Shelve

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OF THE

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INAUGURAL ADDRESS OF THE PRESIDENT.

Dr. T. Spencer Cobbold, F.R.S., &c.

(*Delivered September 26th*, 1879.)

Gentlemen,—When I recently arrived home, at the close of a two months' tour in Brittany, the first periodical that I opened was the "Athenæum" for August 2nd, containing a report of the anniversary meeting of this Club; and after reading the brief summary of your retiring President's address, I naturally felt that it was one of my first duties to consider how I could best place myself at your service. It occurred to me that a few unpretending remarks, designed to serve as a general introduction to the scientific business of our session, would not be unsuitable to the occasion. Your honorary secretary has, indeed, informed me that no such formality as an opening lecture is customary; but, since the delivery of an altogether informal and very brief address is not expressly forbidden, I can only hope that the few remarks now offered will not in any way run contrary either to the wishes or to the sentiments of the Club.

At the outset, I need scarcely say that, but for that legitimate species of freemasonry which unites, or ought to unite, in bonds of more or less friendliness all workers in science, I might have felt somewhat timid at the thought of occupying a chair held by such a *savant* as my predecessor. In this matter, may I not add, once for all, and with your approval, that it was a gracious act on the part of one so occupied as Professor Huxley is known to be with the highest administrative functions of science in this country, to give the Quekett Club the benefit of his advice and personal assistance. Probably no living representative of science has ever shown more

willingness to lend a helping hand to the humblest workers in biology and its outlying territories of applied science than your late President. Doubtless there are many eminent men who are animated by the same generous principles ; but it is not given to many to possess either the power or the prerogative enjoyed by Professor Huxley.

In the infancy of science it was quite possible for one mind to grasp, not only the general conclusions but even also the minutest known details applicable to each special walk of biological research ; but now-a-days, no mind, however capacious, can possibly do more than acquire a general knowledge of the natural history sciences and sub-sciences as they actually stand. Special lines of research have become laboriously—I had almost said, painfully—minute. Thus, to add in the aggregate a mere handful of facts to the circle of the known, it is now necessary that a worker should occupy himself for months, or even years, with the study of a small natural group of organisms. There is also this disadvantage for the special worker, that whilst he is so occupied, it is next to impossible for him to take due cognisance of the work of his fellow-labourers in other territories than his own. This is apt to beget narrowness of vision, sometimes leading to very unpleasant consequences. Rare indeed is it to find a man whose diverse gifts and sympathies enable him to extend his visual range over all the best work being done by home and foreign naturalists ; and yet, notwithstanding the immense difficulties of the task, there are a few, whose names are well known to you, who annually perform prodigies of labour in this respect. To be sure some departments of science have had less justice done to them by collaborators than others, but on this matter I shall have occasion to dwell presently.

Of late years it cannot fail to have struck even the general onlooker in science how much attention has been paid to the lowest forms of animal and vegetable life, whilst the higher and intermediate groups have suffered comparative neglect. It may be said, with truth, that even science is not wholly free from the vagaries of fashion. The present tendency is undoubtedly an outcome dating from the publication of Mr. Darwin's work "On the Origin of Species." Not unnaturally, it was thought that a complete solution of some of the more intricate problems of life could only be arrived at by a thorough and exhaustive analysis of the phenomena displayed by the very lowest organisms. Some of my scientific friends

have been good enough to ask me why I have so carefully abstained from taking any part in archæbiological controversy and in the work upon which it has been based. My apology is this. From the very first it was clear to me, that no ordinary investigator in science could hope to approach this subject successfully, unless by his antecedents and present opportunities alike he were specially trained for the work. This view was more deeply impressed upon my mind after the publication of Professor Tyndall's lectures on "Dust in Relation to Disease," and other kindred topics. Obviously it was necessary to be armed at all points. One must not only have been well versed in the modern methods of physiological research, but must also, in addition to the possession of a competent knowledge of Zoology and Botany, have done special work in the laboratory of the physicist in combination with that very difficult manipulative toil which is known only to those who work with the smallest objective glasses. If any one doubts the extreme caution necessary to the worker employing high powers, let him carefully read Dr. Royston-Pigott's paper "On Microscopical Researches in High Power Definition," recently published in the "Royal Society's Proceedings." To those of us who commenced investigating more than thirty years ago, such an *exposé* of the difficulties of a correct interpretation of facts observed is very significant. For my own part, I take positive comfort in the reflection that I have rarely had occasion to work with objectives higher than the $\frac{1}{4}$ or $\frac{1}{8}$ of an inch. In the matter of Archebiosis, I felt all along that the germ theory of disease and the bacterium hypothesis were in the hands of advocates specially fitted for the task of controversy. It was, in fact, a war of giants, and I said to myself: "Let the giants fight it out; I for one will not venture to enter the lists." How hot the contest became in relation to the etiology of febrile and other diseased conditions is well known to the medical profession. Thus, one of the professional warriors—a former President of this Club, and certainly one of the most skilled microscopists this country has ever produced; who disputes the importance of bacteria considered as cause of disease—thus writes concerning the treatment his views received at the hands of another eminent *savant*. Dr. Beale says:—"Affectation of excessive caution in giving an opinion upon a scientific question may shield a philosopher suffering from confusion of thought, but all the interest connected with the discussion of this subject disappears, if an authority, after a full study of the matter,

tells people that the poison of a contagious fever may be a bacterium or something allied to a bacterium, or something not allied to a bacterium." Well, gentlemen, the warriors have had a good many rounds, and I fear the fight has not yet terminated. As to results, nothing has as yet, perhaps, been definitely settled ; yet, as a patient on-looker (and one not much concerned with the personal disfigurements sustained by individual combatants), I am free to confess myself an entire convert to the hypothesis which holds that organic germs of some kind or other are really capable of producing the most disastrous consequences both to man and beast. However, I must again remark that when an investigator has to deal with the genesis and behaviour of particles, often less than the 100,000th of an inch in diameter, it is not difficult to understand the necessity of extreme caution in drawing conclusions. In connection with this controversy, I am, of course, especially bearing in mind the labours of Messrs. Dallinger and Drysdale, also the work accomplished by Lister, Sanderson, Roberts, Bastian, Beale, Tyndall, Lewis, and your late President, As regards foreign writers and the practical application of their researches, permit me to refer to the able *résumé* of Mr. Steel, in the pages of the "Veterinary Journal."

The most humble member of this Club need not be discouraged by the confessed embarrassments which some of our leaders in science have experienced when dealing with the phenomena exhibited by the lowest forms of life. The discipline of science is a grand one. It demands candour. There is probably no living man of eminence who has not retracted, more or less completely, views or errors of interpretation made in the earlier years of his toil. Now and then it happens that this severe discipline makes the advanced biologist too cautious. He is timid of drawing conclusions, even from the most clearly recognisable facts ; not only so, he will sometimes refrain from expressing any opinion about matters concerning which the unreflecting amateur pronounces with unblushing boldness. Why is this? The lessons of the past afford an ample reply. When one reflects that a Scandinavian microscopist published an expensively illustrated plate, showing, as he supposed, the ova of a cestoid parasite, though all the while they were only the spores of a cryptogam (the explanation of the error being that the entozoon had been removed from a box previously containing lycopodium powder) ; that a celebrated Botanist for years maintained, against all comers, that the extremity of the pollen tube became

detached during the essential act of impregnation in phanerogams and ultimately converted into the future embryo (which was in fact equivalent to saying that a portion of the male organism was directly transformed into a new being); that a living histologist of recognised eminence, as such, misinterpreted the nature of certain vegetation-like appearances and actually described them as representing an entire new genus of fungi, probably of the highest importance in relation to the production of febrile disease, and yet all the while he was only dealing with the phenomena of coagulation—when such errors occur, we need exercise care. In fact, the so-called sheep-pox organisms, just mentioned, had no existence, as such, except in the imagination of the observer; and thus we were furnished with another striking illustration of the dangers which beset the very special specialist who, in this instance, was admitted to possess unusual skill in the employment of modern microscopic appliances, aided by the most approved chemical and mechanical tests. Egregious blunders of this sort are apt to bring microscopic research into undeserved contempt. Again, under the generic title of *Forbesia*, an eminent naturalist some few years back described as a new and gigantic form of polyp a structure which afterwards turned out to be nothing more than the intestinal canal of a marine annelid (the explanation of the error being that the viscus was torn from the worm by the action of the dredge employed in taking soundings, and thus simulated a new and separate organism); and lastly—for one cannot, notwithstanding the abundance of material, go on multiplying instances of scientific imperfection all the evening—there remains the recent confession respecting *Bathybius*, another very natural misinterpretation which was also the outcome of a deep-sea sounding.

Who amongst us that has worked for any length of time with the microscope in the old fashioned way has not fallen into errors of a more or less similar and palpable kind? Let us be modest, and consider the lessons which such frailties teach. For myself, when any fresh mishap of this order occurs I am always reminded of the early error which the illustrious Hippocrates made when, with unaided vision, he mistook a natural suture of the cranium for a fracture of the skull, and had the manliness afterwards to confess his mistake. That, said Celsus, was acting like a truly great man. "Little geniuses," it was added, "conscious to themselves that they have nothing to spare, cannot bear the slightest diminution of their

prerogative, nor suffer themselves to depart from an opinion which they have once embraced ; but the man of real wisdom is always ready to make a frank acknowledgment of his error, especially in a calling where it is of importance to posterity to record the truth."

Some may think that the sentiments I have here expressed are decidedly too *triste*. Pardon me. I have no wish to condemn the present attitude of science, and still less to place a wet blanket over the unpretending observer whose chief and legitimate aim is merely self-improvement. In view of general progress, the true form of the scientist is that of special investigation coupled with a wholesome sympathy for, and regard to, the work being done by others around him. Such a view gives due recognition to the occupation of the humblest amateur ; yet the latter must not be offended if his efforts are at times passed unnoticed. As a matter of fact it is not possible for any one man, however great his capacity may be, to peruse or even to glance at a tithe of the records of natural history and microscopic work published from month to month in our own country, let alone the publications of American and Continental naturalists. To meet the recognised difficulties of the case we have admirable year-books and shorter periodical summaries, collated by men who are both able linguists and conversant with the modern methods of research. The Annual Zoological and Geological Records are invaluable productions ; but in relation to Histology and general microscopic work, I know of nothing to compare with the summaries and bibliographies recorded by Mr. Crisp in the "Journal of the Royal Microscopical Society." In other journals the similar services rendered by Mr. Dallas are an immense boon to those of us who have neither the time nor the ability to perform such herculean tasks. To complete the annual series of works of this order one thing is wanting, and that is a first class Botanical Record. This, doubtless, will ere long make its appearance.

You will remember that I ventured to hint that our learned collaborators, notwithstanding their care, have unwittingly overlooked the astonishing advances of certain departments of Biology. This is particularly the case with a sub-science in which I take an especial interest. I mean Helminthology. To be sure, neither Messrs. Dallas nor Crisp can be accused of neglecting to inform their readers respecting the memoirs of one or two well-known Continental investigators ; but as regards the subject generally

the literature has been much neglected, and the treatment which one of our public eollections of specimens has received is simply disgraceful. In the British Museum such things as internal parasites are stowed away in the crypts as though they were unworthy of exposure to the light of day. To some extent I have sought to remedy the evils of which I speak. Thus in a recently published volume—of the defects of which no one can be more conscious than myself—I have sought to supply a tolerably exhaustive bibliography, and as regards public collections, I have, at intervals, contributed more or less largely to the Museum of the Royal College of Surgeons, to the Edinburgh Anatomical Museum (during the period of my curatorship), to the department of the Oxford Museum under Professor Rolleston's care, and also to many smaller collections, including those of the Middlesex Hospital Medical College, the Catholic College Museum lately under Professor Mivart's care, and also, more especially, to the Museum of the Royal Veterinary College, where, for teaching purposes rather than display, we are in possession of materials of the choicest kind in illustration of the parasites and parasitic diseases of the domesticated animals. Of course, these little efforts have left my private collection in a very mutilated condition ; but still, should any members of the Club be disposed to take up the subject, I may be able to render them some slight assistance. I am speaking exclusively of the internal parasites ; for as regards the external ones I cannot pretend to have any special knowledge. The Club, indeed, already possesses a tolerably extensive series of external parasites, beautifully mounted on slides ; but comparatively few of them are scientifically named. The principal specimens have been contributed by Messrs. Cocken, Beaulah, Michael, Bramhall, Quick, White, Curties, Bockett, Collins, Freeman, and Green, and by Drs. Dickson, Gray, and M. C. Cooke. A considerable number of slides have also been purchased. As regards the entozoa, it is eminently fitting that some steps should be taken towards the formation of an helminthological series. The renowned microscopist, whose name this Club honours as a founder, studied the entozoa. A little closer acquaintance with parasites can do no harm to the Club, provided the creatures are not brought here in a living state, and let loose with a view of demonstrating their wonderful powers of propagation. I have often been amused at the nervousness which some persons display when they first handle or even look at dead specimens of entozoa ; but here, in the case

of living worms, the discipline of science steps in and shows us how to avoid all danger of contagion.

In reference to this matter, let me further observe that it is rather to the practical natural history bearings of the subject that I would invite your attention. From the sanitary point of view, as I have elsewhere urged, "there is no department of biological knowledge that possesses equal interest in relation to the welfare of man and beast, and certainly there is no department of science so thoroughly misunderstood by those who are most directly concerned in the appreciation of its revelations." Of course it is open to any one to occupy himself with the minute structure of helminths, but it will require rare skill and prolonged labour to rival what has been already accomplished in this direction. The memoirs of Messrs. Sömmer and Landois in the histology of the Cestodes, and the still more recent memoir of Mr. Whiteman respecting the anatomy and development of *Clepsine*, are models of what can be achieved in this line of research. But we cannot all do all things; and however important such monographs may be in relation to comparative anatomy and philosophical zoology, it is clear that a much less pretentious kind of scientific activity is capable of producing far greater results in relation to the welfare of the community.

In conclusion, I ask you not to be discouraged; yet, I can well understand how it is that so many shrink from scientific work. Some of us have injured our sight in the clumsy efforts of early life; but now-a-days, by improved appliances, the visual organs are not subjected to the same degree of strain. This is an immense gain. Viewed broadly, I conceive that this Club recognises every kind of microscopic investigation which in its teachings has a tendency to promote general culture and social advancement in the legitimate sense of that much abused term. Because a member, by reason of his calling or other circumstances, is absolutely debarred from sustained scientific labour, that is no reason why he should not associate himself with those who are more immediately concerned in the actual progress of science. Far otherwise. The more a man of active business habits gets out of his daily routine and groove by joining a scientific club such as this, the better for himself and his friends. Such an one soon acquires social ideas of a higher order than those which are commonly obtained at places of amusement only, and ever increasing stores of useful knowledge, gained in an agreeable manner, become thus profitably diffused. In science we have

no caste, except that which results from industrial, intellectual, and social worth, combined with gentleness of manner. If its votaries pay exceptional homage to some great and gifted man—a Huxley, for example—it is because we recognise in him the very highest expression of the principle of the dignity of human labour. When other marks of distinction fade, that principle will come more and more to the front. As to the humble work of the Quekett Club, it may not find its deeds recorded in sumptuous and expensively illustrated quartos ; yet, for all that, it will have contributed something towards the general advancement, something towards keeping in remembrance the life and labours of that good and honest man whose patronym it bears, and last, not least, something towards the individual attainment, on the part of its members, of that inestimable boon of life known as the "sound mind in the healthy body."

On Collecting and Mounting Spider's Webs for the Microscope.

By George Hind.

(*Read August* 22*nd*, 1879.)

(*Abstract.*)

The author, after referring to the various methods adopted by different species of spiders to secure their prey, read a copious extract from Dr. Carpenter's work "On the Microscope," descriptive of their spinning apparatus. He then, after a brief notice of the large web-forming spiders of India and South America, and of the bird catching spider of Surinam (*Mygale avicularia*), proceeded to describe his method of procuring and mounting the web, in the following terms :—

"I found that several methods have been adopted in order to obtain the desired result. One method was, to take the web direct upon a slide having a cell fixed upon it, and at once proceed to mount it. There are several objections to this method. In the first place, it is very difficult to secure the exact portion of the web you wish, the web not being so well under control when suspended in its natural position ; and in the next place it is very difficult to get rid of the moisture that is sure to be present. The method that I have found most successful is as follows :—Take a few pieces of wire, about twelve inches long, and bend them up so as to form rectangular frames. Make a number of these frames, and place them in a racked box made for the purpose, previously gumming them all round so that the web may adhere to them.

"At this season of the year, the webs of *Epeira diadema* are to be found in almost any garden. On looking one over carefully, you will probably find some portion that you will desire to preserve. To do this, take one of the wire frames and put it behind the web ; on drawing it towards you, the web will become cemented to the frame all round. Now with a pair of sharp scissors clip away the rest of the web free from the wire. If this be carefully done, you will find

that portion of the web that you wished to secure tightly stretched upon the frame, which can now be placed in the racked box, and thus kept until you are ready to examine and mount any portion of it. Any insects that you may find can be thoroughly dried before they are mounted.

"In order to mount any portion of the web thus obtained, first cement a thin paper cell upon a glass slip. Then having slightly gummed the cell, place one of the wire frames over it, taking care to bring that portion of the web that you desire to secure exactly in the centre. Having done this, with the scissors remove the superfluous web, and place another paper cell upon the first one, and a thin glass cover over all, securing the cover with a little gum.

"In order to keep the preparations as dry as possible, metal cells might perhaps be preferable to paper ones.

"The webs sometimes contain insects so small that they are difficult to find in any other way, and these, too, in a very perfect state, as they are seldom touched by the spider.

"The web itself is not devoid of interest. The radial threads are continuous, whilst those which form its concentric circles are beautifully beaded. Some time back I obtained several spiders in order to get some good clean threads for mounting, but could not succeed in inducing them to spin in confinement. I was told that I did not exercise sufficient patience, and that if the spider is well nourished when placed in confinement, it will often be several weeks before commencing to spin. As I was not disposed to wait all this time, I used occasionally to shake the spider to make it spin stray threads. In doing this, I discovered the reason why the web is plain in some parts and beaded in others.

"When emitted by the spider, the web is in a very viscid state, and I noticed that when the whole weight of the spider was upon the web, and the thread was fastened off quickly, it was not beaded; but when by some chance the spider had slightly relaxed the tension before fastening it off, I observed a slight quiver pass through the thread, and upon examining it with a magnifier, I found that it was beaded from end to end."

The author concluded with a few remarks upon the value of the thread of the spider for the formation of micrometers for astronomical and surveying telescopes, and upon the methods used to obtain and to prepare it for these purposes.

On the Germination of a Seed.

By A. Martinelli.

(*Read October 24th*, 1879.)

Plate I.

Some time ago I planted some beans (*Phaseolus multiflorus*), which bloomed but bore no fruit. On digging up their stems, I found that the roots had thickened into tubers ; and having examined their composition, together with that of an unplanted seed, I came to the conclusion that the materials which should have formed the fruit were stored up in the tubers, so that the plant might have another start in the spring. I was led further to examine the composition of several cereals, to trace the relation of the embryo to its perisperm, or source of nourishment—endeavouring to gain some knowledge of the purpose which the various parts of the seed subserve in the process of germination. The results of these enquiries form the subject of the present paper.

Seeds may be divided into two classes—Albuminous and Exalbuminous. In the former the term *albumen* is intended to include all the various materials composing the white substance of the seed, although the seed may contain but a very small proportion of the substance technically so named. The classification is based upon position. In albuminous seeds the albumen or perisperm may be described as exterior to, and separable from, the cotyledons or seed-leaves ; in the buckwheat, for example, a transverse section, as at Fig. 1, Plate I., shows its thin leafy cotyledons, in graceful folds, intersecting the perisperm. During germination this nutriment is absorbed through the succulent tissues of the embryo, and, finally, the cotyledons, bursting the seed coats, are thrown upon their own resources and at once prepare organised material for the growth of the plumule (Fig. 2). In the Marvel of Peru (Fig. 3) the albumen forms the central mass of the seed, and so completely is it enclosed by the cotyledons that it can only be recognised by a thin white line on either side of the stem. But, in this instance, it may

be disconnected from the embryo whole, and in such integrity that it has every appearance of a miniature plaster cast, as shown at Fig. 4—the deep depression in the centre being the channel in which the stem laid buried. Experiments have been made in separating the embryo from its perisperm and supplying it with artificial nutriment. They appear, however, to have been attended with so little success that none of the experimentalists have boasted of their *protegés*.

But in Exalbuminous seeds, the bean, for example (Fig. 5), the albumen is not thus separable from the cotyledons. It has been entirely absorbed within their tissues, so that, with the plumule, they occupy the whole cavity of the seed. In germination the cotyledons of the bean remain beneath the ground, as shown in Fig. 6, and do not in any degree partake of the character of leaves. They act solely as repositories of assimilated material to nourish the plant in its earlier stages. In this respect, the lupine, another example of the class, does not differ from the bean ; but its cotyledons have the faculty of developing chlorophyll and rising to the light (see Fig. 7). They partially perform the function of leaves. I am, however, able to show the true significance of these organs ; but if a society existed for the prevention of cruelty to plants, I certainly would not risk the exhibition of the lupine, shown in Fig. 8. This plant was deprived of its cotyledons one week after germination, and for the two following months it only just maintained its *status quo*, adding neither to its weight nor bulk. At the end of that time I gathered it within the folds of my herbarium.

From the above instances it would appear that the cotyledons may assume three distinct phases. In the buckwheat they become the first leaves of the plant, providing for the plumule until the true leaves are formed. In the lupine, by the growth of the lower axis of the stem, the cotyledons rise to the light as organs of assimilation. But the bean grows only from the upper axis of the stem, and hence the cotyledons remain in the ground.

Now if one of the cotyledons of the bean is broken up, the microscope reveals granules of a peculiar type. In polarised light they are distinguished by a black cross, the characteristic feature of *starch*, and that is confirmed by iodine, which colours the contents of the granules blue. Whether we take a grain of buckwheat, a grain of barley, or a potato, their examination would lead to the same result. But their composition varies considerably in other respects.

If we macerate a bean, filter the liquid and add tannic acid, a pink flocculent matter *casein* is precipitated. Its similarity to the casein of milk is so decided, that in some parts of China cheeses are made from the casein of beans. From the expressed juice of the potato *albumen* can readily be coagulated in considerable quantity. Lastly, by softening a grain of barley and removing its outer tissues, we come upon a layer of cells, arranged with singular regularity, containing vegetable *fibrin* (Fig. 9). It lies in intimate connexion with the starchy mass of the grain. Possessing almost the same chemical composition and character as the fibrin of muscle, or the casein and albumen of the egg, it is also analogous to the casein of the bean and the albumen of the potato. When obtained from wheaten flour, it is in a mixed condition, and closely resembles freshly exuded indiarubber.

A more complete analysis may now be made of the various substances referred to. Starch must be regarded as a compound of three elements—Carbon, Hydrogen, and Oxygen, the two latter in the proportion forming water. It consists of a number of molecules, each having the composition represented by the following formula :— $C_6 H_{10} O_5$ and is the carbonaceous portion of the seed. The other constituents of the seed, fibrin, albumen and casein, which occupy so considerable a place in relation to the processes of plant life, contain Nitrogen in addition to Carbon, Hydrogen and Oxygen. They are the principal albuminoids in the seeds already mentioned, and, although so unlike in outward appearance, there is a marked similarity between them in chemical composition and character. Hence they suggest an ultimate identity in nature and purpose. For example, they are all dissolved by potash. The solution blackens salts of lead, and the presence of sulphur is thereby indicated. Nitrate of Mercury, a test of great delicacy, colours them red ; its rapidity and evenness of effect rendering it a striking experiment. In combustion they all emit the same unpleasant odour ; while on exposure to the air they rapidly putrify, and, in that condition, act as organised ferments converting grape-sugar into alcohol, carbonic acid gas, and other compounds.

In contradistinction to this physiological action there is developed from the albuminoids of the germinating seed a non-living ferment called Diastase. To this agent is ascribed the power of converting starch, which is not directly available for plant growth, into carbonic acid gas, dextrin, and grape-sugar. This ferment is stated to be

non-living from the fact that if a germinating seed is exposed to the vapour of ether, growth is immediately arrested, although the evolution of carbonic acid gas, and the conversion of the carbonaceous substance into dextrin and sugar still continue. On the other hand, etherisation at once suspends the protoplasmic functions of the yeast ferment, and from saccharine fluids no carbonic acid is evolved nor alcohol produced. Diastase may be extracted from malt by the chemist as a white soluble substance. It is, however, so subject to change that it cannot be preserved ; it has never even been obtained in any definite condition for analysis.

Its powerful action is best illustrated in the case of brewer's grains. When the starch has been converted into dextrin and sugar, a large percentage of the granular fibrin (from which the diastase has been evolved) remains intact—showing with what a small expenditure of force this metamorphosis is effected. Further, if unmalted grain is mixed with malted grain, it is found that the carbonaceous or starchy matters of both are changed into a form of sugar. Subsequent examination shows the fibrin of the unmalted grain unaffected by the process it has undergone, but that of the malted grain appears to have almost wholly disappeared. Hence we may infer that the transformation has been effected by the decomposition of the granular fibrin of the malted grain.

To this it may be added that the evolution of diastase and the conversion of starch into sugar by artificial means attains its maximum only by a temperature sufficiently high to destroy all vegetable life, viz., 70°C. But under natural conditions diastase is evolved at from 5° to 42°C (the extremes).

The foregoing general remarks may now be of service in dealing with the germination of a bean seed (*Phaseolus*). If sown in cold wet soil, the sun's heat gives no vitality to the germ, but is lost in evaporating the superfluous moisture ; the starch granules remain undissolved (Fig. 10), and the albuminoids decay. If sown, however, under favourable conditions, the two albuminoids of the bean, casein and albumen, undergo decomposition, and act as ferments in the same manner as the fibrin of barley. In the first stage of germination the outer coating of the seed is softened, and moisture penetrates its inmost tissues. Gradually the whole seed or embryo attains a high state of tension ; the starch granules become turgid, increase in temperature, and the ferment is set free. Then chemical action is induced in some of the granules, and those contiguous are

broken up and disorganised. Tested with iodine they take a reddish-brown tinge. The molecules of which the seed is composed now pass from a state of comparative repose to one of inconceivable activity. A certain volume of oxygen seizes upon its equivalent of carbon in the starch, and carbonic acid gas is formed and given off. With this, the first act of respiration by the embryo, the mysterious hand of Nature arouses it from its slumber, and it becomes a living plant. Throughout the period of germination that respiratory process continues ; the atmospheric oxygen absorbed by the water combines with the carbon contained in the molecules of starch until not unfrequently the carbon, in half the seed, is consumed in forming carbonic acid gas. A loss to this extent is readily demonstrated in the case of an albuminous seed such as the Buckwheat. If weighed and planted, and then again weighed just at the moment when the reserve materials are consumed, and after depriving the seedling of the water taken up in germination, it will be found to have lost quite an eighth part of a grain. That is to say, the whole of the plant at this particular point of growth is only half the weight of an unplanted seed which averages $\frac{1}{4}$ grain minus the testa. Such destruction of carbonaceous matter not only causes a considerable increase in the temperature of the seed, but results in the conversion of the remaining starch into dextrin or gum. Thus provided, the rootlets burst through the seed coats in search of further moisture. The fibrils absorb it, and the already prepared dextrin becomes diluted. Forced out of the cotyledons into the central axis of the plant, the dextrin, by taking up the elements of water, undergoes an important chemical change. It is converted into grape sugar, and in this way the solubility of the assimilated materials is increased to the utmost degree.*

Thus abundantly supplied with nutriment, the plumule and its miniature leaves gain strength to force their way in an upward direction. The liquid sap is carried by the upward current into the body of the plant, and its myriad molecules yield up the secretions necessary for the maintenance of its protoplasmic functions. Then the purpose of the molecules as parts of a sweet liquid comes to an end. They give up the elements of water previously taken, and, reverting to the same chemical composition as starch and dextrin, are fixed in the plant as its final insoluble product, *cellulose*. So that a unity of nature underlies these forms. It is only a rearrangement of the same atoms that results in starch, dextrin, and

cellulose; just as a re-arrangement of the same letters produces different words and dissimilar ideas. It is from these atoms of carbon, hydrogen, and oxygen, particle by particle, the various tissues of the plant are built. The solidification of the assimilated material continues until the cotyledons are exhausted. The plant has then sufficiently developed to decompose the carbonic acid gas taken up with the water, and to build up its fabric from the carbon.

$$\underbrace{2\ C_6\ H_{10}\ O_5}_{\text{Starch.}} \times \underbrace{H_2\ O}_{\text{Water.}} = \underbrace{C_6\ H_{10}\ O_5}_{\text{Dextrin.}} \times \underbrace{C_6\ H_{12}\ O_6}_{\text{Grape sugar.}}$$

These formulæ illustrate the gradual conversion of starch into dextrin and grape-sugar. Thus two molecules of starch and one of water produce one of dextrin and one of grape-sugar.

Notes on the Embryology of Achimenes picta.

By T. Spencer Cobbold, M.D., F.R.S.

(Read Nov. 28, 1879.)

Some thirty years ago I commenced a series of observations on the embryogenetic process, as it occurs in certain Monocotyledons and Dicotyledons; and I communicated the results to the Physiological Society of Edinburgh. Afterwards an abstract of the paper appeared in the *Edinburgh Monthly Medical Journal*, but in such a fragmentary form that the late Professor Hughes Bennett urged me to publish fuller details. I had, indeed, already written a short communication on the Embryogeny of *Orchis mascula* in the *Quarterly Journal of Microscopical Science*, purposely withholding other details, in the hope of returning to the investigation at a future time.

After the lapse of so long an interval I will only further say that what was observed by Dr. Burdon-Sanderson and by myself in this country, was chiefly confirmatory of facts and views recorded by Amici. The observations of the Italian botanist had especial relation to the question of the union of the pollen tube with the embryo-sac; consequently, when Sanderson, and likewise myself, succeeded in demonstrating this connection in Orchids, our published statements, in association with the well known discoveries of Hofmeister, Tulasne and others, did but help to set at rest one of the questions which had long been the subject of controversy. It was not until many years afterwards that Schleiden finally abandoned those peculiar views with which his name will ever remain associated.

