third narrow one between the two and not extending to the ends; the intermediate spaces obscurely punctate (cellulate). Length ·0035″ to ·0060″. (Fig. 25.)

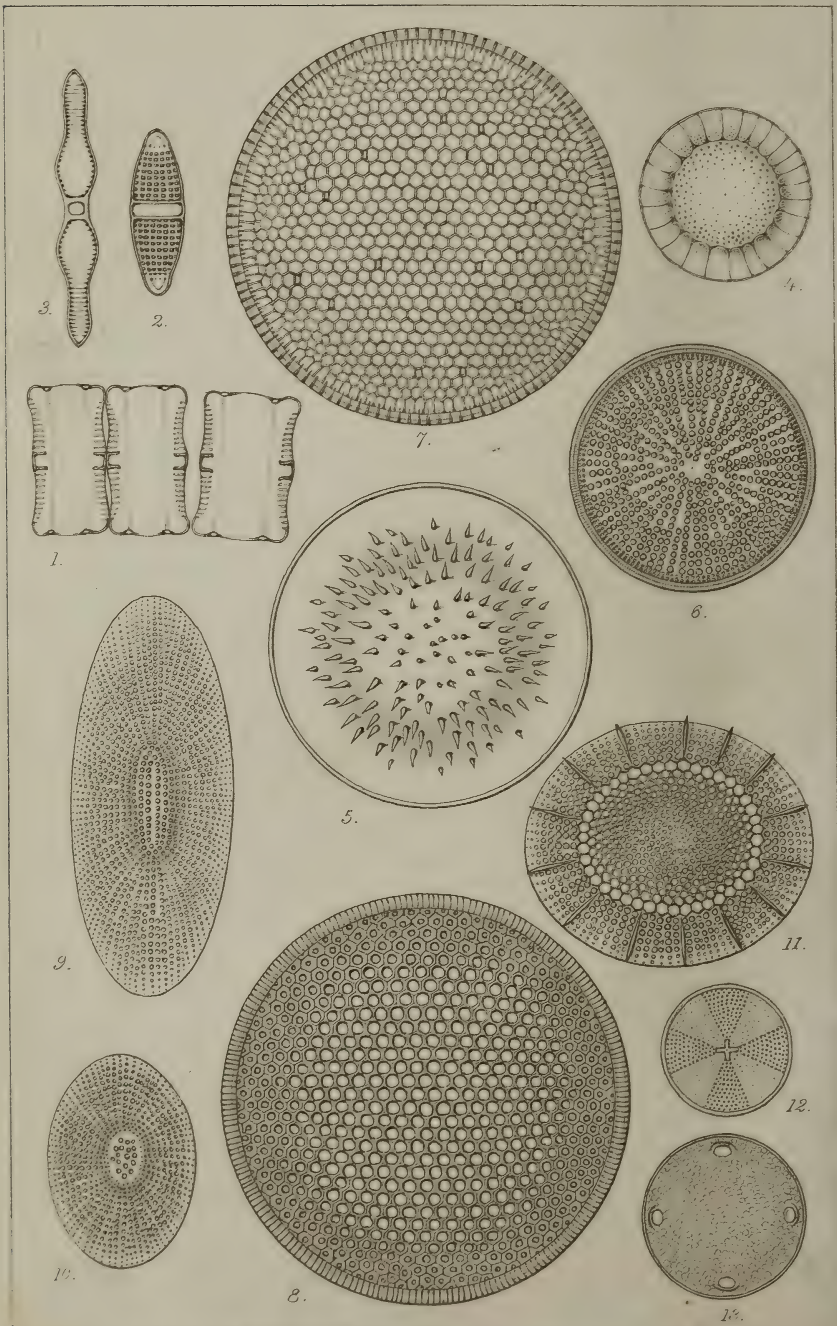
Hab. Red Sea; cabinet of Laurence Hardman, Esq.

The intermediate linear band of striæ serves to distinguish this species at a glance. It has at first sight the appearance of a cleft in the valve, for the striæ, being very fine, are not at once perceived. It extends generally to about two thirds of the length of the valve. Sometimes it follows the curve of the valve, but in others (as in the figure) it is straight or very nearly so.

Navicula excavata, n. sp., Grev.—Elliptic, with an external band of fine striæ, less than half the semi-diameter of the valve in breadth, and a very narrow series next the median line; intermediate space obscurely cellulate, with a large sudden indentation opposite the nodule. Length about ·0030″. (Fig. 15.)

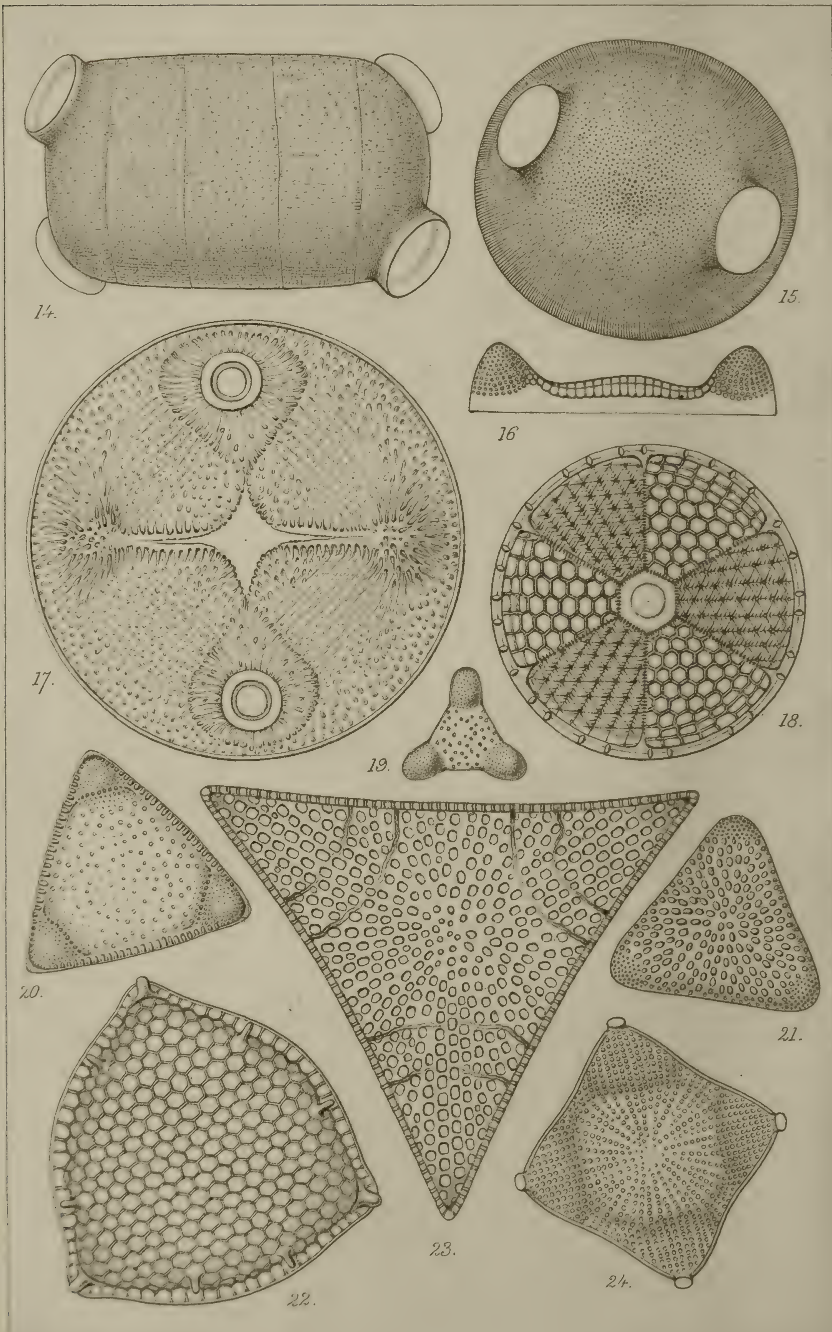
Hab. Red Sea; cabinet of Laurence Hardman, Esq.