At the time of which I speak, our distinguished countryman, Professor Henfrey, also occupied himself with this question, but I am not quite sure that he actually, at that time, witnessed the essential act of fertilisation either in the angiospermous phanerogamia or in monocotyledons. I draw this conclusion not only from the circumstance that I wrote to him unavailingly on the subject, but also because the notion of the entrance of the pollen tube into

the embryo-sac had not been formally rejected by him. At all events the reviewer of Quekett's "Lectures on Histology," in the very first number of the *Quarterly Journal of Microscopical Science* treated the matter as an open question; and I understood that the review was from the pen of Professor Henfrey. Later on it is clear that Henfrey fell in with the now generally received views, but in one of his classical articles, contributed to the "Micrographic Dictionary," we still find him saying that "it is not absolutely known whether the cavities of the pollen tube and the embryo-sac become actually continuous by absorption of the walls at the point of attachment; it is generally believed not, but we have recently had occasion to feel some doubt on this point." Henfrey, indeed, in illustration of the article "Ovule," gives a figure of the embryo-sac of *Orchis morio*, representing the union of the pollen tube with it, but we are left in doubt as to the source of the illustration.

At the present time it is unnecessary to do more than remind the Club that although this part of the question may now be regarded as definitively set at rest, the special views of Schleiden in respect of the phenomena observed in *Mesembryanthemum* were not generally abandoned until Meyen had also watched and described the process as it occurs in *M. linguæforme* and *M. pomeridianum*. Schleiden, indeed, observed the embryo-genetic process in a great variety of genera (*Salvia*, *Ænothera*, *Momordica*, *Epilobium*, *Martynia*, and so forth), but it was from the facts noticed in the genus above mentioned that his most striking conclusions were deduced. Those who desire to go into the literature of the subject should not only consult Bennett and Dyer's edition of Prof. Sach's "Text Book of Botany," but also Dr. Sanderson's article ("Vegetable Ovum") in Dr. Todd's "Cyclopædia of Anatomy and Physiology." It appears to me that this masterly article has never received that consideration which was, and is still, due to it. With these introductory remarks I proceed to record a few unpublished facts that I have observed in *Achimenes picta*.

As every systematist knows, the genus *Achimenes* belongs to the Gesneraceæ, an order of plants especially abundant in South America. Not many observations appear to have been made on the embryology of this family, although several of the genera, including the beautiful Gloxinias, flower freely and produce seeds in our conservatories. I may mention, incidentally, that I have detected

larval nematoids in the leaves of these plants, and that the presence of the worms is exceedingly injurious.

As obtains in the majority of the gesnerworts, the species in question is of a brilliant scarlet colour, and supplied with an irregular five-lobed gamosepalous corolla; the throat being sufficiently capacious to admit the entrance of an ordinary bee. If a flower be gathered a few days after the pollen grains have been applied to the capitate bilobed stigma, some of the tubular prolongations of the intine will be found to have penetrated the loculus of the capsule. How long the pollen tube takes to complete its so-called germination I have not ascertained, but, judging from the length of the style, it is probably not less than a week. Of course, as Hofmeister has shown, the mere length of the style in any plant is not by any means, of itself, a correct indication of the length of time requisite for the completion of tubal growth. Thus, in *Crocus* we are told that the whole length of the style may, in extreme cases, be traversed by the pollen tube in 24 hours, yet in the common *Arum maculatum*, where the length of the style is less than the eighth of an inch, Sachs says that the tube requires "at least five days" to traverse the conducting tissue. In certain Orchids the process takes "several weeks or even months," in which cases ovular development and pollen germination proceed simultaneously. In *Brugmansia* and other long styled genera of the night shade family, it seems to me that unless the process were comparatively rapid, the flowering season itself would not be long enough to bring about the essential phenomena of fertilisation.

In *Brugmansia sanguinea* I have witnessed the early stage of pollen germination, and the intine must extend itself 2,000 times the width of the grain in order to arrive at the micropyle of the ovule. In *Achimenes* the pollen grains are very small, that is about the $\frac{1}{1000}''$ in diameter. In size and form they closely correspond with a species of *Gesneria* which I only examined last week, and in which I found the grains to measure a trifle less than $\frac{1}{900}''$ in diameter. Taking occasion to examine the pollen of *Eranthemum* as belonging to a closely allied order (*Acanthaceæ*) I found that the length of the grains extended up to the $\frac{1}{840}''$. The ovules of the allied forms of *Gesneria* and *Achimenes* above referred to, also closely corresponded in size, averaging about the $\frac{1}{250}''$ from base to apex. Further, in connection with *Brugmansia*, I wish to say that I once noticed a papillary eminence projecting

from the placenta and directed towards the micropyle of an adjacent ovule. On referring to my original notes I find it described as "an enlarged cell containing granules, and somewhat resembling processes that Wilson had previously figured as occurring in *Statice armeria*." However, at a discussion which took place at the Linnean Society, a few years ago, I stated my belief that the process in question was neither more nor less than the projecting end of a solitary pollen tube. To be sure, as Sachs has pointed out, some plants (*Euphorbias* for example) have special hairs developed in the interior of the ovary, which serve as aids in directing the pollen tube to its destination. The cell-process in *Brugmansia* was destitute of any partition, and could not be confounded with any ordinary vegetable hair even of the unicellular type. In *Achimenes*, whilst the outer integument of the ovary is everywhere well supplied with finely pointed hairs, whose large cells often contains a brilliantly coloured protoplasm, the inner integument or lining membrane consists of a single layer of muriform parenchyma, the cells of which measure about $\frac{1}{800}''$ in length, by $\frac{1}{850}''$ in breadth.

By gently scraping the slender, club-shaped utriculi of the stigmatic lobes of *Achimenes* with a penknife, it is easy to remove the germinating grains with portions of their tubes attached. The ovary of *Achimenes* contains numerous anatropal ovules. In an already advanced stage of growth, but prior to impregnation one sees a large central dark mass of cells forming the so-called nucleus or tercine, as I prefer to call it, using Mirbel's term to prevent confusion. Within this mass, at the lower part, one or more of the central cells differentiate to form the embryo-sac, which latter, growing towards the apex of the tercine, expands at the summit so as to present, in profile, a spoon-shaped figure, with the short handle directed towards the chalaza. In actual shape the form of the sac may be fitly compared to the bulb or lower end of a thermometer turned upside down. The thickness of the tercine prevented my observing the nucleus of the embryo-sac itself, and after the sac had acquired its characteristic shape, it showed merely a few fine granules in the interior, or, in addition to these, either a solitary embryonal vesicle (oospore) near the apex, or two vesicles placed side by side. In this situation the vesicle was occasionally obscured by the expanded end of the applied pollen tube, but in one instance it could be seen through the enlarged extremity of the tube. More commonly the applied cœcal end of the

tube presented those familiar appearances which (in other plants) so long led Schleiden to believe that the apex of the sac was actually inverted. Sometimes the appearances were very puzzling, leaving it hard to say whether the pollen tube had been broken off within the micropylar passage, or whether it had been entirely withdrawn, leaving a cast or impression by its previous contact with the sac. In one particular instance the embryonal vesicle showed a finely beaded filament attached below. The appearance thus presented was quite the reverse of that usually exhibited by a true suspensor. In several ovules, as before remarked, there were indications of the presence of two or more embryonal vesicles, the appearances reminding me of what I had also frequently observed in *Orchis mascula*. In this immediate connection I have likewise to add that in one instance I noticed two pollen tubes projecting from one and the same micropyle or exostome; the same phenomenon having also been witnessed by me in *Orchis*. As in this monocotyledon, so in the dicotyledon *Achimenes*, bundles of pollen tubes may readily be recognised within the ovarian cavity. They may be raised on the end of a fine needle and drawn out for separate examination. Here I may mention that in a different sort of plant, namely in *Grevillea phœnicia*, I have observed a distinct folding in of the apex of the embryo-sac. This appeared to have been brought about independently, and without the presence of the pollen tube. The single anatropal ovule in this genus is remarkably simple, showing all the inclosed sac in a most attractive manner.

As regards the further changes in the embryogenesis of *Achimenes* I have nothing to record, but in *Orchis* I have witnessed the formation and growth of the embryo up to the stage of a small globular parenchymatous bud. The yet further cell developments within the embryo-sac of *Orchis*, which never proceed so far as to result in the formation of a true endosperm, have not been observed by me, but these must be very slight, seeing that the ovular coverings remain to form a loose reticulated perisperm surrounding the exalbuminous seed. In *Veronica gentianoides* I have noticed an undivided filament projecting from the micropyle. These projections, notwithstanding the absence of transverse septa, evidently correspond with the confervoid filaments observed by Schleiden in *Orchis latifolia*, and which he so strangely persisted in regarding as pollen tubes.

In reference to the subsequent changes undergone by the embryo,

Hofmeister has probably done more than anyone else, but the observations of Sanderson, especially in regard to the embryology of *Hippuris vulgaris*, are particularly valuable. To Sanderson and Unger we are indebted for a complete account of the formation of the endosperm in *Hippuris*, and by their records it appears that the embryo-sac becomes filled with a multicellular matrix before the act of fertilisation actually takes place. What is ordinarily described as the suspensor, was called by Sanderson the "filamentous prolongation" of the embryo, which it is important to observe is not developed within the tubular or upper end of the impregnated germ-cell or vesicle uutil after the formation of those parent cells of the embryo which form the globular bud suspended by the filament. Into the details of endospermal formation there is no need to enter, but what I want to point to is the extent to which Sanderson's observations go to support the views of Sachs and others who hold that the suspensor (whether it be a long and much divided filament, or only a solitary cell) is a development essentially different from the embryo itself. On the acceptance or rejection of certain supposed analogies, or homologously identical parts, as the case may be, rests the hypothesis of the existence of an alternation of generation in phanerogams, strictly comparable to that which has long been recognised as occurring in Cryptogamia. Whether this hypothesis be admitted or not, the proofs of essential unity of the sexual process throughout the vegetable series of organisms, remain unaffected. Although the question of the source of nutriment to the growing embryo and germinating seed—whether this nourishment be derived from the endosperm, or from the perisperm (which sometimes supplies its place, functionally), or from the seed-lobes of the embryo itself, which in exalbuminous plants has, as it were, stolen the food from the displaced or absorbed endosperm in an early stage of formation—although the question, which was partly raised by Mr. Martinelli's recent paper, is undoubtedly, a very interesting one, I cannot now enter upon it, my object being to receive the verdict of the botanical members of the Club as to whether there is, or is not, any good ground for regarding the two separate embryonal processes of Cryptogams and Phanerogams as fundamentally one and the same. The interest of the question at issue does not stop here, for if this view, in the form that it is advocated by Sachs, be rendered untenable, I think that the ordinary views that are entertained in respect of the adult

status of the frond-bearing, spore-producing asexual generation in Cryptogams will have to undergo revision, and perhaps reversal. Be that as it may, the position assumed by Hofmeister, Pfeffer, and others, seems to be this :—The endosperm, although not an independent structure, and formed within the embryo-sac (where, as we have seen, it is often multicellular or parenchymatous before the essential act of impregnation takes place) is strictly comparable to the free, growing prothallium of a fern or other Cryptogam. The embryo-sac corresponds to the macrospore, and the pollen grain to the microspore of "heterosporous vascular cryptogams." As the nucleus or tercine produces the embryo-sac, this tercine, is deemed the equivalent of the macrosporangium, and so forth. The analogies extend much further, but I have probably adduced sufficient to show the nature of the data on which Sachs and others have founded the proposition that "a concealed alternation of generations exists in the seed of phanerogams." The phenomena of embryonal development, as witnessed in Cycads and Coniferæ are, as they tell us, strikingly different from what obtains in Monocotyledons and Dicotyledons, and since it is alleged that the prothalloid endosperm in these orders actually produces achegonia-like organs, these groups of plants seem to occupy a transitional position between Cryptogams and Angiosperms generally. It happens, likewise, that according to Pfeffer's investigations (quoted by Sachs) there is a still more striking connecting link arising out of the unique fact that amongst Cryptogams the development of a *suspensor* itself may be actually witnessed in Selaginella (*Lycopodiaceæ*).

On a New Universal-motion Stage and Object-holder.

By Robert G. West.

(Read November 28, 1879.*)*

PLATE II.

We are all familiar with a number of bodies which, when seen obliquely, show some features of colour or structure that differ from, or are invisible when the substances are viewed perpendicularly to their surfaces. Instances of this peculiarity are to be found among minerals, crystals, wings, scales, and other parts of insects, and in close rulings or markings on glass, metal, or other substances. To provide for such bodies an oblique presentation to the microscope objective, and to permit their examination on several sides, various contrivances have been devised. The oldest and best known of these is the stage-forceps. This, however, only permits rotation in one plane ; and, in one setting of, say a cube as the object, will only present four sides and four edges. It is, moreover, inapplicable to objects mounted on slides. Professor Smyth, of New Orleans, has contrived a safety-stage which incidentally admits a certain degree of inclination. Messrs. Beck's beautiful little disc-holder presents five sides and eight edges of a cube, but is unsuited for slide-mounted objects. Mr. Zentmayer, of Philadelphia, makes a microscope with its principal stage tilting in one plane, and this, combined with the rotation of the stage, presents successively to view all parts of an object, except that by which it is attached to its mounting. This is, however, a costly and perhaps rather a cumbrous arrangement.

In the last two devices some movements have to be obtained by *compounding* two motions. This is avoided in Mr. Morris's object-holder, which consists of a base-plate to rest on the stage of the microscope, which base-plate is provided with a ball and socket joint, carrying, by means of a short stem, a table or a tray to receive a slide or a disc-mounted object. By this apparatus an object may be rotated, and, within certain limits, inclined freely in every direction ; but it has the very serious drawback that, with the exception of rotation of the carrier in a horizontal position, every

movement involves a lateral and vertical displacement of the object, which is thus continually thrown out of the field and out of focus.

Now, it occurred to me that if I could place the object *in the centre* of the movable sphere, all lateral displacement would be abolished, and the small inevitable focal displacement of the margin of the object would be reduced to a *minimum*, while its centre would remain absolutely undisturbed. My first idea was to place the object-carrying plate on a segment of a sphere of soft iron or steel. This rested on a magnetic post let into the base-plate, and with its upper surface turned to a concavity to fit the spherical segment. The magnet might be made of horse-shoe form, with the spherical segment of iron or steel as a keeper. The segment was so much less than a hemisphere, that the combined thickness of the carrying plate, the slide and an object of moderate size would place the upper surface of this last approximately in the centre of the sphere. It is obvious that, with the low powers for which all these appliances are chiefly useful, this would meet the requirements of the case in respect of the immobility of the object. It was not put to the test of construction; but my only fear respecting it is lest the magnetism should prove not thoroughly equal to its work, and so make occasional shipwreck of a slide.

For carrying out my idea in another form I am indebted to the ingenuity of my friend, Mr. Henry W. Wimshurst, as I am to his mechanical skill for the construction of the specimens now submitted to you. One of these is represented in vertical section in the diagram, fig. 1, plate II. In this figure A A is a base-plate formed with a small boss B in its centre. To this plate is soldered a short brass tube C C. In the lower side of the carrying plate D D is soldered a brass hemispherical shell E E. This shell has a circular aperture on the under side for about a third of its extent. Overlying the aperture is a thin plate H of corresponding curvature; and the whole is held together by means of the spring K, and screw L, the latter being tapped into the boss B. The carrier-plate D has a central aperture for the adjustment of the screw, and spring-clips (not shown in the figure) are provided for securing the slide. The dot M indicates the centre of the hemisphere, and should be fully $\frac{1}{10}$th of an inch above the upper surface of the plate D. An object of moderate thickness mounted on an ordinary glass slide will then be approximately in the centre of the movable hemisphere, and will be practically free from displacement, lateral or vertical, in any position of the carrier-plate D D.

In figs. 2 and 3 is shown an arrangement by which this result is automatically secured for objects of inappreciable thickness, fig. 3 being a transverse section of fig. 2. The carrier-plate D D is provided with brass forks N N, and a narrow transverse opening, P P, through which springs R R press the object-slide against the lower surfaces of the forks N N. As these surfaces are in line with the centre M of the hemisphere, minute objects can readily be placed in that centre. It will be seen that this arrangement automatically compensates for the varying thickness of slides ; and that of objects may be compensated for by the screws W W—two of the screws being tapped into one of the forks, N, and one into the other fork.

Fig. 1 represents the most convenient form for use with reflected light. For the employment of transmitted light, either with the microscope or with Hoffmann's Table Polariscope, the arrangement shown in fig. 2 is provided with an aperture X X in the carrier-plate D, and similar apertures, Y in the spherical segment E and Z in the base-plate A. The weight of the upper part of this arrangement will be found sufficient to retain it in any position, especially if the upper edge of the tube C be finished square or bevelled outwards, so as to give a better bite on E. Either form permits free tilting and rotating movements in all directions, within certain defined limits.

Fig. 4 represents in vertical section an adaptation of the same principle for disc-mounted objects. In this case E E is a hemisphere, along the inner edge of which is soldered a brass ring, V V. The upper surface of this ring is flush with the centre M of the sphere. Inside the hemisphere E, and at its lower part, is soldered a short tube S, in which slides telescopically the carrier T, provided with a socket to receive the disc U. Any object affixed to the disc U can thus be readily adjusted, flush with the upper surface of the ring Y, and can receive motion in every direction, without either lateral or vertical displacement. The hemisphere E will stand secure in any position, and every point of a hemispherical object may be examined.

In each form of this apparatus the point M must be kept in the axis of the microscope. The carrier-plate D should therefore be large enough to permit of any necessary movement of the slide upon it ; and, for use with non-mechanical stages, a tubular projection from the lower surface of the base-plate A, to fit the " well " of the stage would be advantageous.

The arrangement shown in fig. 4 could obviously be made to carry a slide or a disc-mounted object at pleasure.

Description of a "Growing Slide" for Minute Organisms, Constructed by Julien Deby, C.E., &c.

Communicated by J. E. Ingpen, F.R.M.S., Hon. Secretary, November 28th, 1879.

PLATE II.

This slide is illustrated at Figs. 5 and 6 in Plate II., Fig. 5 being a plan view and Fig. 6 a longitudinal section. In these figures, A is a 3 × 1 glass slip, having a glass ring cemented to it, so as to form a cell of about $\frac{1}{8}$in. deep and $\frac{3}{4}$in. in diameter. A small hole is bored through the slip at *a*, inside and near the edge of the cell. The objects, such as bacteria, &c., are placed with a very minute drop of water on a thin glass cover B, which is attached to the top of the cell by a little lard. The slip is then laid upon another of the same size, but not perforated, and a couple of india-rubber bands *b* are passed over the ends. One end of this arrangement is then placed in a little water, which, by capillary attraction, will occupy the space between the two slips, and, by evaporation, will rise into the cell and prevent the minute drop of water on the glass cover from drying up. By this contrivance, a drop of water no larger than a pin's head can be kept of nearly the same size for weeks together, and the development of bacteria or other minute organisms kept constantly under observation.

PROCEEDINGS.

August 8th, 1879.—Conversational Meeting.

The following objects were exhibited :—

Book mite	Mr. F. W. Andrew.
Elytron of Beetle. *Lordops Gyllenhalii* ...	Mr. F. Enock.
Cape Polyzoa	Rev. H. J. Fase.
Sucking stomach of Blow-fly	Mr. F. Fitch.
Stem of Thistle stained	Mr. W. Goodwin.
Section of Molar-tooth of Sheep	Mr. J. J. Hunter.
"The top of the mud," Keston	Mr. J. E. Ingpen.
Daphnia pulex	Mr. A. Martinelli.
Cast skin of Spider	Mr. H. Morland.
Sponge. *Acarnus innominatus*	Mr. B. W. Priest.
Alga. *Cladophora rectangularis*	Mr. T. L. Waterman.

Attendance—Members, 45; Visitors, 2.

August 22nd, 1879.—Ordinary Meeting.

A. D. Michael, Esq., F.L.S., &c., Vice-President, *in the Chair.*

The minutes of the preceding meeting were read and confirmed.

The following gentlemen were balloted for and duly elected members of the Club :—Mr. A. J. E. Arch, Mr. William Burton, Mr. Cuttell, Mr. D. W. Greenhough, Mr. A. H. Soames, Mr. Jno. W. Tate, Dr. H. Whittell, and Mr. Bryce M. Wright.

Three gentlemen were proposed for membership.

The Chairman reminded the members that at the previous meeting there had been some discussion about the nomination of Mr. Hailes as Co-Secretary to the Club, but it was decided that in accordance with the rules it could not be done then. The Committee had, however, since that meeting nominated Mr. Hailes, and the ballot for his election would take place at their next meeting.

The following Donations to the Club were announced :—

"Journal of the Royal Microscopical Society"	from the Society.
"Proceedings of the Bristol Natural History Society"	" "
"Eighth Annual Report of the Chester Society of Natural Science" ...	" "
"Proceedings of the Belgian Microscopical Society"	" "

"Science Gossip"	from the Publisher.
"The American Quarterly Journal of Microscopy"	„ the Editor.
"The American Naturalist"	in exchange.
"The Midland Naturalist"	„ „
"Annals of Natural History"	purchased.
3 Slides	from Mr. F. Enock.
2 Slides of Diatomaceæ	„ Mr. H. Morland.
6 Slides of Objects mounted in Copal Varnish	„ Mr. Julien Deby.

The thanks of the meeting were voted to the donors.

The Secretary made two communications on behalf of Mr. Julien Deby, V.P. of the Belgian Microscopical Society; one being "On Copal varnish as a substitute for Canada balsam," and the other "On a new growing slide for the examination of minute objects under high powers;" the last-named subject being illustrated by drawings upon the black board, and by the exhibition of one of the slides.

Dr. M. C. Cooke said that *apropos* to the subject of mounting in Copal, he might mention that about ten years ago they had employed it in connection with the work of the Fibre Committee; also that some of the slides of the bat's hair which he had presented to the Club some years ago were mounted in Canada balsam, and others in Copal varnish. It was at the time of the Fibre Committee a matter of conversation as to the relative merits of the two fluids, the general opinion being that perhaps for some things Copal might have an advantage.

The Chairman thought it would be interesting to know if these slides were still in existence, and if so in what condition they were at the present time.

Dr. Cooke did not know what their present condition was, but he thought they were all marked so as to distinguish them from the others. Copal varnish kept fluid for a long time, and some slides broken several years afterwards were found still to have the Copal in a fluid state; and this was also the case with one of the slides broken only a short time ago.

Mr. T. C. White said he was very pleased with the growing slide, which he thought was ingeniously devised. He thought, however, that some of the members might not know how easy it was to drill the hole in the slide if they only went the right way about it. If they got a piece of steel, ground the end of it to a three-sided point, and made it perfectly hard, by heating and dipping it in turpentine, they would find it quite easy to bore the glass. If they bored half-way through from one side and then began on the other side the hole would break through as soon as the centre was reached, and could then be cleared out with a small file.

Mr. Hailes said with regard to the slides of bats' hair he believed that all, or nearly all of them were still in as good condition as when they were presented to the Club. A simple method of drilling glass was that of cementing the glass to a piece of metal with shellac, the metal plate having a hole through it of about the size required; then if the tang of a file were

hardened they could break through the glass by a smart stab of the steel point through the glass, and the hole could be chipped and filed out afterwards. The only difficulty was in separating the glass from the metal plate afterwards, great care being required to avoid breakage. There was no difficulty at all in making the hole; he believed he could do a hundred of them in this way without breaking one.

Mr T C. White thought this plan was all very well for large holes, but for small holes such as that required for this growing slide it would hardly be available.

Mr. Hailes did not think it would do for anything less than ¼in., but it would do quite as well for thin cover glass as for slides. He had, when wanting to make a shallow cell, taken a ¾in. cover and broken a ½in. hole through it, thus producing a ring ⅛in. wide in this manner without any difficulty.

Mr. Ingpen said that an important point in the use of Copal varnish would be its refractive index, which he thought was a little lower than Balsam. This might or might not be an advantage according to the objects to be mounted. With diatoms, for instance, he thought there would be a disadvantage, because the refractive index of the diatom silex was less than that of Balsam, so that the use of Copal would in a greater degree than Balsam tend to obliterate the markings.

The Secretary said he had another little point of interest to bring before them, namely, a series of lenses for dissecting purposes. They were achromatic triplets, of particularly fine quality. Two sets had been sent for the examination of members, one being mounted for dissecting and the other for the pocket. They were approximately 1½in., 1in., ¾in., ½in., and ⅜in.; their definition was extremely fine, and their flatness of field very great. They were manufactured by Steinheil, and were lent for exhibition by Messrs Murray and Heath, Steinheil's London agents, from whom particulars as to price, &c., could be obtained on application.

Mr. Geo. Hind then read a paper "On Collecting and Mounting Spiders' webs for the Microscope."

Mr. T. C. White said that he had listened with much pleasure to Mr. Hind's paper—it reminded him of a plan which he had often adopted in mounting insects caught in spiders' webs. He cemented a cell upon a glass slide, and having coated the edge of it with balsam, brought it into contact with the web, so that the capture was suspended in the middle of the cell; another cell was then placed upon the top of the first one, and the covering glass put on in the usual way.

Mr. Hailes said there was one point in Mr. Hind's paper, to which, for the sake of being accurate, he thought he might call attention. It referred to the large spiders catching birds. This was a story which had been repeated over and over again, but it was one which rested entirely on the statements of Mdlle. Merian, which, so far as he was aware, had never been confirmed. He had the opportunity some time ago of seeing Mdlle. Merian's work, and he noticed the careful way in which she expressed herself. In the case of her own observation she always says "I have *seen*"

this or that; but with regard to this particular observation she says "I have *seen*" this spider, and "have been *told*" that it captures small birds, &c.

The Chairman believed that what Mr. Hailes had just stated was quite correct, and that the evidence rested on a very slender foundation, and was entirely without confirmation. With regard to Mdlle. Merian's book, beautiful as the plates were, he feared it was not the most reliable source from which to draw information; he believed it to be a fact that the natives finding that she was willing to pay for anything rare or curious, were quite ready to bring her things which were not always in the same condition as Nature intended them to be—such as the heads of lantern flies on other bodies, &c. With regard to spiders, one was generally so lost in admiration at the beauty of the construction of the web itself, as to lose sight of the manner in which it was hung upon a tree; but they would find that each individual spider would hang it in a different way according to the position of the tree.

The thanks of the meeting were unanimously voted to Mr. Hind for his paper.

Announcements of meetings, &c, for the ensuing month were then made, and the proceedings terminated with the usual conversazione, at which the following objects were exhibited.—

Jasmine leaf	Mr. F. W. Andrew.
Anatomy of Saw-fly *Tenthredo variabilis* ..	Mr. F. Enock.
Algæ. *Batrachospermum moniliforme* and *Cyrtomium falcatum*	Mr. H. Epps.
Insects in Spiders' Webs	Mr. G. Hind.
Palate of Black Slug	Mr. C. Le Pelley.
Leaf of *Drosera rotundifolia* (stained) ...	Mr. J. T. Powell.

Attendance—Members, 53; Visitors, 3.

September 12th.—Conversational Meeting.

The following objects were exhibited:—

Fungus *(Puccinia)* on Bramble	Mr. F. W. Andrew.
Head of Honey Bee	Mr. F. Enock.
Spores of *Funaria* and section of stem of Dog Rose	Mr. W. Goodwin.
Section of Scalp of Negro	Mr. J. J. Hunter.
Embryo of Haricot Bean	Mr. A. Martinelli.
Diatom. *Cymatopleura elliptica*	Mr. H. Morland.
Sponge. *Leucoso lenia botryoides*	Mr. B. W. Priest.
Leaf and sections of *Sphagnum cuspidatum*	Mr. J. W. Reed.
Sections of Ash. *(Fraxinus excelsior)* ...	Mr. J. C. Sigsworth.
Leaf Insect	Mr. J. Willson.

Attendance—Members, 41; Visitors, 4.

September 26th, 1879.—Ordinary Meeting.

Dr. T. Spencer Cobbold, F.R.S., &c., President, *in the Chair.*

The minutes of the preceding meeting were read and confirmed.

The following gentlemen were balloted for and duly elected members of the Club:—Mr. Wm. Brown, Mr. Chas. Curtis, and Mr. H. Hobden.

The Secretary read a letter from the Secretary of the Natal Microscopical Society, requesting an interchange of Proceedings, &c.

The President said he was sure the members would be pleased to hear this letter, as it showed that the Club was not only healthy in its action, but that it had also set others to work in remote parts.

The following donations to the Club were announced:—

"Proceedings of the Royal Society" ...	from the Society.
"Proceedings of the Watford Natural History Society"	" "
"Proceedings of the Belgian Microscopical Society"	" "
"Report of the Natal Microscopical Society"	" "
"The American Naturalist"	in exchange.
"The Midland Naturalist"	" "
"Science Gossip"	from the Publisher.
"Annals of Natural History"	purchased.
"Grevillia"	"
6 Slides of Diatoms from the Monmouth and Cherryfield deposits... ...	from Mr. Hailes.

Mr. Hailes was balloted for and unanimously elected Co-Secretary of the Club.

Two gentlemen were proposed for membership.

Mr. T. C. White suggested that they should send out to Natal a copy of the Catalogue of Slides, so that the members of that Society might note and supply such deficiencies as they were able to fill up.

The Chairman thought this a very admirable suggestion.

The Secretary said that of course the Journal would be sent, and copies of the Catalogue would be sent also.

The President delivered an Inaugural Address on the occasion of his first appearance at the Club.

Dr. Matthews said he had much pleasure in proposing that an unanimous vote of thanks be presented to the President for his admirable Address. They had scarcely expected one so elaborate, and yet they could only have wished that it had been longer, not however on account of its deficiencies, for it left no part untouched which they could have desired to have had handled. He would couple with the vote of thanks a request that the President would allow them to publish the Address in the Journal in the usual manner.

Mr. T. C. White seconded the proposal, and endorsed all that Dr. Matthews had said as to the Address, which would be a valuable addition to their proceedings when they were able to read it in the Journal.

The Secretary said it became his pleasing, as well as formal duty to put the motion to the meeting in the usual way.—Carried unanimously.

The President said it only remained for him to thank them for the very kind and cordial manner in which they had both received the Address and voted him their thanks.