A species having much of the contour of *N. Hennedyi,* but differing from it in the much finer striæ (about 35 in ·001″) and in the large remarkable notch or excavation in the intermediate space opposite the nodule into which the marginal striæ extend.



R. K. Greville, del.

W. H. M^c Farlane, Lith^r Edin^r



R. K. Greville delt. - on stone by F. Huth.   W. H. McFarlane, Lithr. Edinr.

DESCRIPTION OF PLATES I & II,

Illustrating Dr. Greville's paper on New Diatoms. Series XVIII.

Fig.

1.—*Plagiogramma decussatum,* front view.

2.— „ „ side view.

3.— „ *Barbadense.*

4.—*Mastogonia Actinoptychus.*

5.—*Xanthiopyxis ? umbonatus.*

6.—*Coscinodiscus elegans.*

7.— „ *pulchellus.*

8.— „ *robustus.*

9, 10.— „ *oblongus.*

11.—*Brightwellia Johnsoni.*

12.—*Actinoptychus minutus.*

13.—*Eupodiscus minutus.*

14.—*Biddulphia Johnsoniana,* front view.

15.— „ „ valve.

16.— „ *mammosa,* front view of valve.

17.—*Auliscus Hardmanianus.*

18.—*Heliopelta nitida.*

19.—*Triceratium mammosum.*

20.— „ *dulce.*

21.— „ *inelegans.*

22.— „ *Robertsianum.*

23.— „ *Stokesianum.*

24.—*Amphitetras elegans.*

All the figures are × 400 diameters.

DESCRIPTION OF PLATES III & IV,

Illustrating Mr. Jabez Hogg's paper on Vegetable Parasites.

PLATE III.

Fig.

1, *a.*—Second day, specimen from No. 1. Favus-ferment in barley-wort, set aside in a darkened room. Yeast-cells, chiefly ovoid in form, with spores and a few epithelium-scales.

1, *b.*—Fifth day, specimen from No. 1. The yeast-cells more circular in form and larger in size. Spores and torulæ, with bacterium-like bodies in an active state.

1, *c.*—Tenth day, specimen from No. 1. Yeast-cells slightly degenerating, becoming more ovoid; torulæ and bacteria.

2, *a.*—Fifth day, specimen from No. 2, freely exposed to light. Small growth of yeast-cells, with spores and tufts of mycelia, penicillium, and a few large epithelium-scales; bacterium-like bodies not drawn.

2, *b.*—Tenth day, specimen from No. 2. Yeast-cells degenerating and disappearing; spores of mould, mycelia, and bacteria increasing.

3. —Healthy yeast-cells fresh from a porter brewery, drawn rather smaller than they measured.

4. —Portion of a scab taken from a boy suffering from eczema of eyelids and impetigo of scalp, showing spores, moniliform chains, torulæ mycelium, and epithelium-scales.

PLATE IV.

1.—Fresh yeast transferred to a saccharine solution, and showing on the second day a tendency to degenerate.

2.—Degenerated or exhausted yeast taken from the bottom of a porter-vat; cells nearly all void, and torulæ abundant.

3.—Favus-fungus grown in a pure saccharine solution.

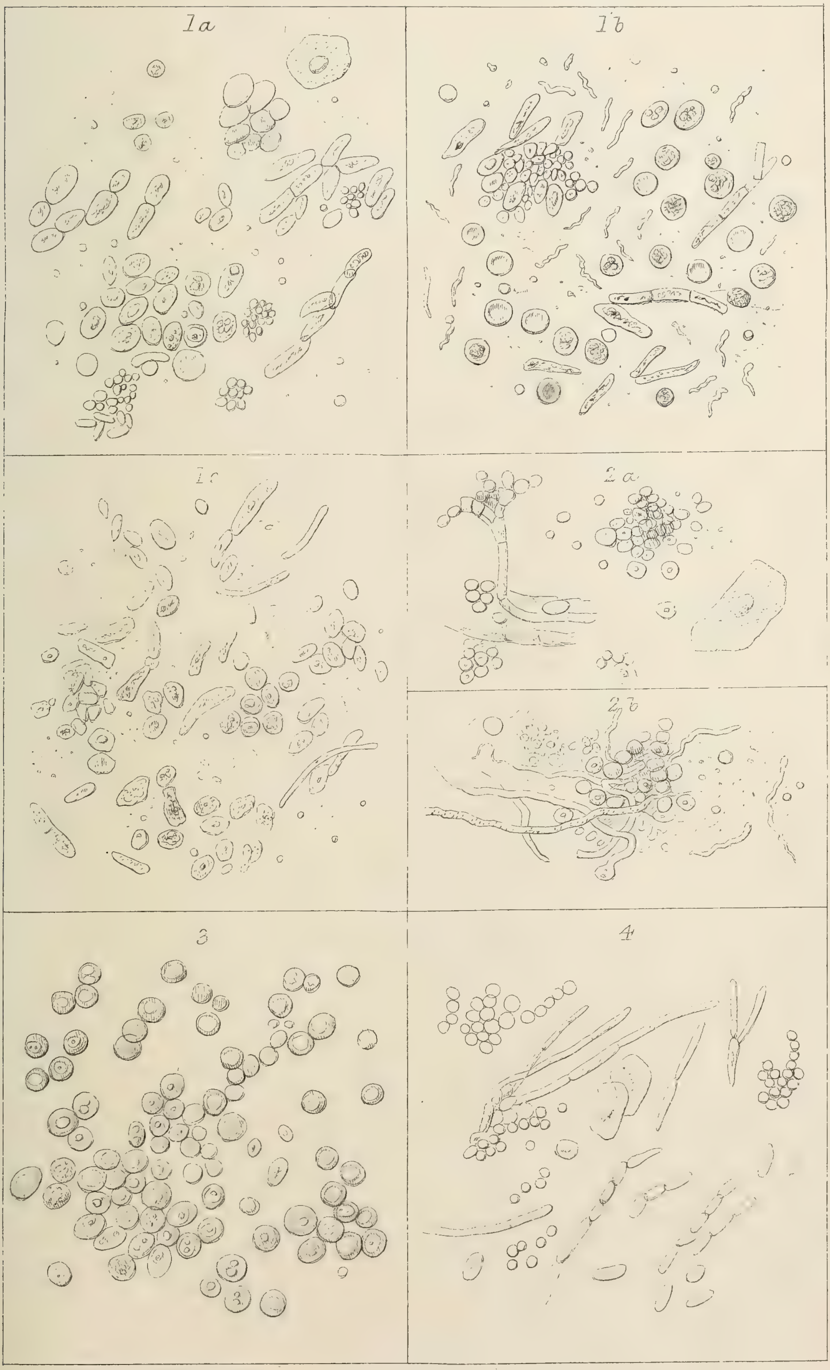
4.—*Aërozoa.* Spores with mycelium, &c., taken in the atmosphere during the cholera visitation of 1858.

5.—Penicillium-spores. Mould growing in saccharine solution.

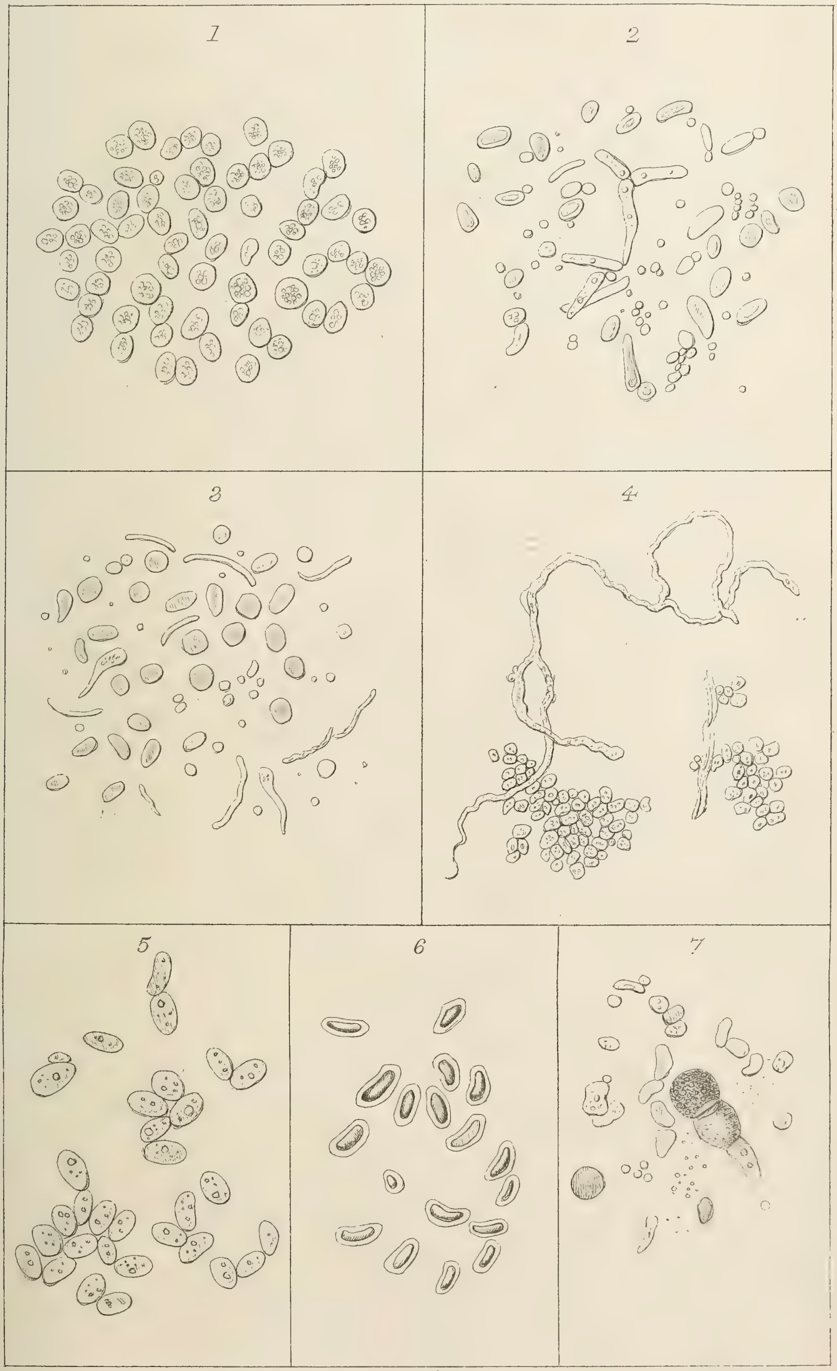
6.—Aspergillus-spores growing in saccharine solution.

7.—Puccinia-spores growing in saccharine solution.

Magnified 400 diameters.



Jabez Hogg del. Tuffen West sc. W. West imp.



Jabez Hogg del. Tuffen West sc.

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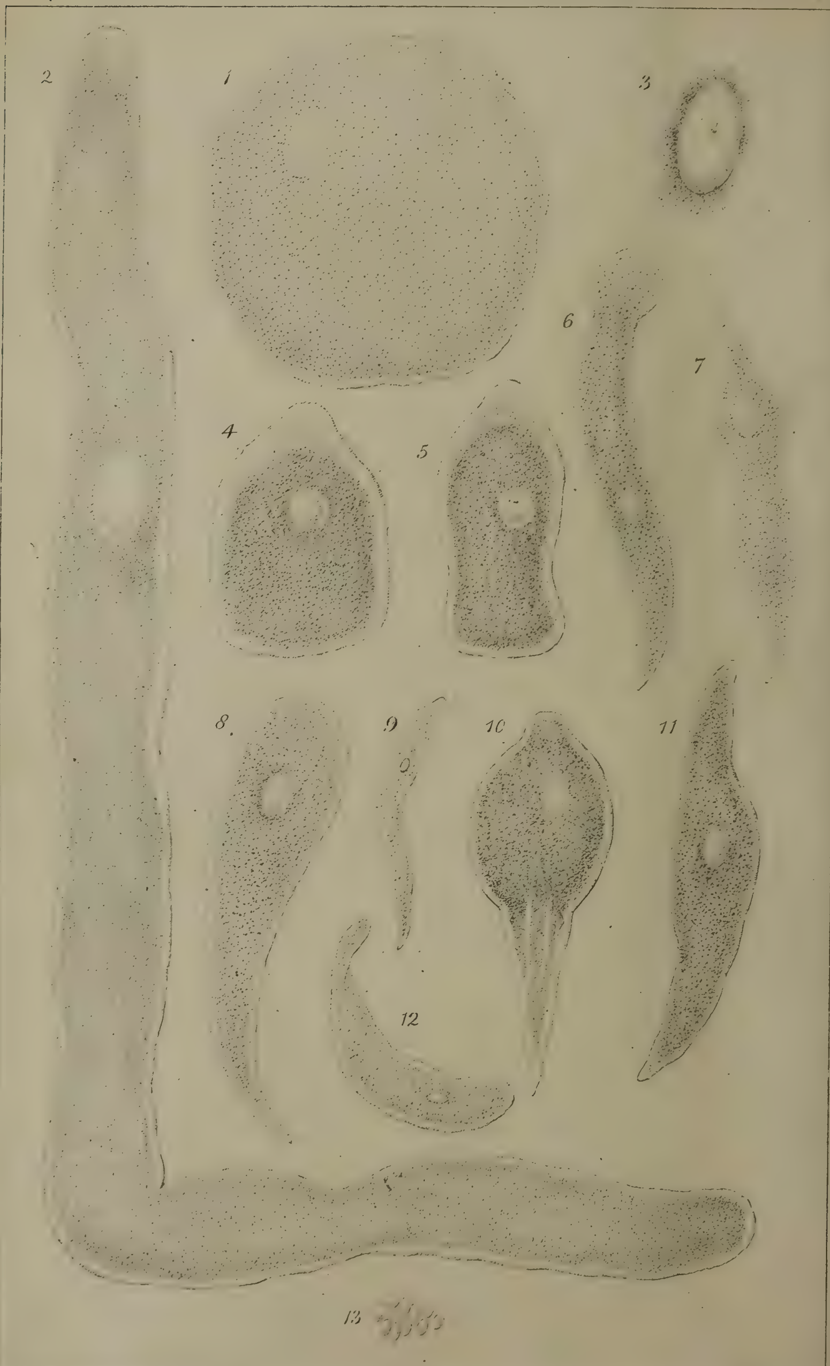