Dr. Matthews exhibited and described a new and elaborately constructed machine for cutting sections of hard tissues.

Mr. Hunter said that he also had brought a section cutting machine for exhibition, but he did not claim it as any new invention, as it was only a modification of one described in the "American Journal of Microscopy." It was designed to get rid of the "planing" cut of most machines, and to substitute an obliquely sliding movement for it, which was found very much better for cutting soft tissues.

A Member said that in Mr. Williams's machine they could get this same kind of sliding action, but it was found desirable to float the sections off the knife afterwards.

Mr. Hunter said the machine he had brought was intended to cut sections of substances imbedded in wax, which Williams's machine would not do. That was a very excellent machine for many purposes, and he was aware that they could get a sliding motion with it. The one now upon the table was only intended for soft tissues.

Announcements of excursions and meetings for the ensuing month were then made, and the proceedings terminated with the usual conversazione, at which the following objects were exhibited :—

Maple Aphis	Mr. F. W. Andrew.
Diatom. *Orthosira*, Opaque, with Stephenson's Erecting Binocular ...	Mr. T. Curties.
Section of eye of *Dytiscus*	Mr. C. G. Dunning.
Hæmatopinus, from Indian Buffalo	Mr. F. Enock.
Labradorite ... ... Splinters of ash tree struck by lightning	Mr. H. E. Freeman.
Caddis worm	Mr. H. R. Gregory.
Section of finger of Orang-outan	Mr. J. J. Hunter.
Larva of *Corethra plumicornis*	Mr. J. M. Offord.
Daphnia pulex	Mr. A. Martinelli.
Parasite of Tortoise	Mr. T. S. Morton.
Palate of *Helix pomatia*	Mr. C. Le Pelley.
Capsella bursa pastoris ... ... *Nuphar lutea*	Mr. J. W. Reed.

Attendance—Members, 74; Visitors, 6.

October 10th, 1879.—Conversational Meeting.

The following objects were exhibited :—

Correa cardinalis	Mr. F. W. Andrew.
Head of Beef Tape Worm, *Tænia mediocanellata*	The President.
Trichosoma tenuissimum, from a pigeon ...	" "
Larva (one day old) of Puss Moth, *Cerura vinula*	Mr. F. Enock.
Reproductive organs of Blow-fly	Mr. F. Fitch.
Leaf of Fuchsia, shewing raphides... ...	Mr. W. Goodwin.
Acari from Sparrow	Mr. H. G. Glasspoole.
Section of foot of Human Fœtus (5½ months)	Mr. J. J. Hunter.
Section of Bone, and of Echinus spine, cut by a new machine	Dr. J. Matthews.
Aglaophenia pluma (Hydrozoon), with extended tentacles	Mr. A. D. Michael.
Conochilus volvox and *Volvox globator* ...	Mr. H. Morland.
Tube-dwelling diatoms	Mr. J. M. Offord.
Gonium pectorale	Mr. C. Le Pelley.
Leaf of *Deutzia*, polarised	Mr. B. W. Priest.
Alga, *Rivularia angulosa*	Mr. J. W. Reed.
Fungus. *Æcidium grossularia*	Mr. H. J. Roper.
Palate of Sea Slug *(Doris tuberculata)* ...	Mr. J. C. Sigsworth.
Diatom. *Pleurosigma australis*	Dr. H. Whittell.

Attendance—Members, 59; Visitors, 10.

October 24th, 1879.—Ordinary Meeting.

Dr. T. Spencer Cobbold, F.R.S., &c., President, *in the Chair*.

The minutes of the preceding meeting were read and confirmed.

The following gentlemen were balloted for, and duly elected members of the Club:—Mr Arthur J. Shelley and Mr Fergus H. Wood.

The following donations were announced, and the thanks of the Club were voted to the donors:—

"Journal of the Royal Microscopical Society"	from the Society.
"Proceedings of the Geologists' Association"	" " Association.
"Proceedings of the Belgian Microscopical Society"	" " Society.
"Popular Science Review"	" " Publisher.
"Science Gossip"	" " "

"The Midland Naturalist"	in exchange.
"The American Naturalist"	" "
"The American Journal of Microscopy" ...	" "
"The Fresh Water Algæ of the Leeds District"	from Mr. B. Turner.
"Quains' Anatomy"	" Mr. J. W. Groves.
"Annals of Natural History"	Purchased.
42 Slides of Acari	from Mr. A. D. Michael.
1 Slide	" Mr. F. Wood.

Special thanks were voted to Mr. Michael for the present of the series of type slides of Acari, which form a valuable addition to the cabinet of the Club, and the following communication from Mr. Michael on the subject was read by the Secretary:—

"Herewith I hand you 42 slides of Oribatidæ (all set in balsam). These slides, when added to those which I have before given to the Club, will form a type collection of all the Oribatidæ hitherto recorded as British, with the exception of eight species, of which I have not been able to obtain duplicates; they also contain larvæ and nymphs of many species.

"I may remind members that the chitine of which these creatures are composed is extraordinarily brittle, and that, consequently, the slides require care in handling."

A letter was also read from Miss Morrell, enclosing a photograph of the late Mr. James Annett, and presenting the sum of £10 to the Club. The special thanks of the meeting were voted to that lady for her valuable donation.

Announcements of Soirées by the Tower Hill Microscopical Society and the Croydon Society, were made by the Secretary; and the co-operation of the members was invited.

Mr. Martinelli read a paper "On the Germination of a Seed."

The President invited some remarks upon the paper, observing that visitors present were not only at liberty to join in the discussions, but the Club would be very pleased if they would do so. They were favoured that evening by the presence of Dr. Fischer, of Sydney, and also of Mr. Stephen Adams, the Secretary of the Natal Microscopical Society.

Dr. Fischer said that the subject before them had many aspects, but it had been only treated chemically, and in order to the proper understanding of the subject, it needed to be regarded physiologically also. He had also expected to hear something more of the tubers referred to, and should like to know why they had not developed.

Mr. J. T. Powell said he had been a good deal interested in the subject, but thought it almost necessary to supply a little more information on some points connected with it. The movements he thought resulted from the successive development of the different parts. The first part which began to grow was the radicle, and that grew downwards; and the next important growth was that of the stalks of the cotyledons, which had a great influence on the growth of the plumule, in the case of those which brought

the cotyledons from the ground, like the mustard. He should like to ask Mr. Martinelli if in the term perisperm, he included the endosperm?

The President thought it a pity that the excellent paper before them should pass off without further notice. Several interesting points had already been touched upon; others would also be of great interest, such as those relating to Morphology, and more especially to the comparison between the development of Phanerogams and Cryptogams. The view of Sachs was that the endosperm was formed in the embryo sac, and the question was, "could they find in the germination of cryptogamic plants any circumstances which were analcgous?" The investigations of Sachs, Hofmeister, Pfeffer, and others had, he believed, established this analogy; the true view being that the impregnated germ became the oospore, and that the endosperm was the equivalent of the prothallus. But they might go through the whole series of organs, and find similar analogies. From this point Mr. Martinelli had dwelt upon matters of great interest relating to the development of the cotyledonary leaves. It was quite possible to push the argument for analogies much further if it were advisable.

Mr. Martinelli said that as regarded the perisperm, he took it to be that food material which was deposited within the tissue of the nucleus, while the endosperm was developed within the embryo sac. As to the tubers, he could say very little about them; he was much interested in them at the time, as well as surprised. When he came to examine them, he found them to be much the same as the bean. He planted one of them, and it came up into a large bush.

The President having briefly referred again to the various topics embraced in so large a subject as that dealt with in the paper, proposed a vote of thanks to Mr. Martinelli, which was carried unanimously.

Seven gentlemen were then proposed for membership, and announcements for the ensuing month having been made, the proceedings terminated with a conversazione, at which the following objects were exhibited:—

Fungus *Peronospora infestans*	Mr. F. W. Andrew.
,, *Puccinia arundinis*	Mr. F. Coles.
Leaf of *Pelargonium quercifolium* (stained)	Mr. T. Curties.
Sexual organs of *Vespa vulgaris* (male) ...	Mr. F. Enock.
Scale of Pike	Mr. H. Epps.
Spongilla fluviatalis	Mr. H. Gilbertson.
Hydra viridis and H. fusca	Mr. W. Goodwin.
Human ovary (inflamed)	Mr. J. J. Hunter.
Membranipora pilosa with the tentacles extended	Mr. A. D. Michael.
Diatom. *Amphipleura pellucida (N. acus)* with vertical illumination and new water immersion $\frac{1}{8}$th objective, having a balsam angle of 112°	Messrs. Powell and Lealand.
Living alga *Vaucheria hepatica*	Mr. J. W. Reed.
Mounted alga *Frullania dilatata*	,,

Attendance—Members. 82; Visitors, 16.

November 14th, 1879.—Conversational Meeting.

The following objects were exhibited:—

Tongue of Spider	Mr. F. W. Andrew.
Pollen of Cedar	Mr. J. W. Cafe.
Fluke of the Indian Elephant *Fasciola Jacksoni*	The President.
Ixodes of Indian Bullock	Mr. F. Enock.
Nidus of Human louse	Rev. H. J. Fase.
Mouth structure of *Staphylinus*	Mr. F. Fitch.
Section of Greengage stone	Mr. W. Goodwin.
„ Molar tooth of Ox	Mr. J. J. Hunter.
Phyllodromia melanocephala	Mr. A. D. Michael.
Entopyla ornata	Mr. H. Morland.
Young *Stephanoceros*...	Mr. J. M. Offord.
Yeast plant. *Torula cerevisiæ*	Mr. J. W. Reed.
Wing of Butterfly *Doritis Apollo*	Mr. J. C. Sigsworth.
Section of Coprolite	Mr. W. Teesdale.
Dark field illumination test slide and optical illusion slide	„ „
Examples of Micro-ruling	„ „
New form of Zoophyte trough, designed by Mr. Botterill, of Liverpool ...	„ „

Attendance—Members, 85; Visitors, 19.

November 28th, 1879.—Ordinary Meeting.

Dr. T. Spencer Cobbold, F.R.S., President, *in the Chair*.

The minutes of the preceding meeting were read and confirmed.

Mr. Hailes mentioned that the donation of £10 from Miss Morrell, announced at the previous meeting, was a gift from that lady herself, and not a bequest from the late Mr. Annett.

The following gentlemen were balloted for and duly elected members of the Club:—Mr. S. C. Adams, Mr. A. J. Crighton, Mr. W. Forster, jun., Mr. A. C. Goodinge, Mr. R. J. Hughes, Mr. J. G. Tasker, and Mr. R. W. Watson.

The following donations to the Club were announced:—

"Proceedings of the Belgian Microscopical Society	from the Society.
"Science Gossip"	„ „ Publisher.
"The Analyst"	„ „ Editor.
"The Midland Naturalist"	in exchange.

"Quarterly Journal of Microscopical Science" by purchase.
"Annals of Natural History" ... ... " "
Reprints of papers on Spermatozoa from the "Quarterly Microscopical Journal" } from Mr. Heneage Gibbes.
2 Slides in illustration of the above ... }
1 Slide ... ... " Mr. H. Morland.

The thanks of the meeting were voted to the donors.

A letter of thanks from the Tower Hill Microscopical Society, for assistance rendered at their recent Soirée, was read.

The following communication from Professor Hamilton Smith, of Geneva, U.S., "On a Method of Dry Mounting," was read by Mr. Hailes, and a specimen exhibited:—"The gutta percha tissue rings recommended by Dr. Tulk I shall always use hereafter. A punch makes them beautifully and rapidly—nothing is simpler than the process. The specimens to be mounted are prepared on the cover, then a ring of gutta percha tissue is placed on the glass slip, the cover laid on it, and the three held together by forceps and *gently* warmed. This will serve to attach them. Now removing the forceps, warm the slide and cover, and press the latter with forceps or a burnisher till (looking obliquely) one sees the attachment is complete. This is all. No varnishes or turn-table work are required, and for all I can see, no *sweating* or destruction of the preparation by change, or drying of substance of ring, as will happen to all asphalte preparations."

Mr. T. C. White thought there would be an objection in the heat required in this mode of mounting, and also fancied it would, instead of preventing, be likely to conduce to "sweating" inside the covering glass.

The President noticed some air bubbles in the ring of the specimen placed in his hands, and thought that if they should coalesce it would injure the cell.

Mr. Hailes said the best way to avoid "sweating" was to leave the cell partially open. Heat would certainly be fatal to such objects as butterfly scales.

Mr. Ingpen exhibited a new form of low power objective by Zeiss, so constructed that by turning a milled collar a great alteration in the magnifying power could be obtained—the definition was remarkably good and the field very flat.

Dr. Matthews said he had some time since the pleasure of an evening's conference with Dr. Carpenter, and found that he used scarcely any other low power than this one. He spoke of it with unqualified praise, and it certainly seemed to answer the purpose of several objectives.

Mr. R. G. West exhibited and described a new form of "Tilting Stage" for the examination of objects in various directions.

Mr. James Smith enquired what arrangement was made for putting an ordinary slide upon this stage?

Mr. West said it was secured by clips.

The President read a paper "On the Embryology of Achimenes picta," and illustrated the subject by diagrams.

Dr. Matthews—who had taken the chair during the reading of the

paper—said that when they had a paper from the lips of one who was an acknowledged master of botanical science, it scarcely became him to invite criticism upon the subject, but he was quite sure that so much interest must have been created that there were no doubt many members present who would like to express their sense of its value.

Mr. W. H. Gilburt said that the question with which the President had been dealing that night was, perhaps, the most interesting amongst many which occupied the attention of Botanists at the present time, and had given rise to some amount of discussion amongst them. Some of the conclusions arrived at could scarcely be upset, and| others, possessing a high degree of probability, were still in abeyance. It had for a long time been held that the Embryo-sac resulted from the simple enlargement of a single cell; but within the last few months Strasburger and others had shown that a much more complicated process was concerned in its production; that not only was there an enlargement of a single cell, but also division of the "Embryo-sac mother cell," and afterward, through the growth of the daughter-cell, which ultimately became the embryo-sac, not only were the sister-cells, but also the other cells of the nucleus so compressed as to be almost obliterated. They had also long believed that the germinal and antipodal vesicles were produced by free cell formation within the embryo-sac; but Strasburger had shown that this was not the case, and that they were the results of the division of the protoplasm of the embryo-sac, such division taking place in the ordinary manner. With regard to the homologies of the ovule, &c., one needed to go carefully through what took place in the higher Cryptogamia and Coniferæ and so on to the Phanerogamia, in order to see how one followed up the other. A good example for illustration would be to take the oosphere of the Lycopodiacea and watch the result of fertilisation. The first effect is that the hitherto naked protoplasmic cell becomes clothed with a cellulose wall; it then divides into two, the lower one of which becomes the embryo the upper one the suspensor. Further division now takes place differently in each of the two cells—in the former, the next two divisions are at right angles to the primary one; while in the latter all the succeeding divisions are in the same plane as the primary one. In the Phanerogamia the process is in all respects, so far, the same; while in the Cryptogamia, Ferns, &c., a formation known as the foot is produced from the oospore by division, the remainder developing into the young plant; the foot being the homologue of the suspensor and the young plant of the embryo. He did not quite understand what the President meant with regard to the relation of the suspensor to the young stem. If he meant that the latter originated from the former, it could not possibly be so. The embryo which at first is simply a spherical cell, by division produces a mass of tissue which becomes differentiated into several organs, viz., Colyledons and plumule; while from the lowermost cell of the suspensor, or the one next adjoining the embryo, and which is known as the hypophysis, the radicle or young root is developed, the remainder of the suspensor perishing.

The President said he was very glad they had been favoured with Mr

Gilburt's remarks, because he had brought the matter forward with a view of exciting discussion, and as an addition to the paper read at their previous meeting. The question was by no means a settled one; but as regarded some parts of it, the more they were looked into the more did they become confusion worse confounded. However, there were some statements of Strasburgher's—that regarding the embryo-sac, for instance—which he thought could not be maintained. As regarded the suspensor, he had made the statement on the authority of some foreign writer, but he did not believe that it was any part of the future stem, Then, again, as to the embryo-sac, the observations were those of Hoffmeister; in the genus *Pinus* more than one embryo-sac was found, but they were differentiated from several cells set apart for the purpose.

Mr. A. D. Michael said he had expressly avoided joining in the discussion, but would just like to say that he had the pleasure of listening to Mr. Ward's paper at the meeting of the Linnæan Society which had been referred to. Mr. Ward had been engaged for a long time in the Kew Museum and Library working at the subject, and his drawings were laid before the Society, and would therefore shortly be in print. He understood Mr. Ward to confirm Strasburgher's views as to formation by cell division, and moving downwards and upwards; this was, in some species at all events, the cause of the formation. Mr. Ward had worked it out with extreme care, but he did not appear to go with the views regarding the Archigonia. The Botanists of the Society present seemed to consider Mr. Ward's paper was rather confirmatory of the views of the earlier Botanists.

Dr. Matthews said it was clear they had not lost the old gladiatorial spirit; but he was glad to find that, unlike those of old, the contest that evening had been a bloodless fight, and had not ended in a victory on either side. He had great pleasure in moving a hearty vote of thanks to the President for his admirable paper.

The vote of thanks was then put to the meeting, and carried by acclamation.

Attention was called by Mr. Ingpen to the exhibition by Messrs. Powell and Lealand of *Amphipleura pellucida* by means of a new oil immersion condenser, in conjunction with a $\frac{1}{8}$ inch water-immersion objective of large aperture.

Notices of meetings for the ensuing month were made, and members were specially reminded that in consequence of the date of their next ordinary meeting falling on the day after Christmas Day, there would be no ordinary meeting held until January 23rd, 1880.

The proceedings closed with the usual conversazione, at which the following objects were exhibited:—

Section of Coriander Seed	Mr. F. W. Andrew.
Fungus—*Uromyces intrusa* on leaf of *Alchemilla vulgaris*...	Mr. F. Coles.
Palate of *Patella vulgata*	Mr. T. Curties.
Diatoms from Gulf Weed	Mr. C. G. Dunning.

Platypria echidna	Mr. F. Enock.
Hand of Human Fœtus	Mr. J. J. Hunter.
Nothrus palustris (Oribatidæ)	Mr. A. D. Michael.
Examples of close rulings on glass viewed by reflected light	Mr. R. G. West.

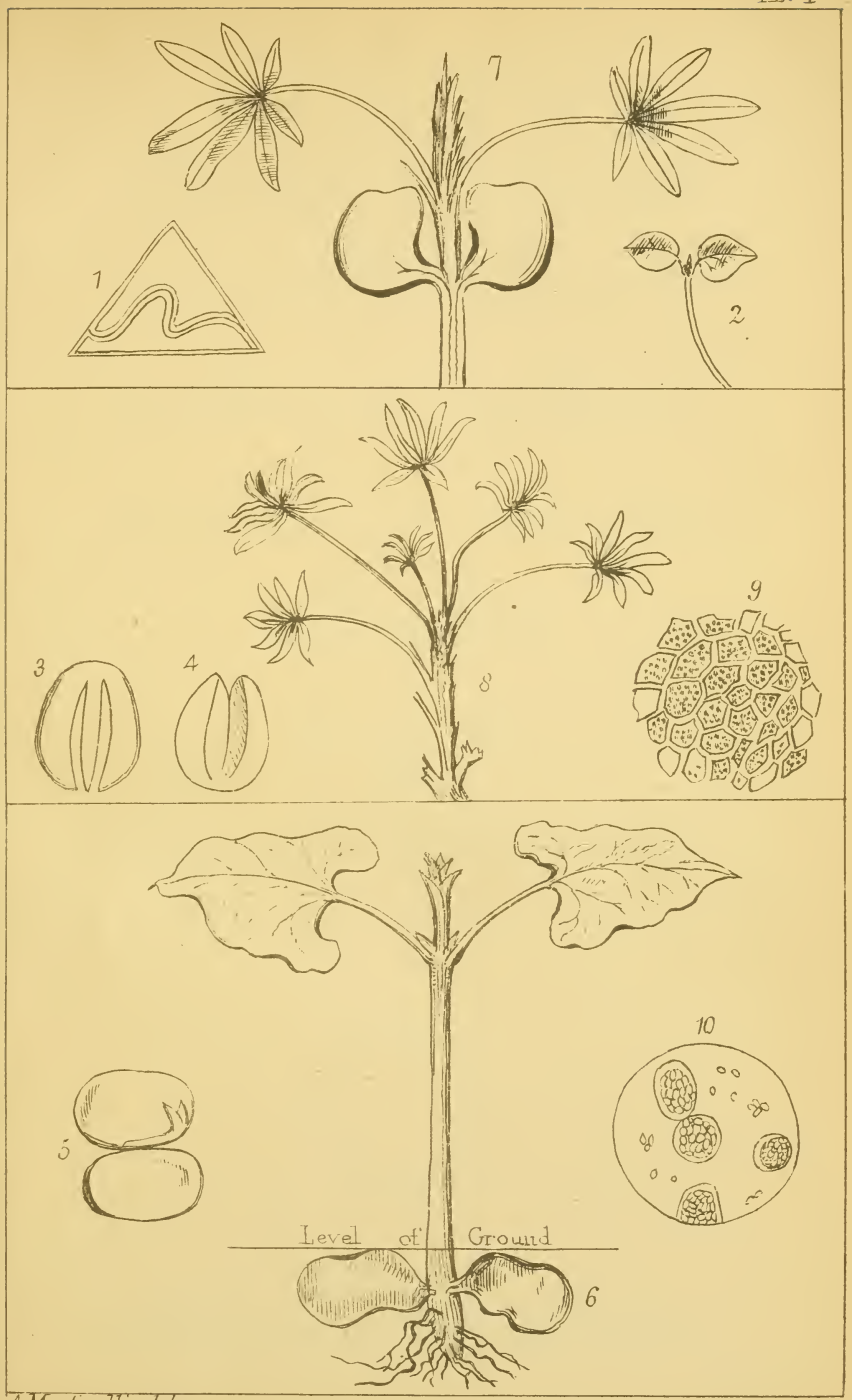
Attendance—Members, 78; Visitors, 16.

December 12th, 1879.—Conversational Meeting.

The following objects were exhibited:—

Impurities in Drawing Paper	Mr. F. W. Andrew.
Section of Porcupine Quill	Mr. A. Ashbridge.
Strongylus auricularis, from the Stomach of a Toad	The President.
Japanese Paper	Mr. A. L. Corbett.
Gizzard of Mole Cricket (*Gryllotalpa vulgaris*), with Zeiss' adjusting objective ...	Mr. T. Curties.
Cordylura spinimana	Mr. F. Enock.
Scolopendron (?)	Rev. H. J. Fasc.
Œsophagus, &c., of Hornet	Mr. F. Fitch.
Bermuda Arrowroot	Mr. H. R. Gregory.
Tongue of Drone Fly	Mr. H. R. Gregory.
Zeiss' Adjusting Objective	Mr. J. E. Ingpen.
Polyzoa—*Eucratea chelata*, „ *Crisidea cornuta*, „ *Hippothoa divaricata* Acarina—*Halacarus notops* ... Foraminifera—*Rotalia ornata*, &c. Infusoria—*Vorticella*, &c., ... (on a leaf of *Delesseria hypoglossum*, showing tetraspores)	Mr. A. D. Michael.
Obisium orthodactylus	Mr. H. Morland.
Larva of *Æstrus ovis*	Mr. T. Partridge.
Gonium pectorale	Mr. C. Le Pelley.
Frustulia saxonica (in checks), with one-eighth immersion objective, and new oil immersion condenser...	Messrs. Powell and Lealand.
Freshwater Alga—*Draparnaldia glomerata* and Red *Protococcus*	Mr. J. W. Reed.
Fungus—*Xenodochus carbonarius*	Mr. J. C. Sigsworth.
Amphiprora rimosa	Dr. Whittell.

Attendance—Members, 77; Visitors, 8.



A. Martinelli, del.

R. G. WEST'S UNIVERSAL TILTING STAGE & OBJECT HOLDER.

FIG. 1

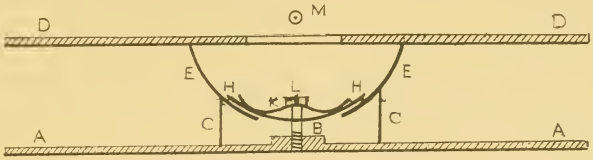


FIG 2

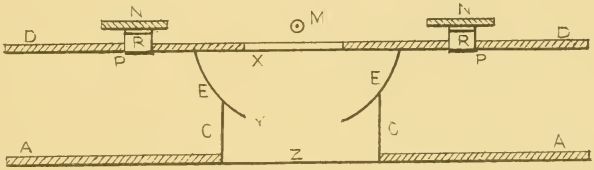


FIG. 3

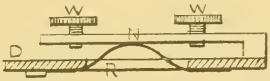
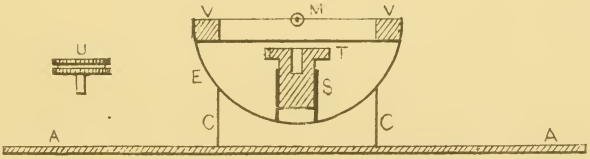


FIG 4



JULIEN DEBYS GROWING SLIDE.

FIG 5

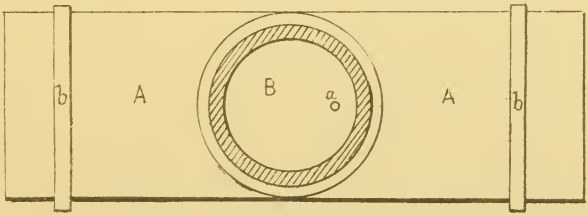


FIG. 6

On the Resting Spores of Protococcus pluvialis.

By T. Charters White.

(*Read January* 23, 1880.)

In defining the "scientific frontier" between the lowest forms of animal and vegetable life as revealed by the microscope, the student is met by difficulties of no ordinary character—he will meet with organised bodies sometimes simulating animal, at others vegetable life; but the boundaries will be so interlaced that it will be extremely difficult to draw the line that shall mark the separation of the two kingdoms.

The subject of my casual communication this evening deals with one of these classes of objects, and one that by an ordinary observer would be undoubtedly placed in the animal world, did not chemical analysis teach him that it was a vegetable—an alga of the simplest type. Possessed of less than ordinary powers of observation, I cannot hope to lay before you any very novel details in reference to my subject, but I may be permitted for a few moments to lay before you sufficient to awaken an interest in the examination of *Protococcus pluvialis*, some specimens of which I have placed under my microscope on the table. The subject has been well studied by such eminent men as Ehrenberg, Cohn, and others, and it is to their monographs and those of our British Algologists that I would refer you for further and more intimate acquaintance with a subject of much interest to the microscopical observer. *Protococcus* has been variously named *Chlamydococcus*, *Hæmetococcus*, &c., but as it is better known as *Protococcus*, it may be desirable that I should use that name in describing it.

When first met with, the observer is impressed with the conviction that what he is looking at are veritably moving animals. They are seen progressing with a rapidly rotating action, are coloured a pale green, and are furnished with a red eye speck. A closer examination will be needed before their true character is made evident. Many of the old writers, as Ehrenberg, claimed them as Infusoria; but others, as Cohn, with a juster determination, have

placed them finally among the Algæ. I cannot give a clearer description of *Protococcus* than that given by Cohn, in a paper translated for the Ray Society in 1853, entitled "Botanical and Physiological Memoirs." He says, "The moving cell of *Protococcus* is composed of two principal parts—a hyaline spherical envelope, formed of a delicate structureless membrane consisting of cellulose, which immediately surrounds the colourless contents, consisting, perhaps, of pure water. In the centre of the envelope occurs a coloured globule composed of the universal nitrogenous protoplasm or mucus of vegetable cells, coloured red or green by a carmine red oil or chlorophyll, and containing in it numerous granules of protoplasm, as well as one or more chlorophyll vesicles. This coloured globule is attenuated at the upper end into a colourless point; from this point go out two cilia, which protrude into the water through two orifices in the membrance of the envelope, and produce the movements of the whole organism. The inner coloured globule is not bounded by any rigid membrane, but merely by a thickened layer of protoplasm; hence its contour is very changeable and passes through manifold transformations in the course of its development." This, then, is Cohn's clear and correct description of *Protococcus* as first presented to the eye of the observer, but changes afterwards take place in them, especially towards winter, when vegetation generally becomes somewhat dormant—changes that may not be passed over because of the interest attaching to their study. Cohn, in the description I have quoted, while mentioning the fact of Protococci containing red and green colouring matters, does not sufficiently distinguish the areas respectively occupied by them. Huxley, in his notice of *Protococcus*, merely states "that the individual Protococci may be either green or red, or half green and half red, or the red and green may co-exist in any other proportion." As they were first seen by me, the central coloured globule was a bright green, having a well defined red spot in its centre, but this had the power of diffusing itself at times through the granules of the green protoplasm and colouring it a dull red. After careful watching, this red would be found to have collected again and formed a red area in some other part or parts of the green globule, and not entirely confined itself to the centre. The movement of this Alga under consideration suggests some relationship to *Volvox*, and it indeed belongs to the family of *Volvocina*. That the green central globule is hollow like *Volvox* is evident, as

it rolls over slowly, and although it is not clear what occupies its centre when the red is absent or diffused, yet its walls contain many vacuoles or vesicles, together with granules of varying size. With these motile forms of *Protococcus*, you will observe some that are three or four times larger, perfectly circular, and filled entirely by a ruby-coloured, highly refractive protoplasm. The bridge by which the motile forms pass over to this resting stage seems at present unrecorded, and although I have watched them very narrowly, I have failed in seeing any transitional stage in their developmental history, but I have noticed in the summer time that these resting spores have become granular and less refractive, and the ruby tint has become paler in a band crossing the cell diametrically, and this has again, a little later, been crossed almost at right angles by another light band, as if the red colour was becoming thinner in these lines—the green colour meanwhile becoming for the first time visible in the light bands ; after a few hours the bands have become separations, while the red matter became defined as a central mass in each quarter of the sphere, and was surrounded with a coating of green. Now the sphere becomes more or less ovoid, and a bulging of the wall occurs at the small extremity of the egg-shaped cell ; meanwhile rotatory movements are seen within, the future macro-gonidia preparing themselves for their independent existence. Suddenly the thinned side of the cell bursts, and the four imprisoned gonidia swim away by means of what seems a fringe of cilia. Professor Cohn doubted the existence of this process of self-division, but Mr. F. Currey, in an article contributed in 1858 to the "Microscopical Journal" avers that he had seen it. He says, he "has distinctly observed it," and I can fully corroborate his observations. Some resting spores of this Alga divide into many smaller gonidia, and I believe from what I have seen that these constitute the so-called *Protococcus nivalis*, or red snow, as I have had an abundance of this plant develop, where before I only had the motile forms of *P. pluvialis;* but though these spores are small at first, they seem to grow by the imbibition of nourishment from the water, and become the same size as the red resting spores to which I first alluded.