E. Ray Lankester del. Tuffen West sc.

W. West imp.

DESCRIPTION OF PLATE V,

Illustrating E. Ray Lankester's paper on the Gregarinida.

Fig.

1.—An unusually large *Monocystis Lumbricorum* of the circular form, from the posterior extremity of the visceral cavity of *L. terrestris*, $\frac{1}{25}$th inch in diameter.

2.—An unusually large *M. Lumbricorum* of the elongated or linear form, from the seminal vesicle of a specimen of *L. terrestris*, in which all the genitalia were occupied by such forms, $\frac{1}{5}$th of an inch in length.

3.—Nucleus or vesicle of the individual drawn in fig. 1.

4, 5.—*Monocystis pellucida*, Kölliker, adult specimens, which are not *pellucid*, showing the extensive development and apparent fibrillation of the sarcodic envelope.

6, 7.—Forms of Monocystis (*M. Nemertis*, Köll.?) met with abundantly in *Ommatoplea* and *Convoluta* and once in *Aphrodita hystrix*.

8.—*Monocystis Cirrhatuli*, n. sp., a large form abundant in the perivisceral cavity of *C. borealis*.

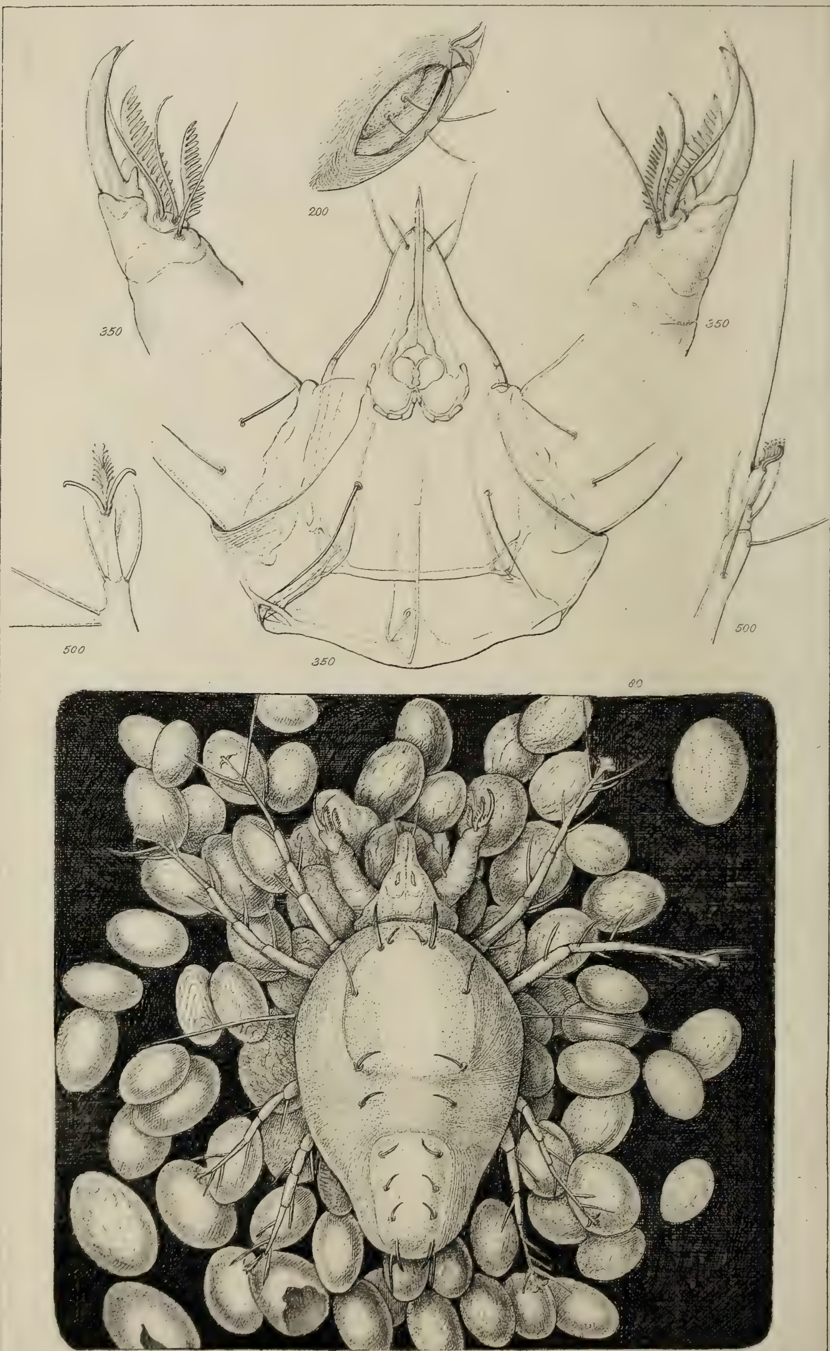
9.—Young individual of *M. Cirrhatuli*.

10.—*Monocystis Eunicæ*, n.sp., from intestine of *E. Harassii*.

11.—*Monocystis Terebellæ*, Kölliker, from *Terebella nebulosa*.

12.—*Monocystis Phyllodocæ*, a form differing considerably from that described by Claparéde.

13.—Somatic granules from *M. Lumbricorum*.



A. T. Hollick del. Tuffen West sc.

W. West imp.

DESCRIPTION OF PLATE VI.