The specimens under my microscope present several stages ; you will see the moving *Protococcus* varying in size from $\frac{1}{1000}$ to $\frac{1}{2000}$ of an inch, and by careful adjustment of the light may detect its structureless cyst and the two flagella ; you will also see its

circular resting cell, the primordial cell which as the season advances will produce its *macrogonidia* for the continuance of the species, and with these Algæ you will doubtless see *Amœbæ* and developing *Philodinæ*. If you seek for an *Amœba*, you will see a red cell—*the* red cell that you have been so familiar with in the study of *Protococcus*, occupying its centre—and you will also find *Amœbæ* coloured with green and red ; and the question naturally arises, " Do these *Protococci* undergo that alternation of generation so familiar to the student of the lower forms of life ? " " Do these *Amœbæ* represent so many portions of Bioplasm the result of changes in the *Protococci*, or have they a separate nature, and have they swallowed the red centre of the *Protococcus ?*" My impression, derivable from an examination of many *Amœbæ*, is that they are the results of changes from the Protococcal state, that they are vegetable, but of course this phase of the subject remains for future investigation. It appears to me that the structureless envelope becomes the homogeneous part of the *Amœba*, while the granular centre becomes the granular *Amœba*. This conclusion is derivable from, and is the result of, the collation of many observations made since last spring, and ought not to be deemed beyond the bounds of probability, inasmuch as some of the former writers on these subjects, and especially Mr. Carter, in the " Annals of Natural History," Vol. xvii., for 1856, mentions the rhizopodous development of the contents of *Euglena* into granuliferous *Amœba*.

Since jotting down these few remarks, I have to-day seen an *Amœba* with a well-defined homogenous circular zone, having within it a pale green granular area, with the red oil spot, but to one side rather than centrally situated, evidently a *Protococcus* undergoing change to an *Amœba*. Now the well-defined circle has broken up into the usual Amœboid projections, and it has passed beneath some decayed vegetation and become invisible.

On the Association of Bodies Resembling Psorospermia with the Degeneration of Hydatid Cysts.

By H. T. Whittell, M.D., F.R.M.S., Con. Surgeon, Adelaide Hospital, S. Australia.

(*Read January* 23, 1880.)

Plate III.

My attention has been directed to the subject of *Hydatids* during the last fifteen or sixteen years, and my practice in South Australia, where *Hydatids* are common, has afforded me a fair field for investigation. Viewed in some aspects, the subject of this paper is doubtless better adapted for discussion in a Medical Society than in one that is exclusively Microscopical; but, as I purpose to avoid as much as possible its medical bearings, and to confine my remarks to a phase in the life-history of *Hydatids*, which can only be worked out by microscopical observation, I have thought it better to present an outline of such facts as are at my disposal to a Microscopical Society rather than to one that is purely medical in its character. And I have been the more anxious to place these facts before the Quekett Club, because the President of this Club occupies a foremost place as an original worker and a writer on the subject of parasitic disease.

For the guidance of such members of the Club as are not familiar with the ascertained facts with regard to the origin and life-history of *Hydatids*, it may be well briefly to notice that an *Hydatid* is a form of worm which infests various parts of the bodies of men or other animals, and which, by its presence may occasion serious or even fatal results to those in whose tissues they take up their habitation. There is scarcely a part of the human body which I have not seen infested by these worms, but their more common seats are the liver and lungs. From the investigations of our best observers, it is now established that the *Hydatid* is, in reality, an intermediate form of existence between the ova on the one hand and a fully-developed tape-worm—*Tænia echinococcus*—on the other. This *Tænia* is a very minute worm, found chiefly in the intestines of dogs, and affords a curious illustration of that form of worm which requires

to pass into the bodies of two distinct animals before it attains to mature life. The ova of the worm pass from the intestines of the dog and find their way, either in food or otherwise, into the body of some other animal—a man or a sheep for instance. Here the embryo from the ova burrows its way into some of the tissues, and developes into an *Hydatid*. This *Hydatid* grows and undergoes certain changes preparatory to its further development into a mature worm, but this complete development can only occur when the *Hydatid* is swallowed by a second dog, or possibly by the same one from which the ova were first passed.

As seen in the human subject, the *Hydatid* appears as a cyst embedded in one or other of the tissues. The outer wall of this cyst is generally a thick membranous capsule, probably formed by the healthy tissues, as a protection in some degree from the intruder. The true *Hydatid* is found rather loosely attached within this capsule, and when an opening is made through the outer wall it may frequently be drawn out in its entirety. The walls of the *Hydatid* itself are formed by a curiously laminated structure, which is so characteristic in its appearance that a competent observer will diagnose the presence of the hydatid after finding a minute portion of it in the field of the microscope. Within the cyst itself there is commonly found a fluid varying in quantity from one or two ounces to many pints. This appears, on a casual glance, like clear filtered water, but, on a closer examination, there will almost always be noticed floating in it a number of parasites just large enough to be seen with the naked eye. An expert hand can catch these in a dipping-tube, and if they be brought into the field of the microscope, they will be found to consist of one or more oval-shaped living bodies armed with two rows of hooklets. For some hours after their removal from the cyst, they keep up a peculiar kind of semicircular motion, extending and retracting their hooklets in a most curious fashion. These bodies are known as the *Echinococci*, and it is from these that the mature worm is developed after they have found their way into the stomach of a new host. Sometimes only one *Echinococcus* is caught in the dipping-tube, but more frequently four or five will be found attached by the posterior part of their bodies to a small portion of the inner wall of the cyst which has become detached. I have watched the movements of these creatures for hours, and in very fortunate instances I have seen a rather rapid movement of cilia just at that part of the body which joins the membrane.

What I have just described is the more common form of an early *Hydatid* cyst. At a later stage of its existence the older cyst becomes filled with smaller ones, which in structure and contents exactly resemble the original. These, the so-called daughter-cysts, vary in number in different cases. It is no exaggeration to say that, in some post-mortem examinations at the Adelaide Hospital, I have seen thousands of them turned out from one original cyst.

Although *Hydatids* are very destructive of human life if left to take their course, there can be no doubt that the worm itself is not possessed of a high degree of vitality. Both clinical experience and post-mortem examinations lead to this conclusion. A very slight mechanical interference is often sufficient to destroy the worm. In Adelaide we frequently find that a simple puncture with a small hollow needle, and the drawing-off of the fluid contents of the sac through the needle, is all that is required to destroy the parasite, and very few simple cysts resist this mode of attack if repeated two or three times. Even those cysts which are supposed to contain daughter cysts will often perish by degenerative or suppurative changes after the surrounding fluid is withdrawn.

Having thus paved the way, I may now go on to notice that it frequently happens that, without any interference from the surgeon, the *Hydatid* dies within the body of its host, instead of passing on through its full course of development. Sometimes this is caused or followed by the formation of an abscess, but perhaps more commonly the *Hydatid* undergoes a form of degeneration, and leaves nothing to indicate its former presence but a putty-like substance, which eventually hardens into a gritty, calcareous mass, in which hooklets, cholesterine, and other products of degenerative changes may often be found. It is no uncommon thing to find evidence of this degenerative change having taken place in the bodies of patients who have died from other diseases, and in whom there had been during life no symptoms leading to the suspicion of the presence of *Hydatids*. When this kind of degeneration is in progress, we find that after the operative puncture I have already described, there flows through the needle, instead of the usual clear liquid, a yellowish creamy-looking and thicker fluid, which, without microscopical examination, may readily be mistaken for pus. In a later stage of the degeneration, the fluid becomes so thick that it will not flow through a small needle, although a little may often be blown from it on to a slide after its withdrawal. It is to this degenerative change, and particularly to its association with what are supposed to be new-

forms of life of a lower type, that I wish to draw your attention. I have here some specimens of the fluid found in cysts in which this form of degeneration had occurred, and also some slides mounted with the same fluid, in which these lower organisms are distinctly shown.

The history of the patient from whom these were obtained was interesting and peculiar. Without troubling you with details of a medical character, I may give you a brief outline of the case. The patient was a rather stout gentleman, of middle life, who having met with an accident, believed that all his symptoms were due to this cause. It was noticed that a swelling formed just over the lower region of the liver. This gradually enlarged, and was accompanied with occasional paroxysms of pain and a faint jaundice. As the swelling continued to increase, it was determined to pass in a fine exploring needle, but no fluid came down the tube. Later on a second exploration was made, but only a few drops of a yellowish-grey fluid were obtained. Later still a larger sized tube was passed into the swelling, and about half a pint of thick fluid, supposed to be pus, was obtained. A portion of this was brought to me for microscopical examination, with a view to ascertain whether there could be found any of the hooklets of *Echinococci* or any other remains of *Hydatids*. I found no traces of pus ; the fluid appeared to be composed chiefly of fatty and granular matter, mixed with the remains of *Echinococci*, such as hooklets, cholesterine, and portions of the walls of the cyst. This cleared up the diagnosis, and left no doubt that the tumour had been formed by an *Hydatid*, and that at the time of puncture a process of degeneration had begun. While searching for hooklets, I discovered that the field was studded with curious-looking bodies, such as I had never seen before. These were so transparent and delicate in structure that I found it necessary to adjust the illumination as carefully as one has to do when looking for the lines on an *Amphipleura*, before I could get a satisfactory view. The drawing on Plate III will give some idea of some of the forms met with. It will be seen that they differ in shape and size, but there is a general family likeness in all of them. They appear to be flattened bodies, the greater number of which are ovoid in shape. The largest I have measured was $\frac{1}{570}$ inch long, and $\frac{1}{1140}$ inch wide. Some of the smaller specimens measured $\frac{1}{1600}$ inch long, and $\frac{1}{3000}$ wide. Some are considerably elongated, while others look like mere specks under a $\frac{1}{5}$ in. objective, but when carefully examined under a $\frac{1}{25}$ in. immersion lens, they show the same

appearances as the larger specimens. Dilute acetic acid does not appear to affect them, nor do they polarize light. I have been unable, with the highest powers in my possession, to make out any internal structure. In some instances I have found a number of smaller ones apparently attached to each other, and so forming one large specimen, but I have not discovered anything like a cell wall, and I have not been able to satisfy myself whether this appearance is due simply to a mechanical or accidental aggregation of the bodies to each other, or to some phase in their life-history.

Having been practising in Australia for the greater part of my life, I had had no opportunity of seeing the parasites which some observers had supposed to be the cause of the cattle plague, but I thought I could detect some degree of resemblance between the bodies under my microscope and drawings of these parasites that had been sent out to us. We were, however, anxious to obtain an authoritative opinion, and it was arranged that I should send one or two slides to Dr. Cobbold, and ask him his opinion respecting them. In reply, Dr. Cobbold wrote, " I regard the peculiar organisms contained in the slides you have transmitted as psorospermial bodies of the nature of pseudo navicellæ. They are not precisely like any I have myself hitherto encountered, and they differ still more from those described by foreign writers. The general facts recorded by you remind me forcibly of the case reported by Gubler in 1858, in which there were twenty cysts in the liver ; the largest of which (six inches in diameter) was, during life, diagnosed as an *Hydatid.* Reference to this and other cases are given in my paper, ' On the Nature of Pseudentozoa found in Diseased and Healthy Cattle,' originally published in *The Lancet*, for Jan. 27th, 1868. It has been reprinted in the supplement to my ' General Treatise on the Entozoa,' and in Prof. Gamgee's work on the Cattle Plague. The whole subject of the gregariniform productions requires revision, and it needs only a perusal of my short paper to show how intricate and involved are the facts hitherto described. Practically it is important to remember that all liver cysts are not necessarily due to *Hydatids*, since Virchow, Gubler, Dressler and others, have encountered cystic formations of the pseudentozoal character above described."

I found on one of the slides, mounted with some of the fluid I have just referred to, a solitary, filiform, worm-like body, which I would gladly have sent on to Dr. Cobbold, but as it was an accidental find on a slide not prepared for the cabinet, I feared that no

mode of sealing with which I was then acquainted would protect it from destruction in its transit through the post. Having, however, last year decided on a visit to Europe, I determined to try whether I could bring it safely to London. I have not been quite successful; some of the glycerine has escaped, but the special object is in much the same condition as when I first found it. I notice that our President has referred in his last work to an outline sketch I sent him of this find, and he suggests that it is a specimen of *Filaria sanguinis hominis.* If this be so, it is certainly the only specimen that has been found in South Australia, and we shall be stimulated to search for other specimens in that region, particularly since the strange discoveries lately made elsewhere tend to show that the Mosquito may after all be of some use in the world, even though that use may be nothing more dignified than serving as hosts to the *Filaria* in certain stages of its development.

It may interest you to know that the gentleman whose case I have just sketched, was cured after the emptying of the cyst, and lived on for several years, when he died from disease in no way connected with his former ailment.

Since the occurrence of this case I have frequently met with others in which a similar looking fluid passed through the needle after puncture of hydatid cysts, and when opportunity has served I have searched for similar psorospermial bodies. I have not always succeeded in finding them, but I have met with them sufficiently often to convince me that their existence in hydatid fluid is more than a mere coincidence. I have never found them in such numbers as in the first case, and sometimes I have had to search through several dippings before I have succeeded in finding any.

On one occasion a lady came to Adelaide from the Interior for treatment of a large hydatid cyst in the liver. I drew off from it about two pints of perfectly transparent fluid which, on examination, was found to contain numerous living *Echinococci.* She returned to her home a few days after, with instructions to come back in three or four months if she found the tumour had not quite disappeared. She returned about six months afterwards, when I found there was still considerable swelling, and I performed a second operation. On this occasion I obtained only a few ounces of fluid, but this was quite different in appearance from the first. It was much thicker, and of a greyish-yellow colour. On microscopical examination, I found numerous granular cells about the size of pus globules, numerous hooklets of *Echinococci*, and after a rather pro-

longed search, I found several psorospermial bodies, similar in all respects to those I found in my first case. These were so few in number, that not more than two or three appeared in the field under an $\frac{1}{5}$ in. object glass. The patient again returned home, but came back seven months afterwards, and begged me to repeat the operation, as she thought the swelling was again increasing. I operated in the early part of last year (1879), and used a larger tube than before. I obtained, however, only a small quantity of thick fluid resembling pus. A microscopical examination of this fluid showed that the comparative number of psorospermial bodies had now largely increased.

At a recent "Gossip Meeting" of this Club, most of us had an opportunity of seeing a beautiful preparation shown by Dr. Cobbold of psorosperms, obtained from the liver of a rabbit. These were much larger than the psorospermial bodies obtained from *Hydatids*, and, in fact, have little or no resemblance to them. They have more body in them, if I may so express it, and have more distinct evidence of organization.

From the cases that have come under my observation, I believe we are justified in concluding—1st. That *Psorospermia* are frequently to be met with in hydatid cysts, their existence there affording an example of a parasite within a parasite. 2nd. That these bodies are not found in the early life of the *Hydatid*. 3rd. That when they are found they afford evidence that degenerative changes have already commenced in the cyst. The question yet remaining to be determined is, What *rôle* do these psorospermia play in the degenerative change? Are they the cause of the degeneration and death of the *Hydatid*, or do they multiply and grow simply because a cyst in a state of degeneration affords a favourable breeding ground for their development? We do not yet know enough of the conditions of life in *Psorospermia* to answer this question. Our President, long ago, demonstrated that similar bodies may exist in the higher animals without any apparent injury to the animals themselves, or to those who partake of their flesh for food. I am, however, a little inclined to the opinion that in the case of *Hydatids*, the existence of these bodies have a greater significance, and I think it probable that extended research will show that they have an active part in producing those degenerative changes which, so far as I have been able to make out, are always in progress when their presence can be demonstrated.

On Bleaching and Washing Microscopical Sections.

By Sylvester Marsh, Jun., L.R.C.P., &c., &c.

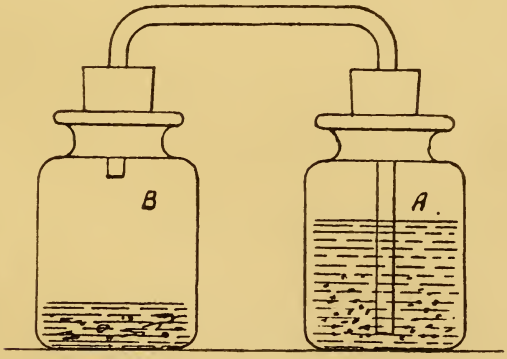
Communicated by A. de Souza Guimaraens, F.R.M.S.

(*Read February 27th*, 1880.)

Now that the practice of staining vegetable tissues, and especially vegetable sections, is so universally adopted, it has become of moment to determine by what means the previous decolourization of such objects may best be effected. That by some process or other a preliminary bleaching ought to be carried out previous to the application of staining agents will be admitted by all, but the precise process to follow so as to obtain the best results with the greatest quickness and safety does not seem so clear. The agents most commonly used for bleaching are :—(1) Alcohol ; (2) Solution of Chloride of Lime ; (3) Labarraque's Solution of Chlorinated Soda, made by decomposing Lime Chloride by the action of Sodium Carbonate. Now to each of these methods there are serious objections. Alcohol is very slow in action and not always certain in result. Solutions of Lime Chloride and Chlorinated Soda do bleach, it is true, but they also disintegrate and destroy ; so that many delicate tissues when subjected to the action of either of these solutions become utterly ruined. The former solution, in addition to its direct destructive influence, has a great tendency to permit of the formation on its surface of a scum of Carbonate of Lime ; this, sinking into the fluid, settles itself upon the sections, so that if they escape absolute destruction they are in danger of becoming coated with a brittle film, which proves equally ruinous to them. The inconveniences here mentioned led the writer to discard these methods of bleaching and to resort for this purpose to the direct action of *free chlorine*. As this process proved itself capable of being so easily carried out, and yielded such safe and satisfactory results both to himself and to several working microscopists to whom he communicated the method, he has thought that a brief description of the process might not be unacceptable to microsco-

pists generally. So far as the writer is aware the method is quite original, but as "there is nothing new under the sun," it is by no means improbable that the same idea may have occurred to others. For carrying out the plan, the apparatus required is simple in the extreme. All that is required is (1) two small wide-necked bottles—those in which chemists sell one ounce of Citrate of Iron and Quinine are very suitable ; (2) perfectly sound corks accurately fitting the bottles ; (3) six or eight inches of quill glass tubing ; (4) some shellac varnish. By mean of a cork-borer or rat-tail file a hole is to be made through the centre of each cork just large enough to grasp tightly the quill tubing. With the aid of a spirit lamp the tube is to be bent at right angles at each end, as shown in Fig. 1. The two arms are not to be of equal length—one should be about one inch and the other about two inches and a half. These arms must now be passed through the holes in the corks, and the corks themselves then made air-tight by a liberal application of the shellac varnish. A notch having been cut in the edge of the cork carrying the *longest arm* of the glass tube, the apparatus shewn in Fig. 1 is complete.

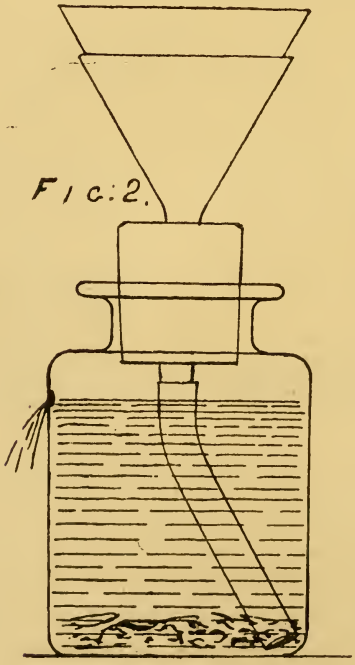
FIG: 1.



To use it, proceed as follows :—About three parts fill the bottle A with filtered rain water, and to this transfer the sections to be bleached. Into bottle B put a sufficient quantity of crystals of chlorate of potash just to cover the bottom, and upon them pour a drachm or so of strong hydrochloric acid. Fit in the corks, taking care that the one carrying the long arm of glass tube be applied to the bottle containing the sections. Immediately the yellow vapour

of chlorine (or strictly speaking of euchlorine) will be observed to fill the bottle B, whence it will pass along the connecting tube into the water contained in the bottle A, and effectually and safely bleach the sections. When the water becomes supersaturated, the excess of chlorine will accumulate in the bottle above the liquid and find an exit through the notch in the cork. As to the time required for bleaching, this, of course, will vary in accordance with the nature of the sections operated upon. As a rule, I set the apparatus to work at night, putting it out of doors in a covered place to avoid the smell of escaping chlorine, and in the morning the bleaching is generally found to be complete—if not, further time may be allowed without any danger to the sections being incurred.

Decolouration having been effected, nothing now remains but thoroughly to wash the sections, for it is necessary to eliminate all trace of chlorine before employing any staining agent. The usual method of effecting this is to put the sections into a large basinful of water, and repeatedly to change the water. As this process is



not only tedious but exposes the sections to considerable risk of being contaminated with dust and other extraneous matter, I always employ in its place a system of continuous washing. For this purpose a small wide-necked bottle similar to those already described will be required. Into the side of this, half an inch or so below the bottom of the cork, a small hole about an eighth of an inch in diameter must be drilled—any tinman will do this for two or three pence. A well fitting cork being provided, this must be pierced through the centre, so as to permit the stem of a small funnel to pass through it. By means of small india-rubber tubing (feeding bottle tube), the funnel stem is to be prolonged till it reaches the bottom of the bottle on the side *which is opposite to that side containing the perforation.* (See Fig. 2.)

All being ready, half fill the bottle with filtered water, and put the sections into it. Fit in the cork carrying the funnel, and after having placed a disk of filtering paper into the funnel place this beneath the water tap, and allow a *gentle* stream to trickle into it. The water will pass to the bottom of the bottle, gradually ascend, and then pass out at the hole in the side, by which means a constant change in the water in the bottle is brought about and a system of continuous washing established. As in bleaching, so in washing, I generally let the apparatus do its work in the night. If the tap be set a-running when one goes to bed, the washing will be found to have been most effectually accomplished by the time one gets up in the morning.

Observations on Filariæ, by Drs. Patrick Manson, John R. Somerville, Joseph Bancroft, J. F. da Silva Lima, J. L. Paterson, Pedro S. de Magalhaes, and J. Mortimer-Granville.

Communicated, with an Introduction, by the President.

(*Read February* 27, 1880.)

Introduction.

I almost owe an apology, not only to the Club but also to the medical profession, for not earlier communicating the new and remarkable facts which I have the honour to bring under your notice this evening. I must explain that during my autumn holiday so large an amount of correspondence had accumulated that I have been unable to overtake the duty of replying to letters, of reading lengthy manuscripts, and of reporting on the various specimens of parasites that were sent during my absence.

Such rapid progress is being made by additions to our knowledge of the habits, developments, and disorders produced by the *Filariæ* and other parasitic nematodes, that in order to render Dr. Manson's researches generally intelligible it is necessary that I should state, in as few words as possible, the position at which we had arrived prior to the receipt of the particulars which the missionary physician now supplies.

The facts of filarial discovery in man originated and appeared in the following order. In its embryonal state, what is now called *Filaria sanguinis hominis* was first discovered by Dr. Wucherer on the 4th of August, 1866. He gave no name to the parasite. Two years later the same or similar larvæ were found by Dr. Salisbury in the urine,* in a case of chyluria (1868). He thought they were a kind of *Trichinæ* (*T. cystica*). On the 22nd July, 1870, I discovered great numbers of the nematode larvæ in the excretions

* Dr. Salisbury's figures are probably inaccurate as to size. Basing his views on the supposition that Salisbury's figures are correct, Dr. Lewis rejects the notion of the identity of the urinary worms found by Salisbury and myself.

of a little girl from Natal, who suffered from endemic hæmaturia, the disorder being occasioned by the presence of the fluke which I have called *Bilharzia hæmatobia.* Tens of thousands of eggs of this trematode passed from her daily, and as many as fifty of the larval *Filariæ* were seen on one occasion mixed with the ova of *Bilharzia.* Like Wucherer, I gave the young nematode no new name. Two years later Dr. Crevaux found similar larvæ in a hæmato-chylous patient at Guadaloupe. Nothing whatever was known of the real significance of these finds until the year 1872, when Dr. Lewis announced his discovery of minute *Filariæ* in the blood. He named the larval worms *Filaria sanguinis hominis.* Neither Wucherer nor myself thought it necessary to give any particular name to larvæ, which might be those of some adult *Filaria*, *Ascaris*, *Strongylus*, or other nematode genus. Dr. Salisbury, indeed, had the temerity to refer the worms to the genus *Trichina;* and Leuckart suggested that they might be young *Strongyles.* In the matter of nomenclature I thought it better to wait and see to what type the adult worm could properly be referred; for these larvæ certainly possessed no distinguishing characters of any particular genus.

Guided by certain indications which I pointed out to him, Dr. Joseph Bancroft, as he has acknowledged, sought for and discovered the adult worm on the 21st of December, 1876. He wished me to publish his very short notice of the worm, because, as he said, "I had set him on the track of the investigation." Accordingly I announced the discovery in the *Lancet* for July, 1877, and afterwards more fully described the parasite in the same journal, naming the worm *Filaria Bancrofti.* I also furnished some anatomical details. Some months after Dr. Bancroft made his discovery, Dr. Lewis also encountered the adult parasite; and losing no time in publishing his description, it appears that his diagnosis of the characters of the entozoon was actually in print before mine. Consequently, although Dr. Bancroft is the real discoverer of the sexually mature parasite, I have, on this basis, been called upon to give up the nomenclature that my description supplied. I willingly do so; with the distinct understanding, however, that such a step shall not deprive my Brisbane correspondent of the honour of priority in this matter. Dr. Bancroft's discovery dates seven months in advance of that of Dr. Lewis, whose verification occurred on the 7th of August, 1877. Two months later, in

Brazil, Dr. Silva Araujo found the adult worm on the 16th of October, 1877, and shortly afterwards Dr. F. dos Santos made a similar verification (12th November, 1877). This closes the record of the first two epochs of filarial discovery. A third epoch of discovery was opened up when, writing from Amoy, in November, 1877, Dr. Manson informed me that he had discovered *Filariæ* in the stomach of mosquitos that had gorged themselves with human blood. Dr. Bancroft, indeed, writing in the spring of the same year, had remarked to me that he fully expected that the hæmatozoa would be thus transferred, but his examinations of mosquitos up to the time of Manson's discovery had not been successful. Other discoveries and verifications rapidly followed, especially those having reference to the power of the hæmatozoa in the production of disease. On this aspect of the subject I cannot now dwell further than to say that the purely clinical questions have already been pretty fully discussed by myself in a paper communicated to the London Medical Society, and published in their recently issued "Proceedings" (Vol. iv, 1877-79, pp. 129-134).

I may add that all the various disorders produced by the *Filariæ* in question have been, as it were, rolled together into one by Dr. Bourel-Ronciére, who calls the collective disease *Wucherer's helminthiasis.* Others have called the disorders *Filariasis*, but, obviously, this vague and too comprehensive sort of nomenclature cannot be allowed to stand. It is now tolerably certain that at least a dozen more or less distinct diseases are caused by the larval *Filariæ*, and amongst these are to be reckoned endemic hæmaturia, chyluria, varix, lymph scrotum, elephantiasis, lymphatic growths (helminthoma elastica), many other lymphoid affections, a skin disease termed Craw-craw (*Filariasis dermathemica*), probably leprosy, and perhaps also certain malarial fevers.

In the acquisition of these results—results which, of course, are not generally accepted, and whose full value and significance will probably not be realised for many decades or centuries to come—the justifiable method of human experiment has played a most conspicuous part. Initiated by Dr. Manson himself, he was thus enabled to trace out the higher larval stages of growth, after the hæmatozoa had passed from man to mosquito. Having caused an infected Chinese to sleep in a mosquito house, the insects were found gorged with blood the next morning. On examining the contents of their stomachs, Dr. Manson ascertained that a relatively far greater pro-

portion of the *Filariæ* existed in a drop of the sucked blood than in a drop taken from the Chinese in a direct manner. Thus, it was not unnaturally inferred that the construction of the proboscis was in some way or other expressly fitted for drawing the worm out of the capillary blood vessels. Dr. Manson examined the gorged insects at regular intervals of time, and he forwarded to me the details that were subsequently communicated to the Linnean Society, and published in their Journal (1879). He likewise reported the results in the *Custom's Gazette*; but probably the summary which I have given in my recently issued work, with illustrations reduced from Dr. Manson's original figures, sufficiently explains all that need be known on this part of the question. Thus the position stood at the commencement of last year; and the novel facts and deductions to which I now invite your attention, must be regarded as a continuation of those records. I may add that since the issue of my treatise, Dr. Lewis has published a beautifully illustrated memoir in which he not only verifies a great deal of what Dr. Manson had already observed, but also adds a multitude of interesting details. Dr. Lewis's writings, however, do not in any sense anticipate the data now brought forward. In the present communication, Dr. Manson commences by referring to the mosquitos (which I have now the pleasure to show the Club) and to a Chinese scrotum at present in my possession. He gives particulars of the remarkable case to which the scrotal preparation refers. He points to a newly observed fact that the worms enter the blood periodically. He interprets the significance of this law of periodicity in some of its more obvious bearings. He appears to have discovered the special means by which the insects contrive to fish up, as it were, the hæmatozoa. He explains the immediate consequences of this curious phenomenon. I may add, parenthetically, that this process affords a remarkable instance of so-called free parasitic ectozoa stealing true entozoa and taking them as prisoners from human hosts, to lodge them, as transported guests, in their own interior. The matter does not stop here. Dr. Manson explains how it happens that human blood does not contain *Filariæ* during the afternoon. He gives a tabular record of the results of the daily examination of the blood at different hours. He shows how the embryos, with almost military punctuality, march to their nocturnal quarters. Proofs of this extraordinary behaviour are supplied by repeated observations. He hints at the importance of

these facts in relation to the etiology of malarial fevers, and he concludes his letter—for such it only pretends to be—by stating his determination to carry on the investigation until the whole body of available facts is explored and the results, in all their professional bearings, are elucidated.

It remains for me to observe that this novelty in helminthology savours somewhat of the marvellous. When the facts come to be fully understood, I think it will appear that neither the parasitism of *Trichina,* nor that of *Echinococcus* approaches in interest that of the human *Filariæ.* Probably millions of victims exist in tropical countries; many of them suffering from grave disorders consequent upon this invasion of their tissues. That in the face of such astounding facts as have of late years come to light there should be found professional men of standing averse to encouraging researches of this kind is one of those retrograde social phenomena which I greatly deplore; but where the interests of humanity are so much concerned such disparagement ought not to be allowed to check our efforts.

It must be obvious to every one that naturalists, physiologists, and medical men will separately view these discoveries from very different standpoints; and it will need some master mind to collate all the phenomena in relation to cause and effect. At present I have only had opportunity to converse at any length with one physician on the subject. In the opinion of Dr. J. Mortimer-Granville we must not look for a solution of the phenomenon of periodical local migration as arising from any special want on the part of the entozoon, but rather as arising from varying physiological conditions affecting the host. Whether this view be correct or otherwise, I think Dr. Granville's suggestions highly important; and as he has been good enough to communicate an abstract of them in writing, I append them to this introduction in the form of a separate commentary.

The communication of Dr. Somerville has more especial reference to the closely allied microscopic *Filariæ* infesting the dog. The adult *Filaria immitis* engaged my attention at Edinburgh some thirty years ago; but, in recent times, Dr. Somerville was, I believe, the earliest to report on this subject in the *Customs Gazette.* He believes that the occurrence of *Filaria sanguinis hominis* at Fuchow to be comparatively rare; but, in this case, as probably obtains in many others, the negative indications may

have entirely resulted from the hours of the day selected or accidentally employed for the blood-examinations. He incidentally alludes, also, to the common eye worm of horses (*Filaria papillosa*) and some other helminthological points of general interest. It is very curious to observe Dr. Somerville's remarks respecting a case of lymph-scrotum, which he examined in company with Dr. Patrick Manson's brother (since deceased). The negative results of his search for *Filariæ* is now readily explained.

Dr. Bancroft's brief communication deals with facts that verify his original opinion that the peculiar growth which he has termed *Helminthoma elastica* is really due to the presence of *Filaria sanguinis hominis.* Of more interest, however, is the circumstance that he has ascertained from actual observation that the common louse of the dog (*Trichodectes latus*) is the intermediate bearer of the larvæ of *Filaria immitis.* It will be remembered that Melnikow long ago demonstrated by experiment the intermediary functions of the louse in respect of the larvæ of a cestode (*Tænia cucumerina*); and it is therefore not a little curious that this insect should play a similar *rôle* in respect of a parasitic nematode.

Dr. J. F. da Silva Lima's letter specially refers to a singular affection which some persons appear to have associated with elephantiasis. He alludes to a paper by himself on *Filaria medinensis*, a translation which (from the Portuguese, by Dr. Paterson) I published in the *Veterinarian* in the spring of 1879.* Dr. Lima encloses a paper by Dr. Paterson, which must be regarded as the sequel to his interesting paper, entitled "Facts in Filariasis," which also appeared in the *Veterinarian* (June, 1879).

As Dr. Paterson's recent memoir, however, is of considerable length and relates to a point respecting which there ought not, in my opinion, to have been any controversy at all, I shall only reproduce a portion of it. The memoir deals exclusively with the nature of the involucrum of *Filaria sanguinis hominis.* Dr. Paterson appears to have thought that the envelope surrounding the microscopic *Filariæ* is no genuine worm structure, but a merely adventitious layer of coagulated fibrin. Having published this view, Dr. Magalhaes, of Rio de Janeiro—from whom I have also received

* "Remarks on the *Filaria medinensis* or Guinea worm; on the occurrence of this parasite endemically in the province of Bahia; on its entrance into the human body by drinking-water."—The *Veterinarian*, Feb.-March, 1879.

communications—seeks to overthrow this theory. In the interests of science it is desirable to publish the facts forming the basis of this unduly warm controversy, in which Dr. Magalhaes has certainly the best of the argument. So far as my own observations have gone, it seems pretty clear that neither Dr. Magalhaes, nor Dr. Paterson, nor even Dr. Lewis himself, appears to have correctly interpreted the nature of this envelope. Dr. Lewis has persisted all along in calling the structure in question "a sheath." It seems to have escaped the knowledge of almost all observers that the so-called involucrum is neither more nor less than an ordinary skin-cast, such as invariably accompanies the moultings of nematode worms. Different larval nematodes cast their skins at different times, and this moulting is usually accompanied with an alteration in the form and structure of the larva, involving the loss of the original tail.

T. Spencer Cobbold.

February 26th, 1880.

APPENDIX.

Remarks of the Local Migration of Micro-filariæ.

By J. Mortimer-Granville, M.D.

Assuming that the change of locality is found to be habitual, and that it is not a too hasty generalisation from insufficient data, it will, I believe, be of great value to the student of rhythmical phenomena like that of "sleep." The change of place may be fairly ascribed to change of state. Looking to the habits of life in the lowest organisms, it can scarcely be supposed that the periodicity can depend on the state or requirements of the *Filariæ*. It is not likely that the parasite needs repose, or that it resorts to special localities to feed. It seems more probable that the state of the circulating fluid determines the presence or absence of the *Filariæ* in its main current, by night and day respectively, or during the waking and sleeping states. Your verbal account of Dr. Manson's report *is not quite explicit as to whether the change of locality depends on sleep, or simply the advent of night.* The alterations and alternations of condition which takes place in the blood are three (perhaps four) in number, so far as any living organism present in it is concerned.

First—The rapidity of the current is diminished in the recumbent posture, and (*in women and children at least*) still further during sleep. It seems probable that there may also be an integral change in the relation of the red and white corpuscles approaching that which takes place when the circulation is retarded in the web of a frog's foot. This modification of the internal current of the main current may cause the *Filariæ* to adhere to the sides of the vessels during rapid circulations, and to fall into the stream when it moves more slowly.

Second—The oxygenation of the blood at night and in repose is supposed to be less complete than during the day; although some experiments made by Pettenkofer and Voit point to an opposite conclusion, and make it appear that of the total amount of oxygen taken in during twenty-four hours 67 per cent. is taken in by night, and only 33 per cent. by day; 58 per cent. of the carbonic acid eliminated during twenty-four hours being given off in the day, and 42 per cent. by night. From these results Somner drew the inference that sleep was caused by exhaustion of the reserves of oxygen during the waking state, that oxygen was stored during sleep, and that when the equilibrium was re-established by accumulation the subject awoke. This hypothesis is barely tenable, but it is worth while to mention it in this connection because it accords with the presumption that the blood is more or less abundantly charged with oxygen during sleep; and this may help to determine the location of the *Filariæ*.

Third—The temperature of the blood is probably lower (or it may be higher) *relatively to that of the tissues* during sleep than in the alteration of state consequent on the presence, or absence, of special elements derived from the food. It does not seem likely that there can be any considerable change of condition consequent upon the periodic or occasional discharge of lymph and chyle into the blood; but it may happen that when the circulation is slow and the body lies recumbent, the parasites are thrown into the main current and therefore appear in greater numbers.

It is premature to speculate on the causes of a phenomenon which may yet prove to be exceptional; but if the conclusion arrived at should be maintained, it will certainly be the duty of physiologists to pursue further into detail than they have ever yet been carried certain neglected inquiries as to the altered conditions of the blood during sleep, and when the brain and body are awake.

Letter by Dr. Manson.

"Amoy, 20th June, 1879.

"T. Spencer Cobbold, Esq., F.R S.

"Dear Sir,—Last mail brought me your kind letter of 28th April, and enclosures. I am glad your new work is about coming out, and hope my London agents have forwarded a copy long ere this time. Had I been in possession of it, I would not have troubled you with questions about *Distoma crassum*. I suspect you are very often annoyed in this way, and I am very much obliged for your courtesy in noticing my letter.

"I will forward by this mail filaria-impregnated mosquitos. They are preserved in glycerine, and were fed on the blood of the man whose case I append. His scrotum I sent to you some time ago in charge of Dr. Holmes, a surgeon in one of Holt's steamers, who kindly promised to hand it to you. I hope you will pardon the delay in sending the mosquitos ; being in general practice here, the many interruptions this entails make work of this sort exceedingly difficult to carry out quickly.

"I read in the *Lancet* lately an account of the discussion on a Lymph scrotum sent from India, and felt disappointed that the *Filariæ* were not found. I determined to send you the first scrotum I amputated, and in which I had unquestionable evidence of *Filariæ*. The scrotum I send is the result, and to complete the case I send particulars of the man's history, and the result of the examination of his blood before and after the operation. The case is one of much interest, as it exhibits, first, the transition from Lymph scrotum to Elephantiasis ; secondly, it demonstrates unmistakably that the parent worm is not necessarily present in the affected tissues themselves, though probably in close proximity. I had hoped you might find the *Filaria Bancrofti* in the scrotum, but the embryos persisting in the blood weeks after the operation show that this is unlikely. Thirdly, it illustrates well a new fact in the history of the *Filaria*—the young escape into the circulation at regular intervals of twenty-four hours, the discharge commencing soon after sunset and continuing till near midnight, from which time till the following noon their numbers gradually decrease ; by two or four o'clock till six they are nearly completely absent. This is a striking and most suggestive fact, and in connection with it one might be tempted to speculate on the causes of the periodicity of

malarial fevers. It is marvellous how Nature has adapted the habits of the *Filaria* to those of the mosquito—the embryos are in the blood just at the time the mosquito selects for feeding.

"Another fact in adaptation you might like to know. The long lash on the tail of the embryo has a meaning in relation to its future life. I think so from the following experiment. Drop a few fibres of cotton into the fluid of a milk (filarious) hydrocle. They will subside to the bottom of the vessel very gradually. Leave them there for a few minutes, and then place them under the microscope. You will find them beset by thousands of embryos in rows and clusters, each embryo attached by its tail lash as one can attach a whip to a rope by striking it sharply with the lash. When the mosquito penetrates a blood vessel, the passing embryos lashing about, as is their habit, entangle themselves thus on the proboscis, and get sucked up. Hence the enormous numbers of embryos in the mosquito's stomach and the secreting faculty of that insect.

"It would be well to warn observers against concluding that a case is non-filarious from observations made during the afternoon, and that the most reliable time to make them is at night, and, if possible, they should employ a mosquito to make it for them. In consequence of my ignorance of this particular point in the history of the parasite, my statistics as to its prevalence in Amoy and neighbourhood lose much of any value they may have been supposed to possess. If I can find the time I may go over the ground again, making examinations after sunset instead of, as formerly, between 5 a.m. and 6 p.m.

"The following are the particulars of the case belonging to the mosquitos and Lymph scrotum I send you ; I copy them verbatim from my note book :—

'*F. S. H.*—Lymph scrotum and Eleph. scrot. insipient. Oah. M. ; æt. 19 ; Khoan Kaw, Eong ; a rice miller. Parents dead ; no relatives with elephantoid disease as far as he knows. Eong is a small hamlet of about a hundred inhabitants in the suburbs of Khoan Kaw. Elephantiasis he has often seen in Khoan Kaw. Drinks well water stored sometimes for several days in a large jar. When 16 or 17, sometimes sick with an evanescent fever and relapsing inflammation (it may be of the testicle) of the right side of the scrotum, accompanied by enlargement of right and left groin glands, especially of right. When 15, had an abscess in left groin

(scar is visible), and the same year in the right leg near the ankle; the whole leg was swollen; described it as "Toa kha tang" (the expression used to designate elephantiasis). Swelling lasted for one month, and subsided with bursting of the abscess. No thickening of leg now. Scrotal inflammation and fever recurred twenty times a year. A year ago it discharged for the first time; has run daily, with the exception of three months since that time, messing his clothes. When seen at hospital it had not been discharging for a few hours. Since then (four days ago) it has dripped constantly. In one hour I saw collected two ounces of white fluid.

"May 10th, 1879.—This morning I examined the scrotum carefully. He had it trussed up in a head cloth. On removing this a fine stream of lymph was forcibly projected as from a squirt from a point at the lower part of the scrotum. Half an ounce ran in a couple of minutes. Scrotum is as large as a small pumelo. The skin of the penis is distinctly elephantiased, and a thickening of the skin is visible and palpable over both groins, lower two inches of skin of abdomen, and over Scarpa's triangle on both sides. The upper and thigh surfaces of the scrotum are covered with a fine silky skin freely moveable over the thickened substratum; a little lower down skin thickened and adherent as in elephantiasis; lower still small ampullæ are visible; lower down these become larger, and along the raphe they are the size of small beans. Pricking any of these the usual fluid escapes. This is most distinctly a case of elephantiasis scroti and lymph scrotum combined. Groin glands are large, especially the right, but they do not feel varicose. However, yesterday I pierced the right side glands with a subcutaneous syringe, and readily obtained abundance of straw fluid. In this I found *F. S. H.*, as also in the fluid from the scrotum, and a very few in the blood from finger. While writing these notes more than three ounces of fluid have distilled from his scrotum.

"Standing, a few ounces of the fluid a feeble coagulum forms, which contracts till, in eight or ten hours, it is one-sixth the bulk of the fluid. It is now tough and fibrous. A small portion was removed and placed between two glass slides and finally pressed out; in the fluid expressed and now surrounding, and in the open meshes of the fibrine, are very many specimens of *F. S. H.* I found none in the serum the clot floated in. It would appear, therefore, that the coagulating fibrine caught the *F. S. H.*, and, contracting, carried, as in a net, all the *F. S. H.* with it, concentrating them. Some of the *Filariæ* were very robust and active, others were

languid, spotted, and shrivelled looking. In one such specimen the lash was quite visible by a low power. Many short fibres $\frac{1}{100}$th in length were also visible—possibly the enclosing tube of collapsed embryos.

"This morning the coagulum which had formed by last night in fluid drawn the previous forenoon, had completely disappeared; a flocculent sediment lay in the glass, and in this great abundance of *F. S. H.*

"May 11th.—Scrotum removed under chloroform—it weighed $1\frac{1}{2}$lb.; there was considerable bleeding and also escape of lymph from two dilated lymphatics, one on either side just external to the cords; by pressing firmly on the enlarged inguinal glands lymph could be made to well up from these two points.

"Scrotum placed in spirit and sent to Dr. Cobbold.

"The patient recovered perfectly from the operation. Being anxious to ascertain if I might assure you that the scrotum sent contained the parents of the embryos I had found in the blood, I have kept this man under daily observation since the operation. But unless the examination of the blood was made during the afternoon, it has invariably been found to swarm with embryos. The inference from this is that there are parent *F. Bancrofti* in the patient still, and that probably you will fail to find any in the scrotum, though you will undoubtedly come across many embryos, especially if you search the sediment of the spirit.

"The following is the record of the daily examination of a drop of blood placed between two slides :—

May 12	...	12	embryos.	June 1	...	6	embryos
„ 13	...	15	„	„ 2	...	11	„
„ 14	...	13	„	„ 3	...	0	„
„ 15	...	35	„	„ 4	...	0	„
„ 16	...	52	„	„ 5	...	36	„
„ 17	...	62	„	„ 6	...	6	„
„ 19	...	2	„	„ 7	...	15	„
„ 20	...	4	„	„ 8	...	6	„
„ 21	...	12	„	„ 9	...	32	„
„ 22	...	18	„	„ 10	...	12	„
„ 26	...	42	„	„ 11	...	0	„
„ 27	...	2	„	„ 12	...	0	„
„ 28	...	3	„	„ 13	...	9	„
„ 29	...	0	„	„ 14	...	56	„
„ 30	...	1	„				

"When embryos were very few or altogether absent, the examination was made during the afternoon. To show you how punctual the embryos are in keeping their time, I had this man brought to my house, and had examinations of his blood made every four hours. At the same time I availed myself of the opportunity to feed the mosquitos I have sent you on his blood, making the case as complete as possible.

HOUR.	12 P.M.	4 A.M.	8 A.M.	12 M.	4 P.M.	8 P.M.
Monday.....	—	—	—	—	—	43
Tuesday	—	6	2	1	0	24
Wednesday ...	57	23	1	0	0	105
Thursday	21	18	0	0	0	29
Friday	—	15	0	0	0	29
Saturday	89	2	1	0	1	53
Sunday	41	2	0	0	0	17
Monday.....	34	5	0	0	0	14
Average	$48\frac{2}{5}$	$10\frac{1}{7}$	$\frac{4}{7}$	$\frac{1}{7}$	$\frac{1}{7}$	$39\frac{1}{4}$

"The quantity of blood examined was, as nearly as possible, the same each time—a small drop, or as much as would keep well together on the point of the finger without running off.

"One evening I watched the influx of embryos, examining the blood very frequently. At 4 p.m. I could not find one; at 6 p.m. I found one, at 7 p.m. two, at 7.30 p.m. ten, at 8 p.m. 29, at 9 p.m. 37.

"As far as I have examined I find that in other cases the embryos observe the same periodicity. I have a gardener who comes from a filarious district. I knew his blood sometimes contained worms. It was examined on three occasions during the afternoon without finding embryos. Yesterday evening it was again examined, about 9 o'clock, and was swarming with *Filariæ*. A neighbour's chair coolie at 4 p.m. had no embryos; at 9 p.m. he had 28 in one slide, and so on.

"If you think these facts of sufficient importance to make public, I would be much obliged by your doing so in any way you think best. They have not left my note-book before; I am gradually accumulating evidence to prove, I hope, to the satisfaction of such cautious sceptics as [the late] Dr. Tilbury Fox and others, that elephantiasis is a parasitic disease. I have got some strange results from tapping enlarged groin glands with the subcutaneous syringe, but until the chain is completed, either by myself or others, I will keep silent on this point.

"It seems to me that Lewis by his great discovery has opened a new field in tropical pathology. The interest and importance of *F. Bancrofti* and *F. S. H.* is by no means exhausted yet. I hear Lewis is in England now, but when he retuns to India I hope he will take up the subject again. Men like myself in general practice are but poor and very slow investigators, crippled as we are with the necessity of making our daily bread.

"Pardon this long and rambling letter, and believe me,

"Yours very faithfully,

"PATRICK MANSON."

"I hope you will find embryos in the mosquitos. I sampled them before placing them in the glycerine; but their structure is so delicate, and they are so minute, that they may be difficult to find, shrivelled up by the glycerine. I would recommend you to soak the insect about to be examined for a few minutes in water."

LETTER BY DR. SOMERVILLE.

"Fuchow (China), 9th June, 1879.

"DEAR SIR,—Knowing the interest you take in these subjects, (as stated by you in the 'Lancet' of 5th April last), and as a small contribution to the literature of *Filariæ*, I venture to send the following notes on the filaria disease in the dog. The paper which I send to you by present mail was published early in 1874 in the Customs 'China Medical Reports,' and it was the first, I believe (of late years, at least), to call attention to the subject in China.

"Since that time I have had many cases of the canine filaria, and several dissections, without, however, finding anything further that is new. So common is the disease here, that one can hardly cut up a native dog, or a foreign dog that has been any length of time in the country, without finding the *Filaria immitis*, in greater or lesser abundance, in the vessels or right ventricle. I have at present under

observation (with view to a *post-mortem* some day) a dog of French breed, whose blood is so full of the parasites that I often have two embryos in the field at the same time.

"With reference to the *Filaria sanguinis hominis*, I think it must be much less common here than at Amoy. I have not yet found it, and neither has my friend, Dr. Asford, of Fuchow, who has the advantage of a large native hospital, and consequently large opportunities of searching for it. The late lamented Dr. David Manson (brother of Manson, of Amoy) only found one subject (a Chinaman) of the disease in Fuchow, and there is a curious circumstance connected with this case. Dr. Manson had the man to his house to show him to me. He had "lymph scrotum," and we first punctured one of the vesicles, and examined it, then another, but without success. We then took blood from different parts of the man's body, and, after working at him for about two hours with a microscope each, we had to give up the search without finding a single *Filaria*. Yet only about a week ago my friend had found numerous embryos! Can it be that the mature female discharges her ova into the vessels only at certain times, and that the embryos have only a limited period for existence in the blood? I have not yet been disappointed by the dog in this way. Once get a dog who has them, and I have always, hitherto, been able to find when I wanted them.

"I was amused to notice the other day in the 'Lancet' (Feb. 22, 1879, p. 268) the following, with reference to one of the specimens of elephantiasis presented at the meeting of the Pathological Society by Sir Joseph Fayrer: 'It was suggested that the numerous small semi-circular bodies, about the diameter of red blood-capsules, met with in the second case in the lymphatic channels, might be transverse sections of *Filariæ*. If so, the number of these organisms present must be very large!' I should think so! We *do* occasionally have two embryos in the field at the same time; but surely to make them anything like so numerous as this is straining the subject to an unjustifiable extent.

"In the case of the dog, it is extremely difficult to find the embryo after the blood has coagulated and movement has ceased; after, in short, the death of the *Filaria*, even when one knows it must be present in the field, and I have never yet succeeded in discovering one next morning after allowing the slide to stand over-night. It is easy enough to observe them for any period within five or six hours after the blood has been taken from the animal.

"With regard to the association of *filaria sanguinis* and elephantiasis and lymphangitis, in the way of cause and effect, I can only send you the following facts, and they give negative results.

"On the 2nd March of last year, Dr. Asford, of this place, asked me to be present at an operation for the removal of a large scrotal tumour—the ordinary elephantiasis Arabum. On removal, I made a careful examination of this tumour (which weighed 40 lbs.) in several different parts, and of its juices, without finding any *Filariæ*.

"There were also, at the same time, two men in hospital with lymphangitis, and another with incipient elephantiasis of the scrotum, and in none were any *Filariæ* to be found. This, of course, is only negative evidence, but I think it is of value, *pro tanto*.

"About the mosquito and elephantiasis, and its allied disorders, it seems to us here that if the mosquito could propagate the disease, we should all infallibly have big legs and scrotums, for we never (except in the rare instance of the presence of an epidemic) boil our drinking water, but only filter it. The Chinese, on the other hand, never on any account use water, except when boiled in the form of tea or soup. Indeed, they look with perfect horror on foreigners drinking cold water. Yet these diseases occur in natives only. I have never (during a residence of 16 years in the country) heard of a case in a foreigner in China, and Sir Joseph Fayrer mentions that he has only seen two instances of elephantiasis in the pure European in India. Surely climate and race are more likely to have to do with the causation of these diseases than the mosquito?

"I noticed last summer a number of *Filariæ* wriggling about in the glass cistern of my wet-bulb thermometer. They resembled the *Filariæ* we sometimes find swimming in the anterior chamber of the eye of the horse in China (I operated on a pony for this some years ago), except that they were larger, some of them being about two inches long. Under the microscope they had the general appearance of the nematodes. They occurred at the same time in a flower-pot in the garden, the bottom of which had got stopped up, leaving a layer of water on the surface of the soil. They quite disappeared as the cold weather set in. What were these worms? and is it possible their embryos could have been deposited by mosquitos? They have not appeared this season as yet, but when they do I mean to study them more minutely.

"I forgot to state, in these rather disjointed notes, a question

that continually occurs to one. Why is it that the mature *Filaria immitis* is so easy to find in the dog, and the mature human hæmatozoon so seldom discovered in man?

"I must not trespass any more on your time, and would only say that if you find these notes of value in any way, I should be pleased you should make what use you like of them.

"I am, dear Sir,

"Very faithfully yours,

"JOHN R. SOMERVILLE."

"Thos. Spencer Cobbold, Esq., M.D., &c., &c."

LETTER FROM DR. BANCROFT.

"Brisbane, May 19, 1879.

"DEAR SIR,—I have not been able to find much new *re Filaria* of late, though I have worked at the subject as usual. I am sorry to say that the old volumes of the 'Lancet' which contain the various points of history have not been preserved.

"I have been examining tank water at a house where cases of filaria disease reside, but have found nothing. The following matters are of interest, and suitable for publication in any way you think fit. I am much at a loss for guiding information.

"Believe me,

"Yours truly,

"J. BANCROFT."

"P.S.—I am preparing drawings of *Trichomonas vaginæ*, which I think will interest Dr. Beale."

"T. S. Cobbold, Esq."

(Filaria Bancrofti.)

There can be no doubt but that the elastic groin tumour and axillary tumour, which I ventured to call *Helminthoma elastica*, are conclusive evidence of the parasitic condition under consideration. The fluid that exudes when the tumour is tapped contains some blood, but when this has been allowed to subside for a few hours, the bulk of the superstratum has all the appearance of milk, and closely resembles chylous urine. It seems, therefore, that this elastic structure—which, in my paper in the "Pathological Society's Transactions" of last year, is described as looking, when exposed by incision, like large everted piles—opens on some

part of the surface of the urinary tract by a lymph vesicle, causing the phenomenon of chyluria.

(Filariæ in the Blood of the Dog.)

I have been favoured by Dr. Araujo, of Bahia, with an account of the *Filaria immitis*, as found in Brazil. I never examined the blood of dogs until April of this year, when I found the *Filaria* described by Welch in the "Lancet" of 1873, p. 337. So far, I have not enquired into the matter of the parent worm of this *Filaria*, my attention being directed to ascertain by what means the parasite may be carried from dog to dog.

On May 17 I found that the louse, *Trichodectes latus*, swallows the *Filaria* of the dog. I have seen the *Filaria* alive and very active among the blood from the stomach of the louse; in blood of fleas so far I have not seen it.

The dog *Filaria* is smaller than the human parasite, shorter by one-fourth, and about half the thickness. It has no envelope. The head is angular, that of the human subject is distinctly oval, so by this peculiarity alone the worms can be distinguished.

The dog worm is more active, and escapes quickly out of the field of the microscope, whereas the human *Filaria* will remain in the field or near by for many minutes, and in half-an-hour it will not have travelled far when under a cover glass. Beck's two-inch, with the higher eye-pieces, I find most suitable to search for *Filariæ*.

LETTER BY DR. DA SILVA LIMA.

The following abstract of a letter (to myself), whilst referring to the communication of Dr. Paterson, also notices other matters having a more or less direct bearing on the subject under consideration :—

"Bahia, le 17 Juillet, 1879.

"Très honoré et savant confrère,

"Je me fais un devoir de vous remercier du bienveillant accueil que vous avez bien voulu faire à mon article sur la *Filaria Medinensis*, en le faisant paraître *in extenso* dans le *Veterinarian*; honneur qu'il ne meritait pas, et encore moins celui d'être tiré à part. Mon excellent ami, M. le Docteur Paterson me prie de vous envoyer son dernier (troisième) article sur la question de la gaine de

la *filaria sanguinis hominis*, publié en portugais dans notre *Gazeta Medica* (Maio, 1879).

"M. le Docteur T. Hall, un confrère très distingué de cette ville est parti d'ici le 6 de ce mois, et après un court séjour au Maranhâo, sa province natale, se rendra à Londres. J'ai profité de son obligeance pour vous envoyer une curiosité de pathologie exotique ; dont vous ferez ce que vous jugerez plus à propos selon l'interêt scientifique qu'elle puisse avoir. Ce sont deux pièces pathologiques de la singulière maladie que les noirs africains appellent *Ainhum*, mot qui dans leur langue (Nagô) veut dire *scier*. C'est une constriction spontanée de la racine des petits orteils qu' à la longue finit par les amputer. Avec ces pièces le Docteur Hall vous remettra un court travail que j'ai publié le premier sur cette curieuse maladie en 1867, et une petite note sur le cas particulier d' où proviennent ces pièces. Quelques medicins de la marine française ont observé cette maladie, Collas à Pondichèry (Ind. Orient), Corre à Nossi-bé (Afrique), (*Archives de Med. Navale*, 1867 et 1879), et la considèrent, bien à tort, comme une varieté de la Lèpre grecque, opinion à laquelle se range, ce me semble, votre compatriote le Docteur Tilbury Fox. Il n'est pas moins vrai, cependant, que cliniquement et histologîquement, cette affection n'a rien de semblable à aucune des manifestations de *l'Elephantiasis Græcorum*.

"Agréez, &c.,

"J. F. da Silva Lima."

On the Involucrum of the Filaria sanguinis hominis.

By J. L. Paterson, M.D., Bahia.

(Abstract.)

Having stated frankly my own conviction that the so-called involucrum of the *Filaria sanguinis hominis* is not an integral part of that nematoid, but an adventitious product, a hyaline mould of the *liquor sanguinis*, through which, in process of setting, it laboriously wriggles itself, I am content to leave the further elucidation of that question to others, and, above all, to Dr. Lewis himself, and shall, with equal pleasure and loyalty receive the final verdict, whether it confute or confirm my own ideas ; and, in the present paper, would desire simply to say a few words in justification of the spirit and method pursued by me in this enquiry, both of which have been

blamed, I think, unfairly, by Dr. Magalhaes in his paper in last number of the "Gazeta Medica."

Dr. Magalhaes, in that, as in his former paper, charges me with calling in question what had been observed by others, notably by Dr. Lewis and himself, for no other or better reason than that I had not been able, as he surmises from inadequate methods, to confirm myself the truth of those observations.

Now, as I have already explained, I never called in question any observation; what I called in question was the interpretation of an observation, plain and palpable and common to all of us.

My method for the microscopic examination of *Filaria*, Dr. Magalhaes finds antiquated. How he came to know my method is to me a mystery; for in no communication of mine have I ever so much as alluded to that subject. When I spoke of the state of the blood on the slide at the end of five hours, I spoke of that state as the context, and the whole scope of my argument showed, not as seen in any original observations of my own, but as seen in those of Dr. Lewis, or of any one else, repeating those observations, according to the method employed and described by Dr. Lewis himself.

With Dr. Magalhaes' permission, I therefore pass on the cap of antiquity to Dr. Lewis, for whose head, and not for mine, it must have been intended. While on this subject, Dr. Magalhaes, who appears to take an unwonted interest in my scientific education, will be glad to learn that, even before his very lucid hints, I had already acquired some elementary notions of the possibility and the means of retarding or diminishing the natural plasticity of the blood, and had turned that knowledge to account so far, at least, as to prolong on the slide the life and movements of *Filaria*, and my observations on the same, to periods frequently extending beyond 24, and not rarely beyond 36 hours.