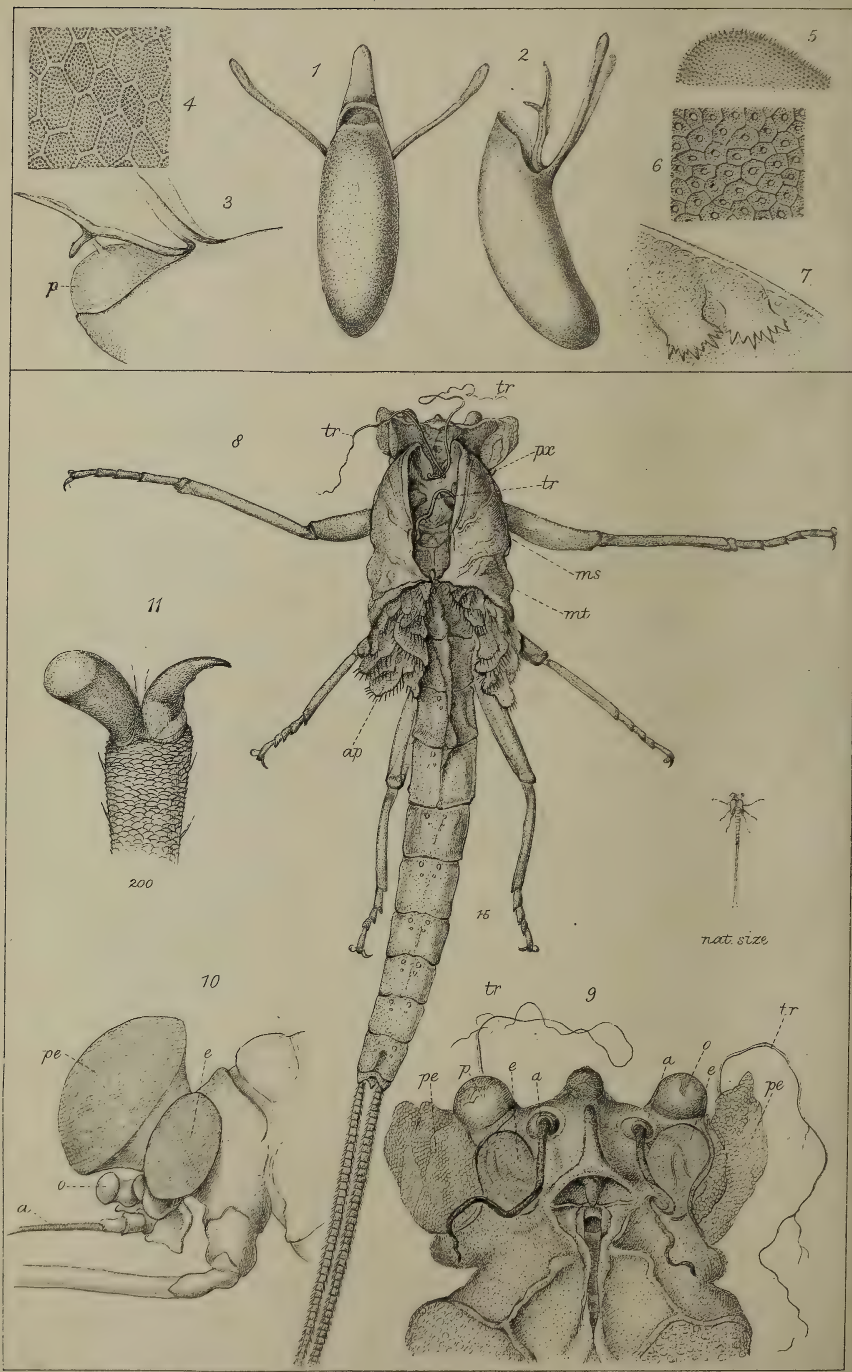
Illustrating Mr. Richard Beck's paper on an Acarus and its Agamic Reproduction.

In the lower part of the plate is shown the position usually taken by this Acarus after arriving at maturity, viz., that of standing over and guarding a large number of eggs. The shells of those eggs already hatched refract a most brilliant blue, and the presence of the parent is often detected by the eye catching this colour.

In the upper part of the plate are shown the falces, with their fangs and combs, and between them the piercers and sucking apparatus of the mouth.

The two small diagrams at the side represent the extremities of two feet, each provided with two claws, two rows of tenent hairs, and one of them having an unusually long terminal hair.

The figure at the very top represents the anus.



Tuffen West ad nat del et sc.

W. West imp.

DESCRIPTION OF PLATE VII.

Illustrating Mr. Tuffen West's paper on the Egg of Scatophaga and on the Cast Skin of an Ephemeron.

Figs. 1 to 7 represent the structure of the Egg of Scatophaga.

Fig.

1.—Ventral aspect.

2.—Lateral aspect.

3.—The opening on side view; *p*, the delicate pellicle investing the young larva.

4.—Portion of the egg-case, about the middle, showing its reticulate and elevato-punctate structure.

5.—Part of tip of one of the divergent appendages, to show the minute punctation on its surface.

6.—Part of the dark portion of the cover, with its 4-5 angular reticulation and translucent spots.

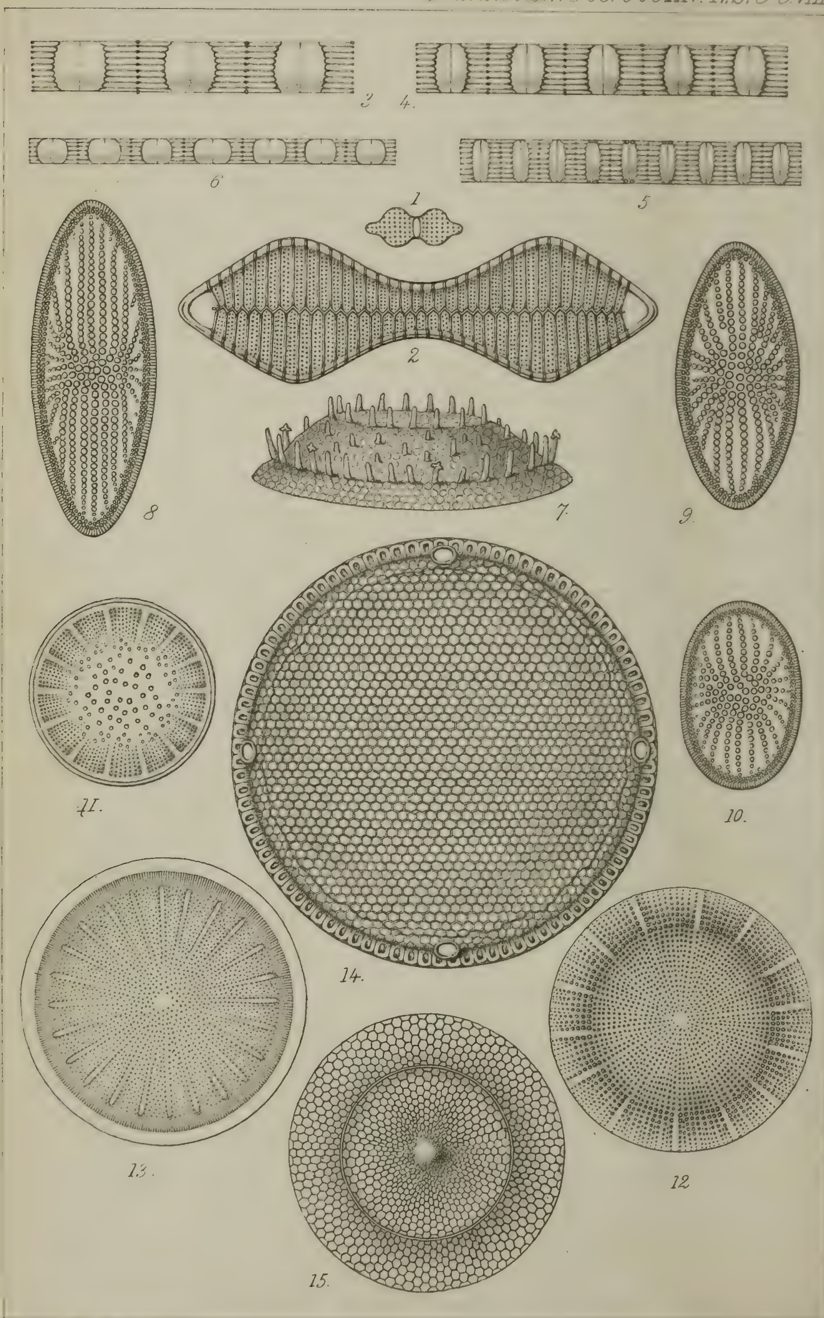
Figs. 8 to 11 illustrate the Notes on Cast Skin of an Ephemeron.