In Dr. Lewis' opinion, no difficulty ought to be encountered by any one in detecting the involucrum, as he had never himself failed to do so in thousands of cases, and affirms that the only requisites for the purpose are a good microscope and properly-adjusted illumination. This assertion of Dr. Lewis I can fully bear out; never, with all the *mal addresse* with which I am so liberally credited by Dr. Magalhaes, having once failed, if not in thousands, at least in many scores of cases, to detect what Dr. Lewis calls—and what under protest, I am content to speak of as the involucrum, when, looked for at the time, and with the slide prepared as Dr. Lewis

directs. Whence, then, all this difficulty, as conjured up by Dr. Magalhaes ?

Dr. Lewis, in perfect consistency with his theory, that the *Filaria sanguinis hominis* is enveloped in an extremely delicate tube, closed at both ends, within which it is capable of elongating and shortening itself, speaks of the shortening of the *Filaria*, and of the visibility of the involucrum as synonymous, as convertible expressions for one and the same phenomenon. How, indeed, could it be otherwise ? The problem is a very simple one. Inside, but unattached to, a very diaphanous tube, closed at both ends, there exists a comparatively opaque body, capable of entirely filling it. Under a low microscopic power nothing is seen but the opaque body. Under even a high power, so closely fitting is the enclosing tube, and of such extreme tenuity, that it cannot be distinguished as a separate existence, so long as the opaque body continues to fill the whole of it, coming into view only when that opaque body is withdrawn.

As the tube is a short one, that withdrawal can be effected only by the shortening of the opaque body itself ; which shortening is, therefore, the exact measure of the part of the tube rendered visible. This shortening, like the opaque body itself, might be seen under a power too low to bring into visible recognition the pellucid tube ; but, under no possible circumstances could the empty tube become visible, and the shortening of the opaque body remain unseen. The difficulty of seeing the involucrum consists solely in its extreme tenuity. The difference in breadth of a blood corpuscle, as it squeezes itself through a space narrower than its transverse diameter, is an appreciable quantity, and is, assuredly, not the ten-thousandth part of the ordinary length of the involucrum as seen in Lewis's demonstrations, and, consequently, not the ten-thousandth part of the shortening undergone by the *Filaria*, as Lewis says, from one moment to another. Now, these two correlative quantities, the shortening of the *Filaria* and the proportional visibility of the involucrum, that, were Lewis's theory the true explanation of the phenomenon, ought to be, and are spoken of by him as being, the exact counterpart of one another, are, in the experience of every observer in Bahia, seen to be altogether independent the one of the other ; or, rather, one of them is seen to be altogether non-existent. We have here, all of us, seen the so-called involucrum of all imaginable lengths, from under one-thousandth to over one half the length of the *Filaria*, and

yet we have never once, any one of us, seen the slightest lengthening or shortening of the *Filaria* itself. And Dr. Magalhães, perfectly ready to show the involucrum, confesses his inability to demonstrate the lengthening and shortening of the *Filaria*. I can, therefore, only repeat what I said in my former paper :—" Either Dr. Lewis, having a preconceived idea that the *Filaria* exists inside a closed sac, and seeing occasionally, as he supposed, half of that sac empty, inferred, but did not observe, the shortening of which he speaks—that shortening being, in fact, an inference and not an observation—or he is there in India observing a *Filaria* altogether different from ours here in Bahia."

Extract from a Paper by Dr. Magalhaes, of Rio Janeiro, on the Origin of the Involucrum of Filaria sanguinis hominis.

" In my preceding article I had said that if Dr. Paterson and I lived in the same town, it might, perhaps, be possible for me to show him on which side lay the truth ; that is, prove to him that the involucrum of the *Filaria* is constituted by a true membrane, and not by coagulated fibrine. More exacting, Dr. Paterson replies that if I could ensure showing him the palpable changes in the length of the *Filaria*, he should almost feel tempted to come to Rio de Janeiro on purpose. If Dr. Paterson puts off his coming to this city till I can assure him of what he thus desires, I fear that Rio de Janeiro will not have the pleasure of welcoming such an illustrious guest ; as the collaborator of the ' Gazeta-Medica ' must be aware that, if in the course of innumerable repetitions of minute and prolonged observations, both in Bahia and in Rio de Janeiro, it was only on some rare occasions that I succeeded in observing and demonstrating the movements of shortening and lengthening, I could not compromise myself to show him, at any given time, such histological phenomenon, the manifestation of which I have not the power of bringing about at will.

" If in all the *Filariæ Wuchereri* such movements were clearly manifested, then, assuredly, the observation of the sheath would not be the difficult matter it is, nor would it have escaped the search of so many observers."

Final Note by the President.

I am sorry such *savans* as Drs. Paterson and Magalhaes should

have displayed opinions so divergent as above shown. I am greatly indebted to Dr. Paterson, but I cannot abandon the views which I put forth in the Linnean Society's Journal, and which I find Dr. Magalhaes has quoted and endorsed in his paper entitled "O envolucro membranoso da *Filaria-Wuchereri*," published in the "Gazeta Medica da Bahia," for May, 1879, p. 223, et seq.—T. S. C.

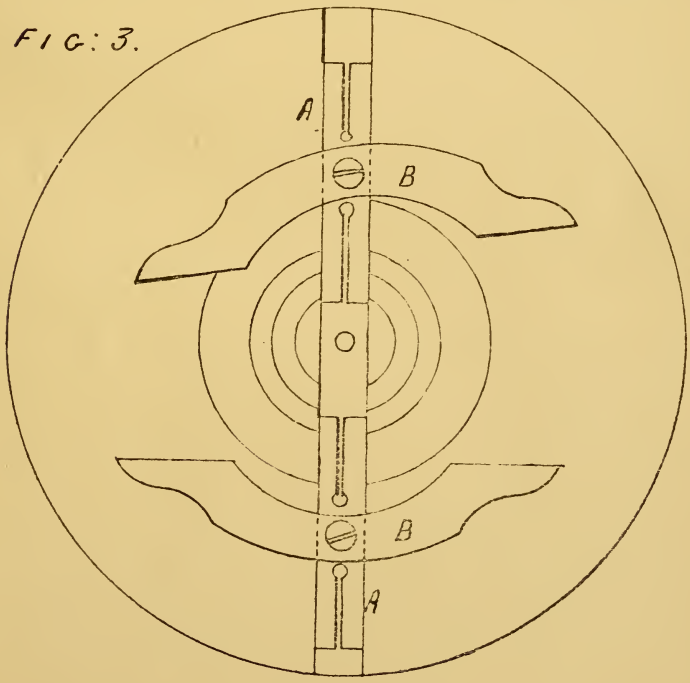
Description of an Improved Microscopical Turntable.

By Chas. G. Dunning.

(Read February 27th, 1880.)

It has occurred to me that some modification might with advantage be made in the ordinary form of Microscopical Turntable. The principle involved in the various self-centering and clipping arrangements is good so far as it goes, but the sphere of action with all these is more or less limited, owing to the fact that, however desirable it may be, you cannot possibly work *out of the centre* with them, and it is with a view to overcome this inconvenience that I have devised the form I now bring to your notice.

The design consists of the usual circular table as shewn at Fig. 3,



with the addition of a dovetail groove across the centre, in which work the two sliding blocks AA. To these sliding blocks are attached the clips BB. One of these clips is rigidly fixed at right angles to its guide, the other being pivoted in order that it may adjust itself to any little irregularity which may occur from the edges of the slides not being quite parallel. The ends of the sliding blocks are cut and "sprung," so as to give sufficient tension to secure a firm grip of the slide; this tension can, of course, be readily increased to compensate for wear. Guiding lines and circles may be ruled on the table for the purpose of centering the slides, but as will be readily seen, any non-central position may be easily obtained even with slides up to two inches in width, thus facilitating the application of the finishing varnish to, or the repair of any slide, the covering glass of which may not have been accurately centered.

Description of a Machine for Cutting Hard Sections.

By J. Matthews, M.D., F.R.M.S.

Exhibited Sept. 26th, 1879.

Plate IV.

This machine is shown in Plate IV., Fig. 1 being a plan view, and Fig. 2 a side elevation.

The apparatus, it will be seen, consists of a metal stage plate A, supported upon four pillars or legs B B, and is mounted upon a base board C. On the upper side of the stage A are four vertical pivots *d*, upon which are fitted, so as to turn freely thereon, the four flanged rollers D D and D^1 D^1. In front of the rollers D is fitted a flat metal plate E, and at the back of the rollers D^1 is similarly fitted a flat strip of wood F, the side of the strip bearing against the rollers being provided with a lining of india-rubber.

The plate E and the strip F are secured together by means of the transverse tie bolt G and the clamp H, thus forming a kind of rectangular frame, capable of traversing freely to and fro on the rollers D and D^1.

At the end of the stage plate A is mounted in suitable bearings a crank-shaft I, fitted with a fly-wheel I* and a winch handle J. This crank is connected by the rod K to the bolt G of the rectangular frame E F.

In front of the plate E are secured the metal bars L and L^1. The bar L is slotted, and is secured by two screws, so as to be capable of adjustment vertically by means of the screw *l*. The bar L^1 is pivoted to the plate by one screw, so as to admit of adjustment laterally by means of the screw l^1. A fine saw web *m* is clamped by its ends to the two bars L L^1. It will now be understood that the saw being clamped in its place, the requisite tension can be given to it by the screw l^1, while, by means of the adjusting screw *l*, its parallelism can be secured. On turning the crank-shaft I by means of the winch handle J, a reciprocating motion will be imparted to the frame E F and to the saw *m*. For holding and

imparting the requisite feed to the material to be cut the following contrivance is adopted :—Beneath the stage plate A is secured a tube M (shown detached in longitudinal section at Fig. 3.) Sliding freely inside this tube is a solid cylinder N. This cylinder is pressed by a spiral spring O against a micrometer screw P. On the upper side of the cylinder N is secured by screws a lever arm Q. This lever arm carries at one end a counterpoise weight R, and is furnished at the other end with a clamp and binding screw S. The material to be cut—say a piece of bone—is fastened by any suitable cement (such as glue) to a slip of wood T, and this slip is clamped, as shown in the plate, to the end of the lever arm Q. By turning the micrometer screw P the cylinder N will be driven forward, carrying with it the lever arm Q and the piece of bone to be cut.

The counterpoise R will now cause the piece of bone to bear upwards against the teeth of the saw, and a rapid reciprocating motion being imparted to this latter, as already explained, a thin slice will be cut off. This operation may be repeated until the whole of the material is cut up. The slices can then be removed from the wooden slip by soaking in a little warm water.

A grooved pulley V is provided on the crank-shaft in order that the machine may be driven by a fly-wheel and treadle if desired, and saws of different degrees of fineness may be employed to suit the various materials required to be cut.

PROCEEDINGS.

JANUARY 9TH, 1880.—CONVERSATIONAL MEETING.

The following objects were exhibited:—

Fabric made from Pine Apple Fibre ...	Mr. F. W. Andrew.
Kœbrenteria paniculata	Mr. A. Ashbridge.
Gregarines from Liver of Rabbit, causing *Psorospermodis hepatica* ...	The President.
Trophi of *Bibis Johannis*, showing external auditory organ	Mr. T. Curties.
Net wing Fly (*Trypeta reticulata*) ...	Mr. F. Enock.
Fungoid growth and insect ova on bark of *Theobroma Cacao*	Mr. H. Epps.
Leaf of Chickweed showing raphides, &c....	Rev. H. J. Fase.
Section of Grain of Wheat	Mr. W. Goodwin.
Sections of Kidney, Tongue, and Lip of Dog, stained	Mr. J. W. Groves.
Oak Spangles	Mr. H. R. Gregory.
Aquatic dipterous Larva shewing anal appendages	Mr. A. Hammond.
Actinophrys	Mr. A. Martinelli.
Ptenidium sp. (Coleoptera)	Mr. A. D. Michael.
Trinacria excavata	Mr. H. Morland.
Section, Rhizome of Fern (*Pteris aquilina*), double stained	Mr. E. T. Newton.
Gonium pectorale	Mr. C. Le Pelly.
Crystals, Platino-cyanide of Magnesium ...	Mr. G. D. Plomer.
Pleurosigma angulatum, with new oil immersion condenser and one-eighth water immersion O.G.	Messrs. Powell & Lealand.
Apical Cell, &c., growing point of *Chara*	Mr. J. W. Reed.
Fluid Cavities in Granite, showing Brownian movements ...	
Palate of *Buccinum undatum*	Mr. T. L. Waterman.
Larva of *Coccinella bi-punctata* ...	Mr. T. C. White.
Head of *Cysticercus fasciolaris* from liver of Rat	
Halacarnus notops	
Fungoid growth on Feather	Mr. J. Woollett.

Attendance—Members, 68; Visitor 13.

January 23rd, 1880—Ordinary Meeting.

Dr. T. S. Cobbold, F.R.S., &c., President, in the Chair.

The minutes of the preceding meeting were read and confirmed.

The following gentlemen were balloted for and duly elected members of the Club:—Mr. W. R. Browne, Dr. J. L. Cassidy, Mr. George H. Dowsett, Mr. F. J. Freeland, Mr. Chas. J. Holland, Mr. F. Hunt, Mr. Jas. Mackenzie, Mr. Francis Martin, Mr. F. A. Stœssiger, Mr. W. H. Seymour, and Mr. Whitworth Wallis.

The following donations to the Club were announced:—

"Proceedings of the Royal Society" ...	from the Society.
"Proceedings of the Watford Natural History Society"	" "
"The Popular Science Review"... ...	" Publisher.
"Science Gossip"	" "
"The Midland Naturalist"	in exchange.
"The American Naturalist"	"
"Grevillia"	Purchased.
"Quarterly Journal of Microscopical Science"	"
"Annals of Natural History"	"
"How to Work with the Microscope," Dr Beale	"
"Primer of the Chemical Microscope" ...	from Dr. E. Cottam.
9 Slides—Sections of brain of Cockcroach	" Mr. E. T. Newton.
4 Slides—Diatoms from Chester... ...	" Dr. Stolterfoth.

The thanks of the Club were voted to the Donors.

A letter of thanks from the Secretary of the Croydon Microscopical Club for assistance rendered at their Soirée was read; also a letter from the Secretary of the New Cross Society inviting co-operation at their Soirée in February.

The President called attention to some portions of liver of Ostend rabbit containing large quantities of *Cysticercus pisiformis*, which had been placed on the table for distribution, and remarked that the specimens would no doubt be interesting, as the subject had excited much attention of late, attempts having been made to show that many of these parasites were merely polymorphic forms of other species. This he thought could not be maintained. The specimens on the table were common bladder worms, which became transferred into the *Tœnia serrata* of the dog.

The President exhibited a large hand cut section of bone, showing the manner in which new bone was formed round the shaft of the femur. The cells of the new bone completely surrounded and enclosed the old, which had become destroyed by Necrosis. The specimen showed how difficult it would be to remove the old bone without permanent injury to the limb.

Mr. Ingpen exhibited and described Mr. Wenham's new immersion illuminator, illustrating his remarks by drawings on the black board.

Mr. Mackenzie said he had used this apparatus for the last fortnight, and found it to work admirably, so that he was able to resolve many of the more difficult diatoms. At first he made the illuminator adhere by a little water, after that he made a clip to keep it on, but since then he had found the best plan was to secure it by means of a small slip of ebonite. He did not much like the plan of fixing the illuminator to the substage, because in moving it about to find another object the film of water was apt to become broken.

Mr Curties thought that this difficulty would not occur if oil were used.

Mr. Mackenzie said he had tried oil also.

Dr. Matthews enquired what oil Mr. Curties used for the purpose?

Mr. Curties said he used castor oil. The object in attaching the illuminator to the substage was to avail oneself of all the movements of the substage, and it must certainly be of advantage as to adjustments to have it attached to that part of the instrument which possessed them. Many instruments had stages so thick as to prevent the use of rays of such obliquity as could otherwise be used.

Mr Ingpen said that the greatest angle likely to be wanted was 45°. Very few wanted more. If they had this super stage they must have something in the shape of a prism or bull's-eye to reflect the light, because if they took it from below the stage they would get it at a greater angle than they could use.

Mr. Curties said that it was certainly a piece of apparatus of great value, and one that could be fitted to almost any microscope.

Mr. T. C. White made a communication "On the Resting Spores of *Protococcus pluvialis.*"

The President in inviting discussion upon the subject remarked that the great difficulty in following up such observations was the time required for tracing out all the changes. Few, if any, amongst the members could do as Mr. Dallinger had done.

The thanks of the meeting were voted to Mr. White for his paper.

Dr. Horatio Whittell read a highly interesting paper "On the Association of Bodies resembling *Psorospermiæ* with the degeneration of Hydatid Cysts."

The President said he was extremely glad that Dr. Whittell had brought this subject forward. Allusion had been made in the paper to a microscopic Hæmatozoon, a description of which was forwarded to him by Dr. Whittell. From this and from the figure sent with it, he was at the time led to believe that it might be the larva of *Filaria sanguinis hominis.* He had now, however, looked at the specimen carefully, and had satisfied himself that it was not a Nematoid structure, but some foreign body. The integument was absent, and it did not correspond either in size, appearance or measurement with the worm in question. The largest in size of the *Filariæ* did not exceed 1-125in., whereas this object was nearly 1-40in. Dr. Whittell's paper dealt with two distinct subjects—first with *Hydatids* and next with the formation of something else within *Hydatids.* He had mentioned that he had observed cilia in or upon the *Echinococci.* This was

very interesting, because only two or three other persons, including Prof. Huxley, had seen and described them. He (Dr. Cobbold) had never seen them himself. Of course the important question to decide was, what was the significance of these singular formations? What Dr. Whittell had noticed was something totally distinct from the psorosperms exhibited at the last meeting, and it would seem that they must be divided into two groups—those which were of an ovoid form and those which were of an Amœboid character. Undoubtedly, in the case which had been mentioned these structures differed entirely from any of the various organizations he had himself described. He confessed that the facts recorded in the paper of Dr. Whittell puzzled him very much, and threw him back again upon the notion that the formations in questions were really the result of the degeneration of an Hydatid Cyst. He was very glad indeed to have heard this paper, and hoped that it would lead to many more observations being made. The curious part of these studies was that every time they examined these psorospermial organisms they seemed to find something different from what they had seen before. They must be content, therefore, to wait patiently for the results of many future observations before any very definite conclusions could be established.

The special thanks of the meeting were unanimously voted to Dr. Whittell for his paper.

Mr. A. D. Michael called attention to a specimen of *Ornithobia avicularia* found parasitic upon a Jay; it was shown for the sake of exhibiting the nervous and muscular systems and the brain and optic nerves. It was mounted just as it was caught.

Dr. Matthews enquired if any member could inform him of a method of decomposing chitine, or of bleaching it in any way so as to render it transparent.

Five gentlemen were proposed for membership.

The proceedings then terminated with the usual conversazione, at which the following objects were exhibited:—

Fungus on Juniper	Mr. F. W. Andrew.
Diatomaceæ (Wenham's immersion "button")	Mr. T. Curties.
Psocus (Bark insect)	Mr. F. Enock.
Starch, sweet potato	Mr. H. R. Gregory.
Section, Spinal cord of calf	Mr. J. J. Hunter.
Scale of *Podura*, one-tenth oil immersion O. G.	Messrs. Powell & Lealand.
Marchantia polymorpha	Mr. A. Martinelli.
Ornithobia avicularia	Mr. A. D. Michael.
Cysticercus pisiformis, from Rabbit ...	Mr. W. Smart.
Double stained Vegetable Tissues ...	Mr. C. V. Smith.
Frond of *Rhipidopteris pellate*	Mr. J. G. Tasker.
Psorospermia from Hydatid Cyst ...	Dr. H. Whittell.
Protococcus pluvialis, &c.	Mr. T. C. White.

Attendance—Members, 87; Visitors, 12.

February 13, 1880.—Conversational Meeting.

The following objects were exhibited:—

Seeds of *Pawlonia*	Mr. F. W. Andrew.
Section of Whalebone	Mr. A. Ashbridge.
Human *Filariæ* from the stomach of a Mosquito	The President.
Triceratium favus	Mr. A. L. Corbett.
Young Oysters	Mr. T. Curties.
Section of head of Moth	Mr. C. G. Dunning.
Cordylura spinimana (spiny-legged Fly) ...	Mr. F. Enock.
Foraminifera—H.M.S. Challenger ...	Mr. H. G. Glasspoole.
Section of Cocoa-nut shell	Mr. W. Goodwin.
Collection of Typical Crystals	Mr. M. Greenhough.
Dicksonia antarctica (Mare's tail) ...	Mr. J. W. Groves.
Diatoms from London Clay—Sheppy Dipterous larva	Mr. A. Hammond.
Hand of Human fœtus	Mr. J. J. Hunter.
Trichina spiralis	Mr. A. Martinelli.
Nymph, *Leiosoma palmicincta*, n.s. ...	Mr. A. D. Michael.
Surirella splendida	Mr. H. Morland.
Trans. Section, *Hydra fusca*	Mr. E. T. Newton.
Actinophrys, sp. ?	Mr. J. M. Offord.
Young Trout	Mr. G. D. Plomer.
Ovary of Potato ... ... „ Poppy ... ... „ Orchis	Mr. J. W. Reed.
Pollen of *Azalea*	Mr. J. G. Tasker.
Protococcus pluvialis ... *Planorbis*, sp...	Mr T. C. White.
Eye of Beetle	Mr. J. Woollett.
Encyonema paradoxum, in situ	Dr. H. Whittell.

Attendance—Members, 79; Visitors, 8.

February 27th, 1880.—Ordinary Meeting.

Dr. T. Spencer Cobbold, F.R.S., &c., President, *in the Chair.*

The minutes of the preceding meeting were read and confirmed.

The following gentlemen were balloted for and duly elected members of the Club:—Mr. Alfred Fieldwick, jun., Mr. George Niven, Mr. Thos. R. Riley, Mr. Adolph Schultze, and the Hon. J. G. P. Vereker.

The following donations to the Club were announced:—

"Proceedings of the Royal Society" ...	from the Society.
"Journal of the Royal Microscopical Society"	„ „

"Eleventh Annual Report of the Liverpool Microscopical Society"	from the Society.
"Proceedings of the Geologists' Association"	" "
"Seventh Report of the New Cross Microscopical Society"...	" "
"Fifth Annual Report of the Postal Microscopical Society"...	" "
"Journal and Proceedings of the Royal Society of New South Wales"...	" "
"Report of the Department of Mines in New Sonth Wales"	" "
"The Midland Naturalist"	in exchange.
"The American Naturalist"...	" "
"Science Gossip"	from the Publisher.
"The Analyst"	" "
"New Commercial Plants"	" Mr. T. Christy.
"Natural History Rambles"	" Dr. M. C. Cooke.
"Annals of Natural History"	Purchased.
"Marine Polyzoa," Hincks	"

The thanks of the meeting were voted to the donors.

Mr Ingpen called the attention of members to an Album of Specimens of Marine Algæ, mounted and sent for exhibition by Mr. F. W. Smith, of 4, Clifton Place, Falmouth, who would be glad to communicate with any gentleman interested in the subject.

A paper by Dr. Silvester Marsh, "On Bleaching and Washing Microscopical Sections," was read by Mr. Ingpen.

Mr. W. H. Gilburt said it occurred to him that for scientific purposes the processes recommended were hardly satisfactory in several respects; because, if they wanted to observe the relation of the tissues the one to the other, it was necessary to do something more than simply bleach them. So also with regard to sections. Sometimes it was necessary to cut them thick in order to see the relation of the parts, and it would thus be necessary to get rid of the cell contents as well as the colour. Again, if they wanted to examine the cell contents, they must do so in their natural condition, and not bleached; for they were well aware that during the bleaching process these cell contents became shrunken; so that for purposes of study they must always be used as fresh as possible. He, therefore, thought that so far as practical work was concerned, they would do better to adhere to the old plan.

Dr. Matthews said there was a mode of differentiation of tissues which seemed too often to be overlooked, and that was with the Polariscope, and strongly commended to the members of the Club a little more careful application of the use of Polarized light in such matters. If the object under examination did not yield to one selenite, it would no doubt do so to another.

The thanks of the meeting were unanimously voted to Dr. Marsh for his paper.

Mr. A. D. Michael having taken the chair *pro. tem.*,

The President read a paper "On Human *Filariæ*," which he illustrated by numerous diagrams and by specimens exhibited in the room.

Dr. Matthews said he should like to ask Dr. Cobbold a question. Some years ago there was an invasion of mosquitos in some parts of London; they were supposed to have been brought over by some ships. Some observers examined them and declared that they did not present any features to distinguish them from the ordinary gnat. He should like to ask if there was any difference between the two? Also, he should like to ask what became of the *Filariæ* which were swallowed by the mosquitos?

Dr. Stephen Mackenzie said he had a case now under treatment in the London Hospital, and that he had repeatedly examined the blood during the afternoon, but found no *Filariæ* whatever. At Dr. Cobbold's suggestion he had also examined the blood at midnight, but found none then. In another case of Elephantiasis the worm had been found in the scrotum, but not in the blood. He thought the facts stated were of great importance, although he believed that they had not any cases in which the *Filariæ* had survived the journey to this country. All the cases of Elephantiasis which had come under his notice were imported cases from tropical climates.

The President said that it had not occurred to him to look into the question of the species of mosquitos, but he believed that Westwood admitted that nearly all the species of mosquito were reducible to two types, although as many as twenty species had been spoken of. As to what became of the *Filariæ* after they had been swallowed by the insects, it was only the female mosquito which attacked man, and as she died after depositing her eggs upon the water, the *Filariæ* passed into the water. Accordingly, when the natives drank the water in an unfiltered condition, the parasites were taken into the stomach, and made their way thence to the lymphatics and neighbouring tissues. He was very glad to see that the practical importance of the matter commended itself to the judgment of Dr. Stephen Mackenzie, but was not surprised to find that he did not know anything of the peculiarity or periodicity in the habits of *Filariæ*, because it was an entirely new fact. The capacity of this entozoon for producing those diseases ascribed to it, was a matter which would of course be fought and battled over for many years to come.

Dr. Matthews said he should like to know if anyone had been able to connect the periodicity of the parasites in the blood with the periodicity of the intermittent forms of malarial fever.

The President said they had heard nothing more on the subject at present than what Dr. Manson said in his communication.

Dr. Mackenzie said that in a form of relapsing fever they had a period of pyrexia, succeeded by a period of apyrexia. In the pyrexial period the *Spirilla* were always found. This fever could be communicated by inoculation, but it was only communicable in that way at a time when the *Spirilla* were present in the blood.

Mr. Michael said that he believed the question as to the mosquitos was looked into at the time it arose, and he believed that just as in this country

a great many different species were all called by the name of gnat, so in other countries anything which fed on human blood was called a mosquito. As regarded the paper which had just been read, he felt sure that it would be received as one of the highest importance, coming as it did from one who was *facile princeps* in such subjects. He had, therefore, much pleasure in proposing that their best thanks be presented to Dr. Cobbold for his bringing to their notice so valuable a communication for publication in the journal.

A vote of thanks to Dr. Cobbold was then put, and unanimously carried.

Mr. Dunning then read a short paper, descriptive of a new form of turn-table, which he exhibited in the room.

Dr. Matthews said that the article was very ingenious and very simple, as well as most efficient for the purposes to which it was intended.

The thanks of the meeting were voted to Mr. Dunning.

The President said he had an announcement to make as to Mr. Crisp's donation fund. In consequence of the difficulty of appropriating it, the Committee had, with Mr. Crisp's entire approval, resolved to devote it to the purchase of books and apparatus for the general use of the Club. He could only say that he thought this was a most kind concession on the part of Mr. Crisp, and that it was the best use to which they could possibly put the fund.

Four gentlemen were then proposed for membership.

Announcements of excursions were then made, and it was intimated that there would be no ordinary meeting held in March, as the fourth Friday in that month would be Good Friday.

The proceedings then terminated with a conversazione, at which the following objects were exhibited:—

Section of Oyster shell	Mr. F. W. Andrew.
Colony of *Acinetæ*	Mr. W. G. Cocks.
Section of shell of *Balanus*	Mr. A. C. Goodinge.
Cuticle, Leaf of Wallflower	Mr. H. R. Gregory.
Pearls from fresh-water mussel	Mr. J. W. Groves.
Cavernous hairs from Dog's lip	,,
Pappus of Thistle, stained	Mr. T. S. Morton.
Trans. sec. *Juncus*	Mr. J. W. Reed.
Elater and spores of *Equisetum*	,,
Section of Laurentian Gneiss from the Isle of Coll	Mr. G. Smith.

Attendance—Members, 97 Visitors, 19.

March 12th, 1880.—Conversational Meeting.

The following objects were exhibited :—

Mosquito from Calcutta...	Mr. F. W. Andrew.
Section of Mulberry, double stained ...	Mr. A. Ashbridge.
Surirella gemma. 1-12 Homogenous Immersion o.g. Abbé condenser and Zeiss microscope	Mr. C. Baker.
Parkes' Micro. Lamp	"
Section Jawbone and Teeth of Cat ...	Mr. T. Curties.
Parasite of Honey Bee, *Braula cæca* ...	Mr. F. Enock.
Arsenic	Mr. A. C. Goodinge.
Spores of *Funaria* germinating	Mr. W. Goodwin.
Eggs of Coccus of the Orange	Mr. H. R. Gregory.
Polycistina from Challenger	Mr. G. Green.
Sponge spicules	"
Insect dissections	Mr. A. Hammond.
Section, foot of Fœtus	Mr. J. J. Hunter.
Section, Lower Jaw of Pollock, showing hinged and developing teeth ...	Mr. J. B. Magor.
Section Stem of Bramble	Mr. A. Martinelli.
Tanais vittatus (Isopoda)	Mr. A. D. Michael.
Trinacria Regina	Mr. H. Morland.
Section, Ginger	Mr. G. D. Plomer.
Nostoc commune	Mr. J. W. Reed.
Section, Gneiss from Bazil Wood, Charnwood forest	Mr. G. Smith.
Section, Chalk with Coral, *Parasmillia centralis*	"
Podura scales (opaque)...	Mr. James Smith.
Section, Brain of Cockroach	Mr. W. Teasdale.
Ebonite super-stage for microscope ...	"
Triceratium	Mr. T. L. Waterman.
Amœbæform bodies from *Protococcus pluvialis*	Mr. T. C. White.