8.—Cast skin entire, except the ends of the tails; *p. x.*, pro-thorax *m. s.*, mesothorax; *m. t.*, metathorax; *a. p.*, alar pellicle, &c.

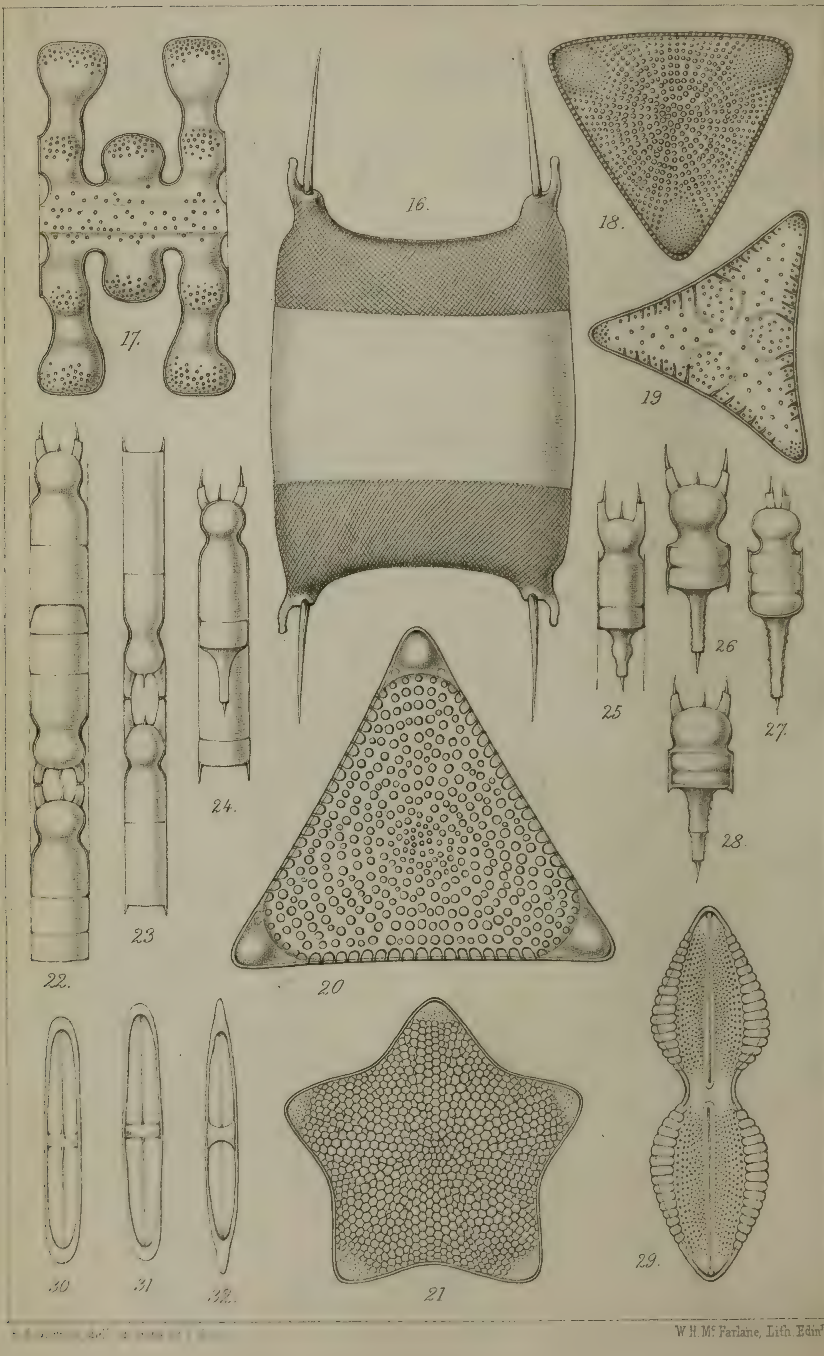
9.—Exuviæ of head, under surface; *a a*, antennæ; *e e*, *pe*, *pe*, eyes *tr*, *tr*, tracheæ.

10.—Profile view of head of an allied species; this is added as explanatory of the preceding figure; similar letters apply to it, with the addition of *o*, one of the ocelli. The grotesque appearance imparted by the upper pair of eyes, borne aloft on stout columns, is well seen.

11.—End of foot, consisting of a recurved, sharply-pointed claw, attached to the side of a pedicellate oval pulvillus. The cast skin figured, when placed on a square of thin covering-glass, adhered sufficiently to bear removal upside down from the spot where it was obtained to a distant apartment.



... by F. Huth.
W. H. McFarlane, Lith. Edinr.



W. H. McFarlane, Lith. Edin.

DESCRIPTION OF PLATES VIII & IX,

Illustrating Dr. Greville's paper on New Diatoms.
Series XIX.

Fig.
1.—*Plagiogramma orientale.*
2.—*Gephyria constricta,* valve.
3—6.—*Melosira castata.*
7.—*Cresswellia rudis.*
8—10.—*Coscinodiscus Lewisianus.*
11.— „ *Normanianus.*
12.— „ *Barbadensis.*
13.— „ *elegans.*
14.—*Eupodiscus Hardmanianus.*
15.—*Craspedodiscus umbonatus.*
16.—*Biddulphia Chinensis.*
17.— „ *podagrosa.*
18.—*Triceratium repletum.*
19.— „ *picturatum.*
20.— „ *lantum.*
21.— „ *quinquelobatum.*
22—28.—*Syringidium Dæmon.*
29.—*Navicula spectatissima.*
30, 31.—*Stanroneis rotundata.*
32.— „ *scaphulæformis.*

All the figures × 400 diameters, except fig. 16, which is × 200.

DESCRIPTION OF PLATE X,

Illustrating Dr. Bastian's paper on Pacchionian Bodies.

Fig.

1.—Different forms of Pacchionian bodies seen on surface of arachnoid.

2.—Appearance of epithelial covering of Pacchionian body.

3.—Tesselated epithelial cells from surface of pericardium.

4.—Solitary cells of same kind from Pacchionian body.

5.—Homogeneous, structureless network of tissue from surface of same body.

a. Spiral elastic tissue.

6. More highly developed tissue of same kind, presenting slight traces of fibrillation.

7. Interlacing bundles of fibrous tissue fully developed from more mature Pacchionian body.

8. Ordinary fibrous tissue from surface of mature body.

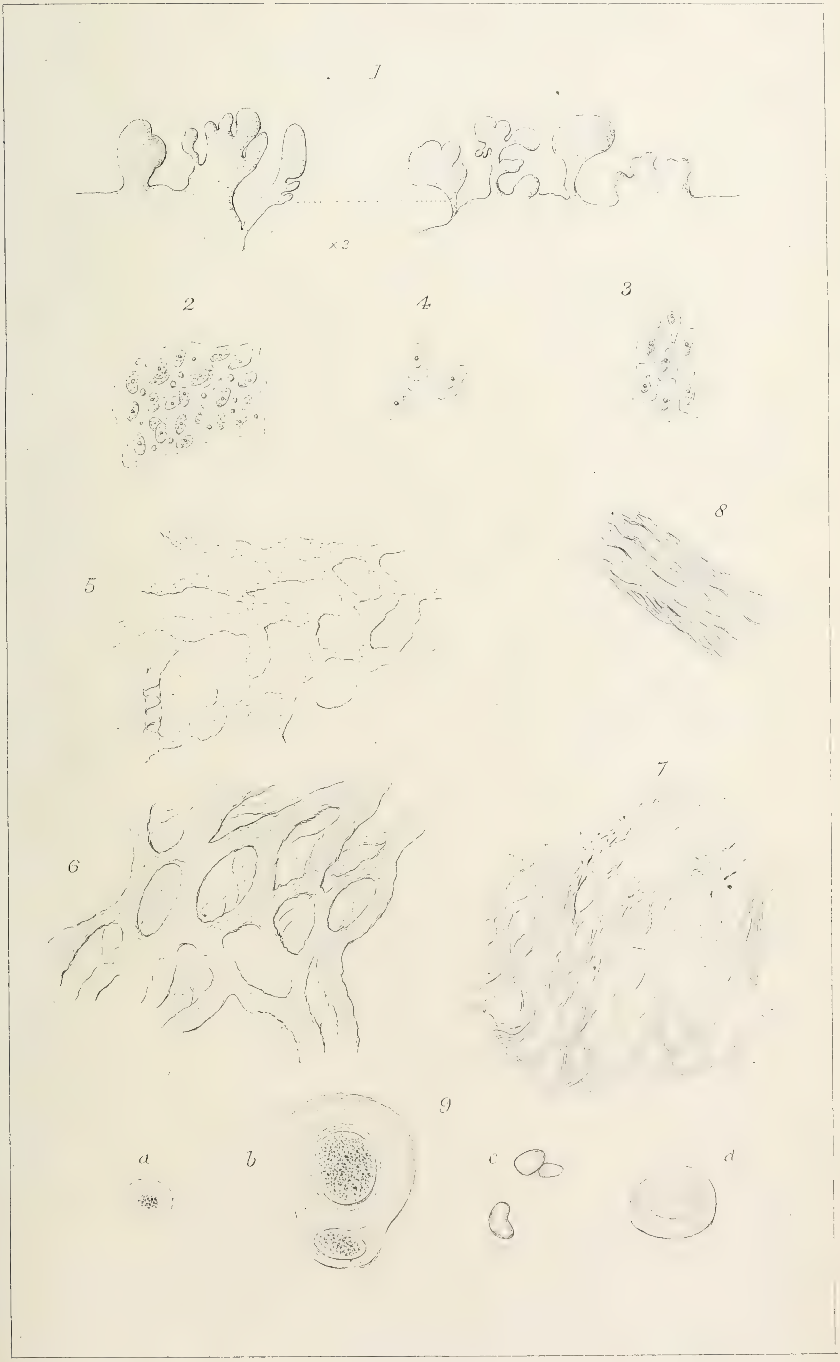
9. Different forms of calcareous deposit.

a. Granules with concentrically arranged tissue developing around them.

b. Body of same kind, only larger and more mature.

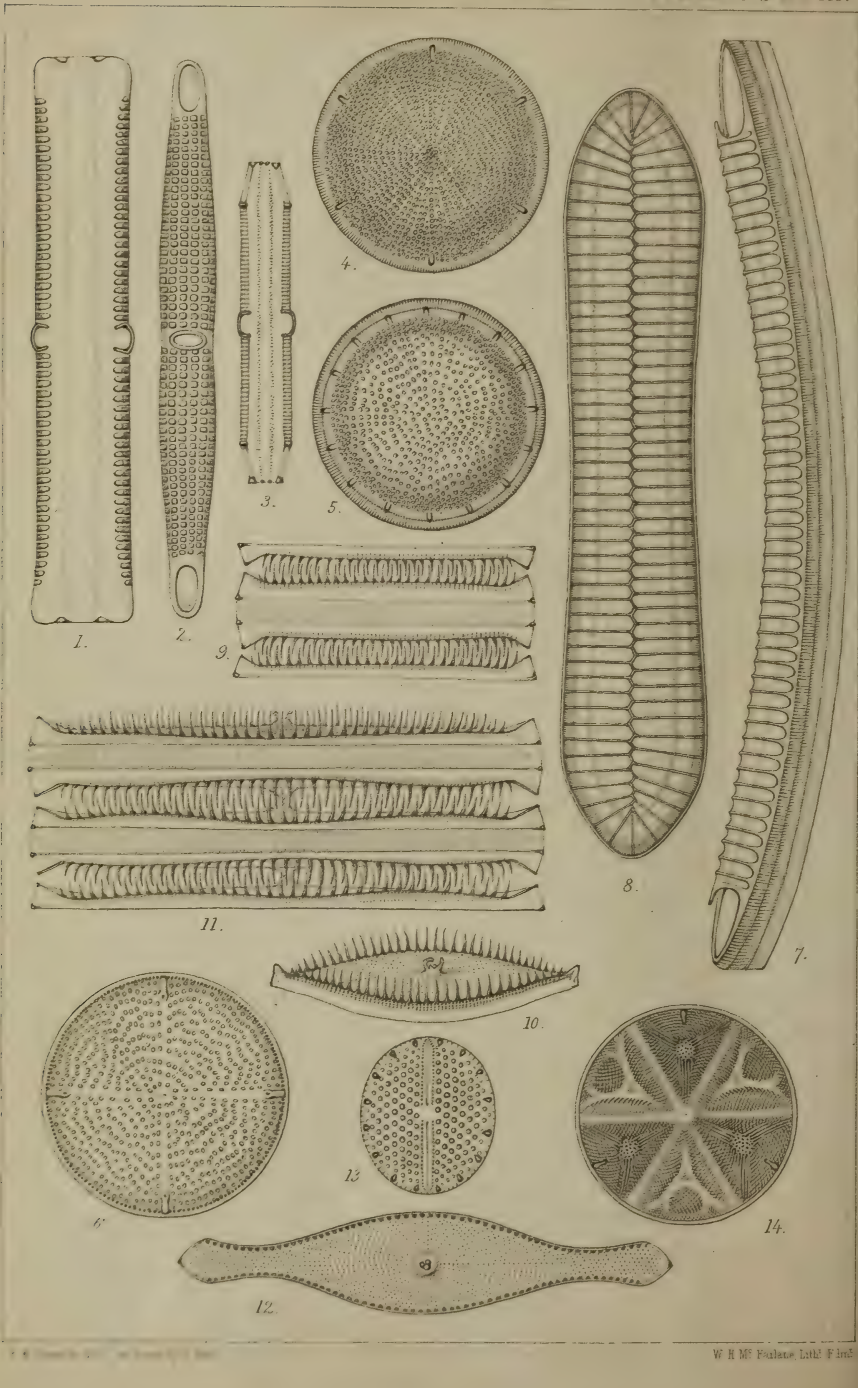
c. Simple, highly refractive, calcareous nodules.