Attendance—Members, 86; Visitors, 13.

April 9th, 1880.—Conversational Meeting.

The following objects were exhibited :—

Ambulacral discs of *Echinus*	Mr. F. W. Andrew.
Wing of Lappet moth	Mr. C. G. Dunning.
Indian mosquito	Mr. F. Enock.
Scales of Buff-tip *P. bucephala*	Mr. A. Fieldwick, jun.
" *Morpho menelaus*	" "

Polysiphonia sp. ?	Mr. W. H. Gilburt.
Frullania tamarisci, Hepatica	Mr. H. G. Glasspoole.
Vorticella	Mr. H. R. Gregory.
Heliopelta, with Wenham's new illuminator	Mr. W. Gregory.
Plocamium coccinium	Mr. D. W. Greenhough.
Section of lower jaw of Cat	Mr. J. J. Hunter.
,, Dermal spine of Ray	Mr. J. B. Magor.
,, Incisor of Rodent	,,
Pedicellaria from *Echinus miliaris* ...	Mr. A. D. Michael.
Achnanthes subsessilis	Mr. H. Morland.
Polyarthra trigla. Rotifer	Mr. J. M. Offord.
Sponge-*Hyalonema Sieboldii*	Mr. B. W. Priest.
Chœtophora elegans. Alga	Mr. J. W. Reed.
Crystals of Uric Acid	Mr. J. Walters.
Organic aromatic bodies from Coal Tar ...	,,
Thysanura-Lipura Burmeisteri	Mr. T. C. White.

Attendance—Members, 76; Visitors, 12.

400 diam^s

FIG. 1

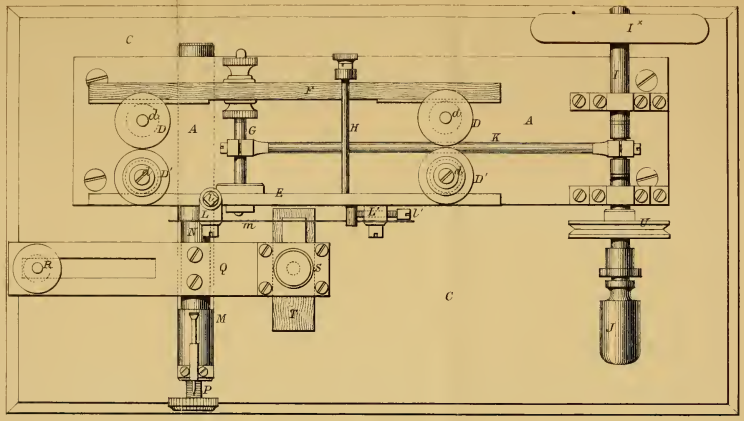
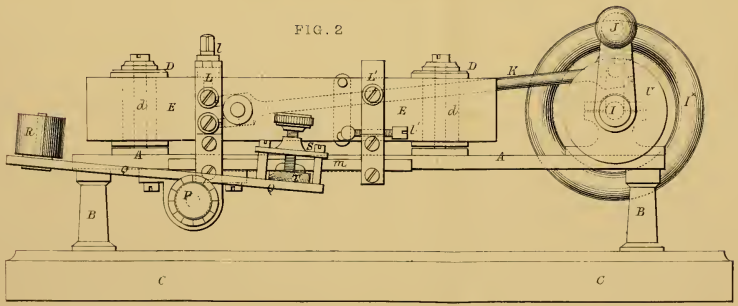


FIG. 3.

FIG. 2



On a Simple Method of Cleaning Diatoms.

By Dr. H. Stolterfoth, M.A.,

Scientific Secretary of the Chester Society of Natural Science.

(*Read April 23rd*, 1880.)

In bringing before your Club my new process of cleaning, I do not pretend that it is universally applicable, but I have found it so useful, and many of my friends have used it with such good results, that I wish to make it more generally known. I was led to it by trying to clean some of the Welsh deposits. Very poor results were obtained by the common acid process, and even alkalies destroyed the valves of the larger *Surirellæ* (in which these deposits abound), before they were free from the dirt with which they were filled. I then thought that it was thorough washing these forms required, and what would answer better for the purpose than *Soap?* —so I boiled them in soap and water for about an hour, and I was quite astonished at the result. Since then I have tried the process on all kinds of fresh and salt-water deposits, and should now never think of returning to the old process, with its spirting acids and alkalies which so often injure the valves.

The method I follow is this: I place in a test-tube (6in. long by 1in. wide) a portion of the earth or mud about $\frac{1}{4}$in. in depth, and pour in water till the tube is $\frac{1}{4}$th full; into this I drop a piece of common yellow soap, about the size of a small pea, and then boil gently over a lamp. I examine the solution under the microscope from time to time, by taking out a drop with a dip-tube, and putting it on a slide; as soon as I see that the valves are clean, I fill up the test-tube with cold water, and let it stand, then wash in the usual way, until all trace of soap is removed, and then mount in any way you please.

In pouring on the cold water after the boiling, the solution is quite fluid as long as the water is warm; during this time the diatoms fall to the bottom, but, on getting cold, the solution assumes a somewhat jelly-like consistency, and holds the fine particles and

mud in suspension, and is a very useful means of getting rid of what is often a great trouble.

The advantages of this process are—

1st. Its great simplicity.

2nd. No danger from acids or alkalies.

3rd. The removal of mud and broken particles.

In deposits, however, in which there is much organic matter, we must still have recourse to acids or fire to destroy this, but the result will be improved by afterwards boiling in soap and water. I have also boiled fresh gatherings in soap and water, and then burnt on platinum-foil with good success, much of the flocculent matter being removed.

On an Undescribed British Sponge of the Genus *Raphiodesma* (Bowerbank.)

By J. G. Waller.

(Read April 23rd, 1880.)

PLATE V.

During a stay of two months at Torquay, engaged eight hours a day, there was but little opportunity for recreation in Natural History. Nevertheless, each evening I was down by the sea-side, either at Anstey's Cove or at Meadfoot, and, occasionally, when tide served, at that very interesting spot, Hope's Nose, the eastern promontory of Torbay. Abundance of the *Laminaria* here often strews the coast, and their roots are incrusted with sponges and other organisms. It afforded a very ready means of collection, and thus I became possessed of some rare examples, and of the one, I am about to describe as, new to our fauna, as well, also, of many early states of growth, which is always interesting to observe.

It was upon a small pebble held in the root grapple of *Laminaria saccharina* that I found the sponge in question, but before I proceed to describe it, I must call attention to another, found under similar conditions in many different stages of development, and generally in the deepest recesses. It was very small and insignificant, and might easily have escaped attention. When examined, it was seen to be crawling over the rootlets in a very regular manner, sometimes over small pebbles held within them. Upon this one of limestone, we see it in its youngest development, and it is interesting and instructive to note its peculiar mode of growth. It begins with a few spicules, arranged in a somewhat semi-circular form, and, at nearly right angles, are fasciculi of the same disposed with almost rhythmical regularity, with about equal distances between each fascicle ; and thus it proceeds in *one* direction only, moving forwards, and never reversing its steps (Fig. 1). This is remarkable in a sessile sponge, which, in general, developes all round from a centre, and spreads in every direction ; it is, therefore, a feature to be noted, as it ceases to be visible, when, in a further development, there

are accumulated layers, one over the other, which may start from a base having another axis.

Procuring a portion for microscopic examination, after giving it a rigid scrutiny, I became convinced that it was the sponge to which Dr. Bowerbank had given the name of *Hymeniacidon macilenta*, the specific term being very expressive of its meagre condition or habit. His description, however, in no way alludes to the peculiarity to which I have drawn attention, or to its fascicular arrangement of the spicules. The specimen, therefore, from which he made his description, must have been so developed as to have concealed this structure, which could scarcely, otherwise, have escaped the attention of so good an observer. Let me, however, now refer to the intimate characters of *Hymeniacidon macilenta* as set down in Vol. ii., p. 176, of the "British Spongiadæ."

It is described as thinly coating zoophytes, and in the living condition to be of a bright scarlet colour. The skeleton spicules are sub-clavate acuate, those of the membranes of the same character, but longer and slender; and amongst the latter a few tricurvate-acerate. Retentive spicula, inequibidentate and dentato-palmate anchorate, small, and few in number, and the latter also very minute. One of the most characteristic forms, which are most abundant, are contort bihamate spicules of a large size.

It is unnecessary to give any further details. But we must now turn our attention to another genus, which Dr. Bowerbank divided from this of *Hymeniacidon* on account of some special characteristics, which bear directly upon the subject in hand. *Hymeniacidon* is specialised, as having its spicules disposed without any kind of order on the membranes. It is obvious, therefore, that the sponge I have been describing as *H. macilenta* cannot be consistently considered as belonging to the genus thus defined. It is impossible to say that the spicules are arranged without order. Yet there can be no doubt, that it is the same as that above-named, but in a different state of development. That this not only belongs to the genus separated from *Hymeniacidon* under the name of *Raphiodesma*, but must also be referred to a species described by Dr. Bowerbank in Vol. iii., p. 230, I will now proceed to consider.

The genus *Raphiodesma* is distinguished from that of *Hymeniacidon* in that its skeleton is composed of bundles of spicules unconnected with each other, the fascicules being represented as compacted at their centres, but free at each end. But this latter character will require some modification, as I shall presently show.

Furthermore, these fasciculi are stated to be carelessly thrown together in every possible direction, the interstices forming elongated, angular areas, like that of a confused mass of netting extended in one direction only. Sufficient for our purpose this to comprehend the character of the genus, so we will now go to the special form within it, to which allusion has been made, and to which I propose to combine *H. macilenta*. This is *Raphiodesma sordida*, described in the "Spongiadæ," Vol. iii., p. 230.

In this description, it, like *H. macilenta*, is parasitic—its colour red or orange in the living state. Its skeleton spicules are sub-clavate acuate, those of membranes the same, but more slender, a few slender tricurvate ones. Retentive spicula contort bihamate numerous, also bi-dentate, inequi-anchorate, dentato-palmate—the latter congregated in rosette-shaped groups.

Now this, as nearly as possible, accords with that of *H. macilenta*, and what differences appear in Dr. Bowerbank's fuller account are too slight to warrant any separation the one from the other. Solely we miss the rosettes in the latter, which distinguish so many of the genus *Raphiodesma*, and are sometimes so abundantly found in the species to which I consider it ought to be referred. But, even this must give way, for in some of my preparations I have detected this very interesting feature, and may also state that it is often scarce in the species, wherein it is really a constant form. I do not, therefore, think, that there can be the smallest doubt, but that these described as two, are really but one species in different stages of development.* And, if this be admitted, it is necessary to point out, that the earlier condition of growth, seen in the fascicules, do not show the peculiarity of being attached at the centre, but rather are fixed at the base and spread out at the apices, somewhat resembling the venerable scholastic institution called "birch." Nor in the full development of *Raphiodesma sordida* is this always lost, though in *R. lingua*, its near ally, the fasces strictly conform to the tabulated characters of the genus.

I have felt myself to be under a double necessity in thus introducing my subject, first, because the sponge I am about to describe to you appeared to me, before I gave it an intimate examination, to be that I have identified as *H. macilenta*, or, as rather the early condition of *R. sordida;* secondly, because I cannot think

* In this opinion our member, Mr. Priest, to whom I am indebted for several specimens of *R. sordida*, perfectly concurs, and was early to express his decision.

that the former can retain its place as a species, nor do I believe that, had Dr. Bowerbank lived to see such facts as I have stated, he himself would have retained it. The new sponge has much in common with it in general mode of growth, especially in the young condition as above described. The fasces proceed in one direction from a base. They spread out birch-like in form, and have precisely the same kind of spicules in the skeleton. Nothing but the microscope could have separated the two, yet that also distinctly allies it to the group of *Raphiodesma*, to which both must now be referred.

The sponge in question was found sessile upon a small pebble of limestone within the roots of *Laminaria saccharina*. It is extremely small, only measuring $\frac{1}{4}$in. by $\frac{1}{8}$. In this, its dry and well bleached condition, no natural colours are preserved ; it is simply of a creamy white, such as most of the siliceous sponges assume when they have been thrown up on the coast exposed to sun and air. We lose, therefore, all features but those of its intimate structure, which makes it a subject for the microscope. Its general appearance under examination is confused. But this confusion, nevertheless, has an order, and, although it may sound paradoxical, is the result of order. The fasciculi, which seem as if culminating one over the other, forming a ridge in the most developed part, nevertheless obey a law which dictates their progression in one direction only from a base, following nearly a right line from it. Nor do they ever reverse their route in an opposite direction (Fig. 2). And in this they conform exactly to the rule obeyed in the sponge I have previously spoken of as *H. macilenta*. But, as I have shown, that as different layers start from another base, they will naturally cover over the one beneath at a different angle, so, in the end, the whole mass may assume an heterogeneous mixture apparently devoid of order.

As the sponge was not found in a fresh condition, one is not able to pronounce an opinion as to the distribution of either oscula or pores. None of the latter are visible, but there are indications of some of the former, though not very conspicuous. The whole of the membranes, which are pellucid, are thickly matted with fine hair-like acerate spicules, somewhat flexuous, as is generally the case when such are delicate in form. These spicules, abundantly interwoven together, (Fig. 5) and combined by a very large number of minute anchorate forms, quite separate it from any of its congeners, though it is intimately allied, in general character, to all others of the genus. A portion of the basal membrane shows us the early mode of develop-

ment, and as all sponges commence by a membranous expansion, it is interesting to take particular note of this feature. The hair-like spicules have a fascicular arrangement though laid in flat bands, the spicules parallel to each other. A few of the skeleton spicules, without any defined order, cross these irregularly, as well as a few of the finer kinds which belong specially to the membranes, and interspersed, as previously stated, are scattered small anchorate spicules (Fig. 3). Upon this membrane the sponge developes its fascicules, proper to the skeleton in that regular order described as belonging to this and to the sponges alluded to, as congeners.

We are a long way as yet from any cognisance of the laws which separate one species from another, but there is no reason why they should not be similar to those operative in the vegetable kingdom. A slight shift of a plant to fresh earth is sometimes sufficient to produce changes which would move many observers to talk of a separate species, so that it is not only possible, but probable, the development of a sponge under either restricted conditions of growth, or of a more exuberant fertility, may equally change its nature and produce a variation. I have already shown how great is the variation with our freshwater sponge (*Spongilla fluviatilis*), and there can be no reason why it may not operate extensively amongst the marine sponges ; I cannot help thinking that, if more accurate knowledge was obtained, it would reduce the number of species. It is, to my mind, far more interesting and more instructive to combine together groups under the name of variation, than add to our already overweighted terminology by a persistent separation. I shall, therefore, now call upon you to follow me in an examination of the whole of the genus *Raphiodesma*, to show how closely they are allied, and how much of their divergencies may arise from slight differences of conditions under which they have developed.

Three, out of four of the species tabulated by Dr. Bowerbank, are marked by possessing those beautiful rosettes formed of clusters of anchorate spicules. In the species under consideration, one of these also occurs, thus making no doubt of its close alliance (Fig. 6). But in mode of growth, as spreading over thinly, it is nearest to that of *R. floreum*, separated from it, however, as from all others, in the want of the bihamate spicule. This latter form unites *R. floreum* directly with *R. sordida*, indirectly with *R. lingua*, wherein these are found so extremely minute as to require high powers for examination. *R. floreum* wants the tricurvate spicule of *R. sordida*, or it is difficult to see how, in their structural details, you could separate the one

from the other. *R. lingua* is the most robust of the genus, growing to a larger size than any other ; its skeleton spicules are correspondent ; we lose the clavate form, and they are simply acuate. It differs mostly in the larger and more compound character of its fasciculi, in which there is no pretence of the birch-like form or of the bases or apices being coincident. The skeleton spicules ally it to *R. simplissima,* which, however, is wanting in all the other forms found in the genus.*

I have thus shown the natural alliance of the group, and how they diverge the one from the other. Whether they must not hereafter, be brought closer to each other, is a matter we cannot at present decide. I confess the tendency of my mind is to reject as evidence of distinction of species very minute details ; at best it is arbitrary, and the result of our ignorance rather than of our knowledge. It is, therefore, with something of a pang or twinge of conscience I feel compelled to add a new name, but I sincerely hope it may hereafter be disposed of. I propose that of *Raphiodesma minima*, which expresses the smallness of its size as found.

In the Sponge under consideration, the form of the anchorate palmate spicule does not differ materially from that common to the genus (Fig. 7). In its smaller size, it is very abundant on the membranes, intermingled with its fine hair-like spicules. These latter may be analogous to the extremely small acuate spicule of *R. lingua.* It is well to note that spicules which belong to the membranes, and generally of a minute size, are sometimes found nearly obsolete. In few sections of *R. sordida* have I found *in situ* the tricurvate figure given by Dr. Bowerbank, but in those of *H. macilenta*† they are extremely abundant, interweaving with the bihamates. These latter also are often sparsely distributed in *R. sordida,* and vary in size ; but this must naturally be looked for in examples not fully developed. Dimensions of spicula, when given, must be taken with some little reserve, for they are not constant in the same species, and can never be depended upon as a character to distinguish a species.

There is still, however, something further to be said on analogies, and the harmonious alliance between divergent forms. It is interesting to trace the connection of species, still more so, when through

* Refer to Dr. Bowerbank's "Spongiadæ," Vol. iii., Plates xxxvii, xlvii, lxxvii, lxxvi, xc.

† I use this term as referring to examples in my collection which agree with Dr. B.'s description, but my argument is that it is not a species.

them, we trace the connection of genera, and thus extend the genealogy. *Raphiodesma* is a progression, perhaps, we may say, to a higher development, from the simpler structure seen in *Hymeniacidon*. In this latter, there is no sort of regularity in the arrangement of spicules; but, in the former, there is a beginning at least of order in the fasciculi and their disposition, which naturally leads on to another higher development in the genus *Desmacidon*. Now, in following out this natural progression, it is interesting to observe that we carry with us the same character of spicules.

We have seen how, in *Raphiodesma*, there is an attempt to form a more regular skeleton than that of *Hymeniacidon*, but that the network is never connected. In the next genus, *Desmacidon*, we find this done and perfected. Let us now see which of the species allies itself closest with the genus in question.

Desmacidon consists of a fibrous network, well-marked and defined, "composed entirely of spicules arranged in accordance with the axis of the fibre, cemented together, and thinly covered with keratode." Out of twelve species which Dr. Bowerbank has tabulated, six present us with forms of spicules associated together precisely like those in *Raphiodesma*. This is remarkably shown in *D. copiosus*, where are two forms of sub-clavate spicules in the skeleton, as in *R. sordida*, small tricurvate and also two kinds of anchorate spicules very closely resembling those of the latter species, as well as the bihamate form. So that the two species of two different genera are in this particular nearly identical. In *D. ægagropila* there are the same general forms, but without the tricurvate. *D. constrictus* presents us with the same forms as the latter, though with a remarkable development in the anchorate spicules as well as in those of the skeleton. *D. similaris* has acuate skeleton spicules, anchorate tricurvate and bihamate spicules; *D. Peachii* the sub-clavate spicule again with a divergent form of the bihamate, &c. Lastly, that most interesting species, *D. rotalis*, agrees in possessing similar bihamate and anchorate forms with an acuate skeleton spicule.*

Thus, I think, we clearly perceive in these three genera a progressive development from a lower to a higher type, if we can so call that, which has a more complete network in a more definite order; and this progress, associated with similar forms of spicules,

* For these details I must refer to Dr. Bowerbank's "Spongiadæ," Vol. iii., Plates lxxii., pp. 265, 357; lxiii., lxxxiii., lxxi., p. 183; lxxxix., p. 319; lxiii., xc., p. 327.

seems to show that there is a natural connection between them. If so, it would be a strong argument in favour of the general arrangement of Dr. Bowerbank, as founded on natural conditions, which distinguish one genus from another, yet ally them in a close bond of union.

To recapitulate then : this Sponge, referred to the genus *Raphiodesma*, is but little removed from *R. sordida*, and but for the absence of the tricurvate and bihamate spicules, and the possession of long hair-like acerate spicules in the membranes, as it were in substitution, might easily be pronounced to be the same. It is a problem in the future to show why such a slight divergence exists, or to what development it is due.

Raphiodesma minima (J. G. Waller).

Sponge, Sessile, coating. Colour, in living state, unknown. Dried, cream-white. Pores inconspicuous. Oscula, dispersed, simple, minute. Membranes pellucid, spiculous. Spicules acerate, hair-like, flexuous, intermingled with minute inequianchorate dentato palmate spicules in great abundance, and a few of larger size dispersed and congregated in rosettes. Skeleton. Spicules subclavate, subfusiform, acuate, disposed in regular fasciculi, united at the base, but spreading out at the apex, generally keeping to the length of one spicule ; the bases and apices coincident. In development these fasces seem to proceed in one direction only, at nearly right-angles to a basal axis. The same description of spicules are also found in the membranes, but few and dispersed.

DESCRIPTION OF PLATE V.

Fig. 1. Early development of *Hymeniacidon macilenta* (Bowerbank), from a pebble found at Torquay, showing the regular arrangement of fasces of spicules (40 diam.).

,, 2. Development of *Raphiodesma minima*, exhibiting a similar arrangement of fasciculi (40 diam.).

,, 3. Early development of the basal membrane, fasciculi, &c., of the same (90 diam.).

,, 4. Skeleton spicule (200 diam.).

,, 5. Hair-like spicules of the membranes (200 diam.).

,, 6. Rosette of anchorate spicules on one corner of the sponge; the only one preserved (333 diam.).

,, 7. Form of anchorate spicule, showing also side view (333 diam.) The minute examples on the membranes do not differ materially in form, but are about half the size.

List of Objects Collected at various Excursions.

By M. C. Cooke, M.A., LL.D., A.L.S.

(*Communicated* May 28th, 1880).

HAMPSTEAD HEATH, FEBRUARY 20, 1880.

Algæ—
- *Spirogyra quinina.*
- *Scenedesmus quadricauda.*

Infusoria—
- *Euglena viridis.*
- *Euglena spirogyra.*
- *Euglena pleuronectes.*
- *Stentor Mulleri.*
- *Glenodinium cinctum.*
- *Coleps hirtus.*
- *Uroleptus lamella.*
- *Ptyxidium ovulum.*
- *Prorodon teres.*
- *Paramecium aurelia.*
- *Trachelius ovum.*
- *Euplotes charon.*
- *Vorticella microstoma.*

Infusoria—
- *Vorticella convallaria.*

Protozoa—
- *Actinophrys.*
- *Amœba guttula.*
- *Amœba limax.*

Rotiferæ—
- *Metopidia acuminata.*
- *Rotifer vulgaris.*
- *Philodina roseola.*

Entomostraca—
- *Cyclops tenuicornis.*
- *Cyclops serrulatus.*

Arachnidæ—
- *Tardigrada.*
- *Oribates lacustris*, Michael.

SNARESBROOK EXCURSION, MAY 1, 1880.

Algæ—
- *Stigeoclonium thermale.*
- *Draparnaldia plumosa.*
- *Zygnema cruciatum*, Ag.
- *Spirogyra nitida.*
- *Spirogyra communis.*
- *Ulothrix tenerrima*, Kutz.
- *Ankistrodesmus falcatus.*
- *Scenedesmus quadricauda.*
- *Pediastrum heptactis.*
- *Hydrianum heteromorphum*, Reinsch, new to Britain.
- *Volvox globator.*
- *Gonium pectorale.*

Desmids—
- *Sphærozosma secedens*, DeBary, new to England.
- *Hyalotheca dissiliens.*
- *Euastrum elegans.*
- *Euastrum elegans* var. *inerme.*
- *Cosmarium botrytis.*
- *Arthrodesmus incus.*
- *Arthrodesmus octocorne* var.
- *Staurastrum dejectum.*
- *Staurastrum cuspidatum.*
- *Staurastrum arachne.*
- *Docidium Ehrenbergii.*
- *Docidium baculum.*

DESMIDS—

Closterium intermedium.
Closterium linea, Perty, new to England.

INFUSORIA—

Euglena viridis.
Euglena deses.
Stylonichia mytilus.
Stentor Mulleri.
Stentor niger.
Stentor polymorphus.

ROTIFERÆ—

Metopidia acuminata.
Rotifer vulgaris.
Philodina roseola.
Melicerta ringens.

ENTOMOSTRACA—

Daphnia vetula.

MILL HILL, MAY 15, 1880.

ALGÆ—

Spirogyra Weberi.
Spirogyra Weberi var. *Hilseana.*
Spirogyra turpis.
Vaucheria clavata.

DESMIDS—

Closterium Ehrenbergii.
Closterium acerosum.
Closterium lineatum.
Closterium Dianæ.
Closterium moniliferum.

DIATOMS—

Nitszchia acicularis,
Nitszchia sigmoidea.
Nitszchia minutissima.
Synedra obtusa,
Pinnularia viridis.
Navicula cryptocephala.
Navicula sphærophora,
Cyclotella operculata.
Pleurosigma Spenceri,
Pleurosigma lacustris.
Surirella minuta,
Cymatopleura solea.

PROTOZOA—

Amœba princeps?
Amœba guttula.

INFUSORIA—

Cryptomonas globulus.
Cryptomonas fusca.
Euglena viridis.
Euglena deses.
Euglena pleuronectes.
Euglena spirogyra.
Euglena longicauda.
Prorodon teres.
Coleps hirtus.
Bursaria vernalis.
Paramecium aurelia.
Vorticella, very large form.
Vorticella microstoma.
Vorticella convallaria.
Dileptus folium.
Cyclidium glaucoma.
Aspidisca lynceus.

ROTIFERÆ—

Rotifer vulgaris.
Pterodina patina.
Brachionus urceolus.
Metopidia acuminata.
Furcularia sp.

On Two Species of Acarina believed not to have been before recorded as British.

By A. D. Michael, F.L.S., F.R.M.S.

(*Read May* 28, 1880.)

PLATES VI and VII.

The two species which I propose to bring before your notice to-night are very different, and I am not aware that the capture of either in Britain has been hitherto recorded; they are two of those exceptional and intermediate forms which produce a feeling akin to despair in the minds of classifiers, and which will not readily accommodate themselves to the definition of any known family. This remark is specially applicable to the first species. Both have been previously found in Germany, thanks to the industry of Dr. P. Kramer, of Schleusingen; as, however, there is not, I believe, any description of them in the English language, and as, moreover, I have been able to trace the immature stage of the first species, and the female and some early stages of the second species, neither of which Dr. Kramer appears to have traced, and as I have also some points of construction to detail which the very limited number of specimens at his command did not enable him to deal with, I have thought that this little paper might have sufficient interest to justify my bringing it before you.

Labidostomma luteum. Kramer.

Plate VI.

During the spring of 1878, whilst engaged in hunting for *Oribatidæ* in moss growing on the ground at Epping Forest, my attention was arrested by an Arachnid of a bright orange colour, which appeared new to me, but which was making off with a rapidity which did not leave any time for consideration. I secured it in spite of its swift movements, and brought it home for examination, and during the season I captured one other specimen; it did

not belong to the family I was in search of, and, indeed, at first, I had doubts whether it was one of the *Acarina* at all; I, however, soon felt that the resemblances to the *Phalangidæ* and the *Pseudo-Scorpiones* were only superficial, while those to the *Acarina* were in essential characteristics; but when I came to decide upon what family it belonged to, it was a very different matter. There seemed such serious objections to including it in any known family, that, being busy with the *Oribatidæ*, I allowed the matter to stand over, hoping to find more specimens and investigate further. In this I was tolerably successful, for during the season of 1879 I found a number of specimens, both in the perfect and nymphal stages; but in the meantime a notice of the creature from the pen of Dr. Kramer had appeared in the first number of the "Archiv fur Naturgeschichte" for 1879. Dr. Kramer does not say when he found it, but it is probable that it was before I did; he has given it the name above quoted. Subsequently to my finding it, Mr. George, of Kirton Lindsey, found some specimens; and, not being aware of its previous capture, was as much puzzled as myself.

I cannot say that I am any further advanced than I was in 1878 in the question of what family it belongs to, and Dr. Kramer has evidently felt the same difficulty, but he escapes from it in a way which I confess did not strike me; he creates a new genus for it, says that it is very difficult to classify, and that it is not one of the *Oribatidæ*—an assertion which he is quite safe in making—and there he leaves it. I must, I fear, in the main follow his example; but I will briefly point out the reasons why it is difficult to include it in any established family.

Analogies.

Firstly, as to those creatures which have a certain resemblance but do not belong to the *Acarina*. From the *Phalangidæ* it is divided by its unsegmented abdomen, tarsus of one joint, and the position of the genital organs. From the *Scorpionidæ* it is divided by the absence of constriction between cephalothorax and abdomen, and by the latter not being segmented, notwithstanding the singular resemblance of the mandibles of this species to the cheliceræ of *Obisium*, &c.

Among the *Acarina*, the hard exo-skeleton covering the whole

body of the adult *Labidostomma* will confine it to three families, viz., the *Oribatidæ*, the *Gamasinæ*, and the *Halicaridæ*.

It is not one of the *Oribatidæ*, because, firstly, the front pair of legs in that family is invariably a true pair of walking legs; whereas in *Labidostomma* they are hardly walking organs at all, but mere feeling organs, as in *Gamasinæ*, *Cheyletus*, &c. Secondly, the stigmata of the *Oribatidæ* are always one on each side of the upper surface of the cephalothorax, lead into an air sac below, and are protected by short external tubes or rings, from each of which issues what is called a stigmatic hair; this arrangement is absent in *Labidostomma*, the stigmata being placed more as in *Gamasinæ*. Thirdly, all known *Oribatidæ* have five joints to each leg; *Labidostomma* has seven. Fourthly, most of the *Oribatidæ* are sluggish creatures, and are all vegetable feeders; *Labidostomma* is very swift and apparently predatory. Fifthly, the claws are different. The resemblance to the *Oribatidæ* is chiefly in the chelate non-retractile mandibles, and in the different parts of the sternum being united by apodemes.*

The *Halicaridæ* approach *Labidostomma* in the position of the genital organs and one or two other particulars, but are utterly different from it in the formation of the mouth organs, the form and mode of attachment of the legs, the formation of the feet, the breathing apparatus, &c.; and, moreover, they are entirely aquatic, whereas *Labidostomma* is terrestrial.