d. A much larger one, showing concentric markings.



Tuffen West sc.

W. West imp.



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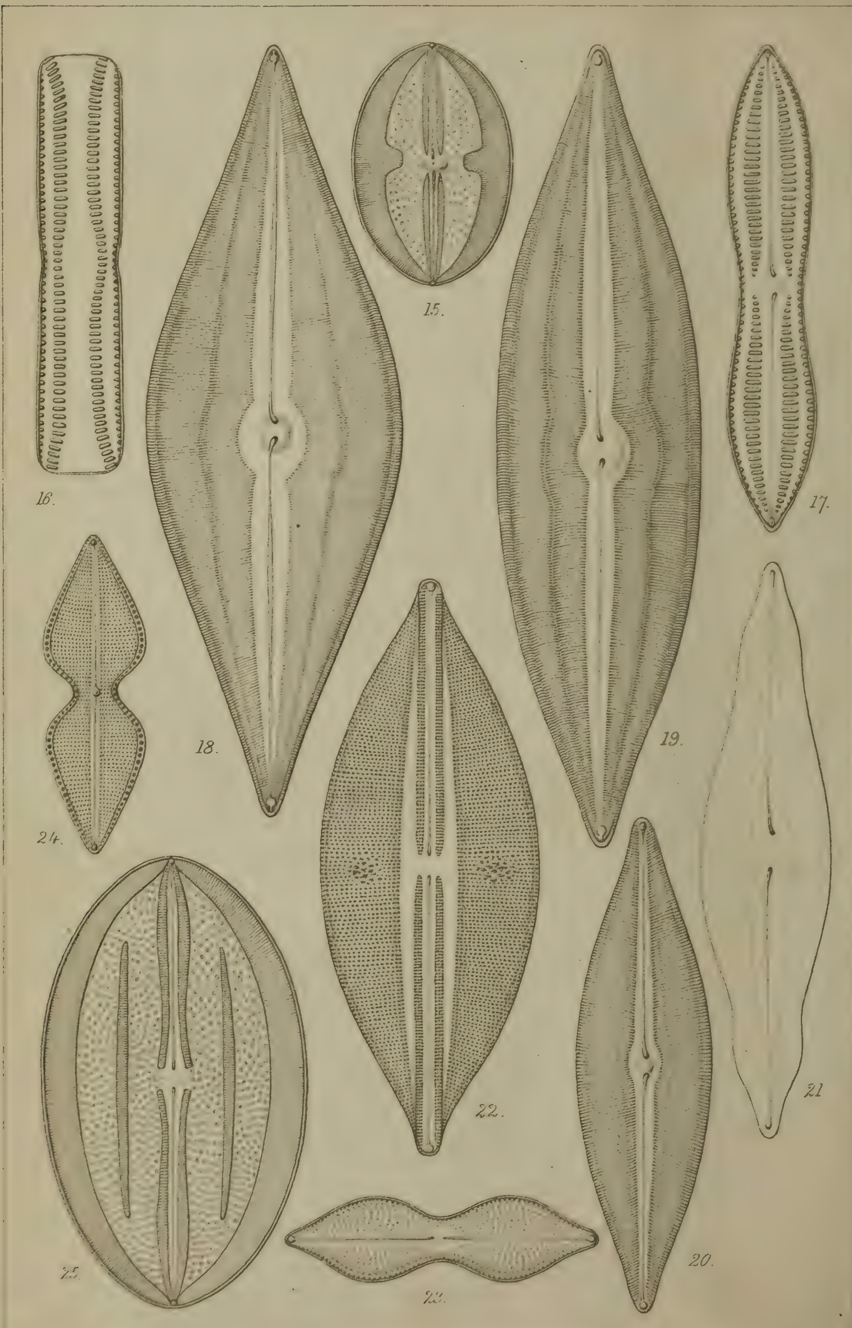

R.K. Greville del.t on stone by F. Huth. W.H. M.c Farlane, Lith.r Edin.r

TRANSACTIONS OF MICROSCOPICAL SOCIETY.

DESCRIPTION OF PLATES XI & XII,

Illustrating Dr. Greville's paper on New Diatoms. Series XX.

Fig.

1.—*Plagiogramma elongatum,* front view.

2.— „ „ valve.

3.— „ *angulatum,* front view.

4.—*Cestodiscus Stokesianus.*

5.— „ *pulchellus.*

6.—*Aulacodiscus sparsus.*

7.—*Gephyria gigantea,* lower valve, front view.

8.— „ „ valve, side view.

9.—*Rutilaria elliptica,* front view.

10.— „ „ valve.

11.— „ *superba,* front view.

12.— „ „ valve, side view.

13.—*Cocconeis armata.*

14.—*Omphalopelta Moronensis.*

15.—*Navicula excavata.*

16.— „ *Egyptiaca,* front view.

17.— „ „ side view.

18, 19.— „ *permagna,* very large, from Berbice.

20.— „ „ small var., from Berbice.

21.— „ „ var. from Delaware River, U.S. (outline of Dr. Lewis's figure).

22.— „ *Zanzibarica.*

23.— „ *Jamaicensis.*

24.— „ *strangulata.*

25.— „ *rimosa.*

All the figures are × 400 diameters.

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