There remain the *Gamasinæ*, and this family seems to offer the greatest resemblance, the mode of arrangement of the external stigmata, the general effect of the creature, the chelate mandibles, the mode of using the front legs, the position of the other legs, the number of joints in the leg, the development from nymph to perfect creature, the fact that the dorsal plate turns over and embraces the ventral, but in the female allows it to escape when the abdomen is

* In order that my meaning may not be mistaken, I annex a shortened translation of Professor Robin's very clear definition of the word ("Journal de l'Anat. et de la Physiol.," 1867, 523):—"*Epidemes* are parts of the dermal skeleton of articulata, which arise from the internal face of certain of the pieces and project into the interior of the body, but they always arise from a single piece, and are consequently simple. *Apodemes* (in the articulata) are internal, or occasionally also external, blades, of the same nature as the dermal skeleton, but placed at the lines of attachment of two segments or pieces of the edges of which they form prolongations; thus they are always formed of two blades pressed against each other and soldered (anchylosed) together. . . . ." This character distinguishes them from epidemes, which are formed of a single blade.

distended by eggs; and many other by no means unimportant points agree with the *Gamasinæ*. On the other hand, one can scarcely venture to include it in that family in the face of the following differences, viz., firstly, the mandibles are not retractile; whereas in all *Gamasinæ* which I know of they can be wholly retracted within the body, often so far that it is quite startling, and this forms a leading character. Secondly, the genital opening is on the abdomen close to the anus instead of in the cephalothorax as in *Gamasinæ*. Thirdly, the anus is protected by plates differing greatly from the *Gamasinæ*. Fourthly, the palpi have four joints; *Gamasinæ* have five. Fifthly, the tarsus is not provided with a caroncle. Sixthly, the joining of the segments of the sternum by apodemes above referred to is not found in the *Gamasinæ*.

Description.

Adult. (*Plate VI*, Fig. 2.)

♀	Average length about	·68 mm.
	,, breadth ,, ...	·36 mm.
	,, length of legs, 1st and 4th pairs about	·45 mm.
	,, length of legs, 2nd and 3rd pairs about	·32 mm.

The whole creature is chitinous and of a beautiful orange, and appears divided into three parts; the anterior of these, which is far the smallest, is really the rostrum and mouth organs, of which the enormous mandibles almost hide all the rest; the second is the remainder of the cephalothorax; and the third, and far the largest, is the abdomen. The whole dorsal surface is reticulated with raised ridges enclosing spaces most commonly hexagonal, but very frequently pentagonal and of other forms; all the ridges are marked with regular depressed transverse striæ, giving them a beautifully finished appearance (Plate VI, Figs. 2 and 8).

The rostrum, as seen from above, would appear to consist of the mandibles only (Figs. 1 and 2, and Fig. 4), as they arise immediately from the camerostomium, and from their great size hide the whole of the rest of the organs; their full length (as seen from below) is more than a quarter of that of the creature, but only about half is seen from above. Each mandible is thin, narrow, and of

very hard, clear chitine at the points, and continues so about a third of its length ; thence it suddenly enlarges into a bulb, very round on the outside, but flattened on the inner side, so that when the two lie together they are flask or gourd-shaped. The upper surface of the bulb is reticulated like the dorsal shield. The mandibles seem to be solely holding implements or nippers, as the two joints which form the chelœ are much bowed and only touch at their tips, but, as from their great length they would be liable to strain and dislocation, a beautiful arrangement exists to prevent this—the fixed penultimate joint, which is the upper one (Fig. 4,*a*), projects a little beyond the moveable ultimate one, and has a strong bi-forked or notched tip ; the inner point (Fig. 4,*c*) of the bifurcation is the longest, and the tip of the moveable joint falling into the notch is quite protected from all lateral strain. The maxillæ are excessively fine, sharp-pointed, acicular, retractile organs ; below them lies a thin lingula, which, doubtless, with the maxillæ, forms a sucking tube. The palpi (Pl. VI, Figs. 1 and 3,*c*) are large, and partially seen from above ; they consist of four joints, of which the first is short, the second much longer, the third the longest, and the fourth short, conical, and ending in a long spine. The palpi bear sparsely scattered fine hairs. There is a chitinous labium (Fig. 3) ending in the lingula.

The cephalothorax seen from above is nearly twice as broad as it is long, and is divided into two parts—a posterior, almost oblong, and an anterior, like an ornamental collar, lower in level, forming the camerostomium ; its shape will be seen by the drawing. The dorsal surface bears a pair of long hairs springing from little pits, and standing upward and forward. These hairs are beautifully branched or pinnate ; the branches or pinnules being sub-opposite, far apart, and very fine. One of these hairs is shown at Fig. 7. On the ventral surface the cephalothorax, as usual, extends much further back.

The legs are seven-jointed ; each leg is of nearly equal thickness throughout—the first and fourth pairs are the longest, of about equal length, the latter being a trifle the longer ; the two centre pairs are of about equal length. The comparative lengths of the different joints vary greatly in the different legs, and will be best gathered from the drawing (Pl. VI, Figs. 2 and 3). All the legs are finely striated with transverse striæ. The tarsi are curiously excavated to receive the claws when thrown back. It is singular that

the claws of the front pair of legs are totally different from those of the other legs—each of the front legs has two strong unequal claws, slightly curved, and set at a small angle. Each of the other legs has a triple claw, the centre one strong and curved, the lateral ones fine, short, and bent almost at right angles. Upon the sternal surface a central longitudinal blade (apodeme) projects inward, four transverse apodemes run from the thickened lateral ridges which form supports for the legs, and join the central apodeme, dividing the whole sternal surface into eight spaces. The legs are articulated in deep cups protected by the lateral ridges, which are rough with projecting points.

The abdomen may be roughly described as fiddle-shaped, the anterior margin nearly straight, slighly convex anteriorly, the centre having a small point extending over and coalescing with the cephalathorax. The abdomen is the same width as the cephalothorax for a short distance, then suddenly widens with an almost square shoulder. On the side just behind this shoulder is a small rounded projection which Dr. Kramer regards as being an eye. I am not satisfied that it is so; the position would be singular, and I have not been able to observe any pigment layer or internal optical structure; whatever it be it is protected by a strong spine above it. Immediately behind this projection is a second conical one which is perforated by the external stigma, which is conical with the point outward. There are a few spines round the hind margin and down the notogaster. The genital and anal apertures are placed together in the posterior part of the ventral surface, and form a large squarish aperture with rounded corners, which is closed by four hinged plates or doors—the two anterior or genital plates (Fig. 3, *g*) being much the largest. The eggs are very large, and I have not ever seen more than one mature at the same time.

The Nymph. (Plate VI, Fig. 1).

The Nymph is a most beautiful creature, which it is not possible to do justice to by uncoloured drawings, nor have I succeeded in mounting it for the microscope so as to preserve the colour, which is its principal attraction. It is of a bright rose colour, with two darker, almost crimson patches on the back, while the depressed channel and raised margin of the abdomen are pale grey. The Nymph resem-

bles the mature form, except that the chitinous shield, instead of covering the whole notogaster, only covers about the anterior half of it, and ends with a rounded outline; the posterior part of the abdomen is membranous only, and somewhat arched in the centre, sinking abruptly into a depressed channel some distance within the margin, while the actual margin is raised and slightly reflexed. The chitinous shield carries the two dark red patches above-named.

The differences from all recognised families, the disproportionately large and exceptionally formed mandibles, the differences of the claws on the respective tarsi, the elaborate reticulation of the dorsal surface, and the two pairs of beautiful branched hairs, besides numerous other matters, must always make this an interesting species.

Pygmephorus spinosus. (Kramer.)

Plate VII.

This species, which is the second that I shall introduce to your notice, was also discovered by Dr. Kramer. It is a parasitic or semi-parasitic species. Kramer found a single specimen upon the mole, and figured and described it in the "Archiv für Naturgeschichte," 1876, p. 254. He only found a single specimen, and I am not aware that any one has found it, or at all events recorded its capture, since. If this has not the beauty of the last described species it is probably quite as curious; Kramer evidently thought it most extraordinary, and he was right. His specimen was a male; of course he did not know that the female and immature forms were different, nor probably did he suspect that it is not universally parasitic in the immature stages, which seems to me to be the fact, and, moreover, when parasitic in an immature stage, I doubt its being confined to the mole, as I have found on flies an acarus which I cannot distinguish from it.

The most conspicuous peculiarity is the front leg of the male, which is shorter than the other legs, and instead of having a pointed tarsus carrying a double claw and sucker as they do, ends in an almost globular mass, formed of the tarsus and fourth joint, which is very large in comparison to the size of the creature. This tarsus carries a single deeply curved claw, proportionate in size to the tarsus itself, and closing over a fixed chitonous projection on the tarsus, so as to form a holding instrument of no ordinary power.

(Pl. VII, Fig. 3). Dr. Kramer naturally takes it for granted that the object of this is to seize and hold the hairs of the mole, and its great resemblance to the holding claws of such *Anoplura* as *Pediculus capitis* would naturally suggest the idea—which is confirmed by the existence of holding claws in *Myobia*, *Mycoptes*, *Listrophorus*, &c., the nearest allies. Led by these considerations, I also at first supposed this claw to be for holding the hairs of the mole, but I afterwards came to doubt it, my reasons being as follows, viz., 1st, in *Myobia*, *Mycoptes*, &c., both sexes, as well as the immature forms, have the holding claws. In this species it is only the adult male ; if they were for holding the hairs they would be as necessary to the females and larvæ, at all events to the former, as to the male, and their development in the adult male only seems to point to a different use. 2nd. There are numerous other *Acarina*, as for instance, *Dermaleichi*, *Gamasinæ*, &c., in which the adult male has one pair of legs specially developed for holding the female, and little used for any other purpose. 3rd. In *Myobia*, *Mycoptes*, &c., the mite adheres so firmly to the hairs of the mouse that it is almost impossible to detach it ; and if one wants the mite, one must pull out the hair—the creature frequently dies with the hair firmly grasped in its claw. The present species does not adhere to the hairs, as far as I could see, but may be picked off without difficulty, except what arises from its small size, and may be obtained by merely shaking the mole. 4th. This species is provided with suckers to four of the other legs for holding purposes, which are absent in *Myobia*, *Mycoptes*, &c.

I have stated above that I do not think that this species is parasitic in all stages ; my reason for this is that I have found a considerable number of immature specimens (Nymphs), which, as usual, closely resemble the female, in moss, from whence they probably attach themselves to the mole on attaining their final stage. It is not at all unusual amongst *Acarina* for a creature to be parasitic in one state and not in another ; thus, for instance, the Nymphs of many *Gamasinæ* are parasitic while the adults are not, and the larvæ of some *Trombididæ* will fasten themselves to human beings, but adults will not.

Dr. Kramer found upon the mole, together with the present species, an *Hypopial* creature, which he considers to be a new species, and calls *Labidophorus talpæ*. It is very minute, and when living is a clear pretty creature. In the present state of the vexed

Hypopus question, I do not now propose to express any opinion as to what an *Hypopus* is, but I simply record the fact that I also found Kramer's *Labidophorus talpæ* accompanying his *Pygmephorus spinosus*, and I did not find them separate. I do not attach much importance to this, but, so far as it goes, it favours the views of those—such as Megnin, Claparède, Dujardin, and Haller—who hold that an *Hypopus* is a stage in a life history, not a separate creature.

Description.

The whole creature is chitinous, somewhat transparent, yellowish brown, with an irregular white band down the centre, caused by the excretory organs showing through; flattish on the dorsal, slightly convex on the ventral surface. It has the appearance of being divided into four parts, viz.: first, the rostrum, which is small and broader than long; secondly, the fore part of the cephalothorax, extending from the rostrum to the epimera of the first pair of legs; thirdly, the hinder part of the cephalothorax; and, fourthly, the abdomen. The cephalothorax extends much further backward on the ventral than on the dorsal surface. The legs of the two front pairs are near together, as are those of the third and fourth pairs, but there is a wide interval between the second and third pairs. The abdomen and hinder part of the cephalothorax seem to show traces of segmentation, a fact which Claparède observed in *Mycoptes musculinus*, a species which, as above stated, appears to me to be more closely allied to the present one than any other which I am acquainted with.

Male.

Length (without legs) about . . .	·33 mm.
Greatest breadth „ . . .	·18 mm.
Length of rostrum as usually carried, about .	·025 mm.
Breadth „ „ „ .	·05 mm.
Length of first pair of legs about . . .	·15 mm.
„ second „ „ . . .	·12 mm.
„ third „ „ . . .	·18 mm.
„ fourth „ „ . . .	·23 mm.

Rostrum, as seen from above, slightly curved in front, coming to a sharp point at each side. It is, however, carried bent down upon

the sternal surface, and there the rostrum ends in a blunt point. The opening of the mouth is on the under side, and is usually concealed by the bending down of the rostrum. The mouth organs are minute and obscure, and appear to consist of two curved style-like mandibles working alternately, and somewhat similar to the triangular styles of *Mycoptes* (which Claparède regarded as the mandible of the *Sarcoptidæ* with the last joint become abortive) and a maxillary lip or maxillæ with the palpi almost coalescent with it. The mouth, and probably the first stomach, seem to form a sucking apparatus.

The cephalothorax on the dorsal surface widens rapidly, so that the fore part of the cephalothorax and the rostrum together form a truncated triangle. The whole length of the under surface of this part of the cephalothorax is occupied by the great round coxæ of the first pair of legs. A little behind these the cephalothorax widens suddenly over the coxæ of the second pair of legs, and then sweeps outward until it attains the greatest width over the centre of the coxæ of the fourth pair of legs, whence it narrows sharply at the insertion of the abdomen. The posterior angle of the cephalothorax projects and forms a shoulder which carries a spine directed backward close to the abdomen and almost reaching its posterior margin. The abdomen is almost square, with the hind corners cut away; the posterior margin transparent and retractile.

The anus is small and subterminal, but more on the under than the upper surface. The legs are five-jointed. The coxæ of the first three pairs are very large, and look globular. The two first pairs are set in indentations at the side; the third pair are more under the body, but still at the lateral margin. The fourth pair are entirely different in shape, much longer, set further under the body, thickest, almost straight at the inner edge, shortly afterwards narrowing, becoming tubular, and curving backward and outward. The trochanters of the first three pairs of legs are much narrower than the coxæ, and seem almost fitted on to the exterior surface thereof. In the third pair in particular the coxæ are really indented to receive them. The trochanter is the largest joint, except the tarsus, and, in the third pair, is the longest joint of all. In the fourth pair it is only slightly longer than the coxa. The third joints (femurs) are short and sub-cylindrical in each leg, but slightly wider at the distal extremity. The fourth joint in each leg, except the first, is somewhat similar in shape to the third, but nearly twice the length.

In the first pair it appears to have coalesced with the tarsus (unless, indeed, the projection hereinafter mentioned be the homologue of the tarsus), and together they form a great club-like mass which is the leading characteristic of the creature, and which is larger than the whole rostrum, and looks utterly out of proportion to the animal, giving it a most comical appearance when walking. A little below the centre of the anterior margin of this mass a great clear chitinous blunt tooth projects straight forward. It has on the lower surface an appearance of being articulated, and may possibly be the homologue of the fifth joint; but I do not think that this will turn out to be so. It appears to me that the great single claw is articulated not to the tooth, but to the mass before spoken of just where the tooth springs, and that, therefore, the tooth would more probably be the homologue of the absent second claw. The single claw which terminates this leg is as disproportionately large as the tarsus which carries it, somewhat bulbed near its insertion, the bulb striated with curved ridges. From the bulb the claw turns almost at right angles, and is curved, thick, bluntly-pointed and striated with oblique ridges on the inner surface. There is not any sucker to this leg.

The tarsi of the other legs are totally different, they are longer than the third and fourth joints put together, elegantly tapered, and terminated by a double claw set on a long peduncle; the claws stand almost opposite to each other, and are short, stout, very sharply curved, and have a sort of short inner claw with a pad or brush under them in the second and third pairs of legs; those of the fourth pair are longer, slighter and of a more open curve, and lie more against one another than the others; the peduncle is straight in the second and third pairs of legs and is continued below the claws and terminated by a bell-shaped sucker. In the fourth pair the peduncle is very long, the claws are terminal, and there is not any sucker.

The skeletal strengthening of the sternal surface appears to be as follows: A central chitinous external ridge runs from the camerostomium to the hind margin of the cephalothorax, and sends a branch partly round the camerostomium. Almost immediately behind the coxæ of the first pair of legs a strong chitinous band starts from the sternal ridge, and passes entirely round the creature inside the dermal skeleton; this is conspicuous, both from the dorsal and sternal aspects, in consequence of the transparency of the chitine. Near the lateral margin of the body this ridge joins the

epimera of the first pair of legs, which are short and broad. Behind the second pair of legs a third ridge leaves the sternal one, and extends to the edge of the body, where it joins the epimera of the second pair of legs which send broad bands beneath the skin, supporting the coxæ of these legs and joining the epimera of the first pair. A fourth ridge starts from the sternal ridge opposite the coxæ of the third pair of legs, and inclines slightly backwards, but only runs about half way across the abdomen. A fifth ridge runs along the posterior margin of the cephalothorax, and it bears in the centre a triangular plate. Each epimeron of the third pair is a small, almost square, piece at the anterior margin of the coxæ ; a little outside the centre it sends a strong shaft outward and slightly backward, where it joins at somewhat less than a right angle to a long chitinous bar, which runs forward along the side of the cephalothorax until it nearly reaches the coxæ of the second pair, where it turns round and soon splits into several short, fine, radiating spines or blades. The epimera of the fourth pair are short bars between the coxæ of the third and fourth pairs, and send a thin, transparent, curved blade right across the third pair of coxæ. The stigmata are most singular, consisting of short, flexible, bell-shaped projections immediately behind the first pair of legs ; they are set on a tubular peduncle, which communicates with a sub-cylindrical air sac or peritreme, which lies along the lateral margin of the body ; from this two bunches of tracheæ start, one near the middle, and one at the posterior extremity ; they are distributed to all parts of the body. Five principal bands of muscle may be clearly seen inserted in each coxa of the first two pairs ; they arise from the sternal and lateral ridges before mentioned, each set of five embracing an angle of the sternal and lateral ridges, and proceeding obliquely forward to the coxa, becoming closer together as they advance : the muscles inserted into the third coxæ run almost straight across from the sternal ridge, those of the fourth pair run obliquely backwards from the sternal and short ridges.

The excretory organs form an irregular central band near the dorsal surface ; they are generally filled with the usual white opaque granular matter.

The distribution of the hairs is as follows : a pair of very long ones each side on the above-mentioned shoulder pointing backwards, and almost reaching the posterior margin. A strong hair standing outward from the lateral margin, between the first and second, and

another between the second and third pairs of legs, two pairs on the back standing nearly upright, and two pairs near the posterior margin, all long ; and one other pair on the margin shorter, and lower in level. There are conspicuous hairs on almost every joint of each leg, those on the tarsi being the longest and most numerous ; those near the insertion of the legs are sparsely pectinated. The ventral surface has a pair of hairs.

Description of the Female.

The principal differences are that it is slightly smaller in size than the male and the cephalothorax much shorter, the abdomen wider and not square, but gradually diminishing, and with a rounded posterior margin. The first pair of legs are thin and small, entirely without the great club and claw of the male ; the second pair, on the contrary, are thicker and stronger than in the male, but otherwise similar ; the two hind pairs of legs are practically similar to those of the male. The hairs are all longer and stronger than in the male, and much more numerous round the hind margin and on the ventral surface ; otherwise similar in position. The vulva appears to be in the central line of the ventral surface, but just behind the fourth pair of legs, the labiæ a little separated posteriorly, and with a fine undulated sternite in front of it. The second lateral ridge of the sternal skeleton is far less conspicuous than in the male, and is more curved, and bends backward in two loops until it joins the third ridge. The fourth ridge is straight, and goes entirely across the body. The fifth ridge, on the contrary, is almost absent, unless the sternite mentioned above be its homologue ; the fourth epimera send bands above and almost round the hind legs.

The rostrum of the female is longer than in the male.

DESCRIPTION OF PLATES VI, VII.

Labidostomma luteum. Plate VI.

Fig. 1.—Nymph.—(*a*) The mandible, (*b*) Ultimate movable joint of ditto, (*c*) Palpus, (*d*) Cephalothorax, (*e*) Chitonous plate on abdomen, (*f*) Depressed channel, (*g*) Raised reflexed margin, (*h*) Lateral projection stated by Kramer to be, or to be furnished with, an eye, (*i*), Stigma.

Fig. 2.—Perfect Creature.—The above explanations (except *e* to *g*) would be applicable to this figure also.

FIG. 3.—PERFECT CREATURE.—Under side (*a b* and *c*) as above. The labium and lingula are seen lying between the mandibles. 1, coxa, 1st pair of legs ; 2, ditto, 2nd pair ; 3, ditto, 3rd pair ; 4, ditto, 4th pair. (*d*) Central apodeme, (*e e*) Transverse ditto, (*f f*) Lateral ridges, (*g*) Genital plates, (*h*) Anal ditto.

FIG. 4.—MANDIBLE.—(*a*) Penultimate joint, (*b*) Outer point of ditto, (*c*) Inner point, (*d*) Long hair carried by this joint, (*e*) Moveable ultimate joint.

FIG. 5.—End of the tarsus and the claw of one of the first pair of legs.

FIG. 6.—The same part of one of the other legs.

FIG. 7.—One of the branched hairs.

FIG. 8.—A portion of the Chitonous dorsal surface, showing the reticulation.

PYGMEPHORUS SPINOSUS. PLATE VII.

FIG. 1.—ADULT MALE.—(*a*) Rostrum, (*b*) Club formed by coalescence of 4th and 5th joints of 1st pair of legs, (*c*) Single claw of ditto, (*d*) Quadruple claw of 2nd and 3rd legs, (*e*) Sucker below ditto, (*f*) Double claw of 4th pair of legs, (*g*) Stigma.

FIG. 2.—FEMALE.—The dorsal shield is removed to show structure. (*a*) Rostrum, (*b*) Stigma, (*c*) Air sac, (*d*) Main trachea starting, with other smaller ones, from centre of air sac, (*e*) Trachea starting from end of same, (*f*) Excretory organs.

FIG. 3.—FIRST LEG OF MALE.—(*a*) Coxa, (*b*) Trochanter, (*c*) Femur, (*d*) Coalesced 4th joint and tarsus, (*e*) Tooth-like projection, (*f*) Claw, (*g*) Pectinated hairs.

FIG 4.—Mouth organs seen from below.

PROCEEDINGS.

April 23rd, 1880—Ordinary Meeting.

Dr. T. Spencer Cobbold, F.R.S., &c., President, in the Chair.

The minutes of the preceding meeting were read and confirmed.

The following gentlemen were balloted for and duly elected members of the Club—Mr. Archibald Seth Smith, Mr. Fredk. Stewart, Mr. Arthur Williams, Mr. Henry John Whitney, and Mr. G. W. H. Gates.

There were four proposals for ballot at the next meeting.

The following donations to the Club were announced:—

"Proceedings of the Royal Society" ...	from the Society.
"Proceedings of the Royal Microscopical Society"	" "
"The Analyst"	from the Editor.
"Rutherford's Outlines of Practical Histology"	" Mr. J. W. Reed.
"Annual Report of the Geologists' Association"	from the Society.
"Inaugural Address of the Epping Forest Natural History and Field Club"	" "
"Proceedings of the Norfolk and Norwich Natural History Society" ...	" "
"Annual Report of the Norfolk and Norwich Natural History Society"...	" "
"Popular Science Review"	from the Publisher.
"Science Gossip"	" "
"Proceedings of the Belgian Microscopical Society"	from the Society.
"The Midland Naturalist"	in Exchange.
"The American Journal of Microscopy" ...	"
"The American Naturalist"	"
"The American Monthly Microscopical Journal"	"
"Annals of Natural History"	Purchased.
"Grevillia"	"
5 Slides	from Mr. E. T. Newton.
8 Slides	" Mr. J. W. Reed.

A portrait of Prof. Quekett from Prof. Rupert Jones, per Mr. T. C. White.

Mr. T. C. White said he had very much pleasure in presenting this last

named donation from Prof. Rupert Jones. He had the pleasure of knowing Prof. Quekett 20 years ago, and could testify to the correctness of the likeness. Although too large for the album, this portrait would, no doubt, be carefully kept and highly valued by the members of the Club.

The thanks of the meeting were voted to the donors.

Mr. Ingpen said it would be remembered that some time ago a donation of £10 was received from Miss Morrell, who desired that it might be expended in some way for the benefit of the Club. It had been decided by the Committee that it would be most beneficial to purchase with this money some additional apparatus for the microscopes belonging to the Club, and they had therefore obtained from Mr. Crouch a 1in. and ½ objective, a polariscope, a pair of No. 2 eyepieces, a single No. 3 eyepiece, and a Webster's condenser. The purchase of these would absorb the amount at disposal, and he was quite sure that the members would agree with him as to the usefulness of the investment.

The President said they would also be pleased to hear that Mr. Crouch had added to these articles a silver side reflector, which he presented on his own account.

The President regretted to announce that since their last meeting they had sustained a serious loss in the death of Dr. Sharpey, who was not only an old friend of the Club, but one to whom the Club owed the privilege of meeting in that room, for it was he who first expressed to his colleagues the design and utility of the new Society. It was therefore most fitting that the Club should express its sense of their loss, and that the same should be suitably conveyed to the Dean of the Faculty of University College. He happened to know Dr. Sharpey some 30 years ago, before he came to London, and knew that he was one of those who always was ready to do all he could for the advancement of young students, and he lent in this same way a helping hand to a young body of microscopists, such as they then were. What he had done for many individuals epitomized what he had done for the Club, and what he had done for the Club epitomized what he had done for science at large. His name remained indelibly connected, first with the Edinburgh College, and afterwards with University College, to the time of his lamented decease.

A vote of condolence was then put to the meeting, and carried unanimously.

A paper by Dr. Stolterfoth, "On a Simple Method of Cleaning Diatoms," was read by Mr. Ingpen.

Mr. T. C. White thought that though the method proposed might appear a novel one, there seemed to be a great deal of truth in it; and all who had tried knew what was the trouble of using acid. He read a short time ago a paper by Prof. Stanley Jevons, "On a Method of Getting Rid of Dirt by Means of Soap." He put some chalk into a trough of water, and when it was quite dissolved he put a small particle of soap into it, and in a short time afterwards the particles of chalk were seen in agitation, and the Brownian motions were very rapid.

Mr. Thos. Spencer said he should imagine that the action which took

place in this instance arose from excess of alkali, which so often occurred in soap. He had himself tried, and given up soap altogether, and in its place he now used Hyposulphite of Soda, which was the best detergent known; it not only did not do any mischief, but actually dissolved the dirt away. For very many purposes he knew of nothing so good as this.

Mr. Ingpen agreed with Mr. White that the action was rather mechanical than chemical.

Mr. Michael did not doubt that there was a mechanical action at work due to the Brownian movements, but thought there was also a chemical action in the process.

Dr. Matthews said that the great majority of soaps contained Silicate of Potash.

Mr. Spencer said that the soap which contained Silicate of Soda was certainly the best of all.

Mr. Ingpen suggested that they could get a soap made on purpose, if it were needed.

Mr. Spencer said that was of course supposing that soap was the best thing to use, which it was not.

Mr. J. G. Waller read a paper, "On a New British Sponge," to which he gave the name of "*Raphiodesma minima*."

Mr. Priest said he had been working at the same subject for some time, and found a specimen of *Raphiodesma sordida* at Ramsgate last year, which he thought was very much like one which Mr. Waller then thought was *Hymeniacidon macilenta*; and on reference to Dr. Bowerbank's book he found the close agreement which Mr. Waller had described.

The President said that the attention given to the paper showed the interest which had been taken in the subject. He did not think that any blame should be attached to those workers who had opened up these subjects years ago, because they had not minutely followed out every detail —they had done useful service in opening out the subject, and in preparing the way for special work such as Mr. Waller and others had been able to accomplish.

Mr. Martinelli read a paper "On the Structure of the Stomata in the Holly," which he illustrated by numerous photo-micrographs.

The President thought the photographs gave a remarkably good general idea of what these Stomata appeared to be.

Mr. W. H. Gilburt commented upon the paper, and suggested that some of the appearances observed were due to the peculiar mode of preparation adopted.

Mr. Martinelli, in reply, admitted the possibility of this view.

Mr. E. T. Newton described a simple section cutting machine, which was exhibited by Mr. Curties. He did not claim it as being either entirely new, or that it was to supersede everything else, but it was simple in action and construction, and was produced at a moderate cost. It had the usual hole in the centre, and a means of raising the wax up as required, with the very great advantage that the cylinder containing the wax was loose in the central tube, and could therefore be raised up or pushed down

with equal facility. The wax was also prevented from turning round by means of a small screw in the side.

The thanks of the meeting were unanimously voted to the authors of papers.

Announcements of meetings for the ensuing month were then made, and the proceedings terminated with the usual conversazione, at which the following objects were exhibited :—

Section of Peppercorn	... Mr. F. W. Andrew.
Net-wing Fly, *Trypeta reticulata* ...	... Mr. F. Enock.
Diatoms on *Polysiphonia*	... Mr. W. H. Gilburt.
Melicerta ringens	... Mr. H. R. Gregory.
Section of Finger of Orangoutang ...	... Mr. J. J. Hunter.
Epidermis of Holly	... Mr. A. Martinelli.
Section of leaf of *Ficus elasticus* ...	... Mr. J. W. Reed.
Gizzard of Flea	... Mr. C. S. Rolfe.
Pollen of Palm, *Chamærops fortunei* ...	... Mr. J. G. Tasker.

Attendance—Members, 77 ; Visitors, 8.

May 14th, 1880.—Conversational Meeting.

The following objects were exhibited :—

Section of Luxullianite	... Mr. F. W. Andrew.
Halodactylus	... The Club.
Section of *Clematis*	... Mr. F. Coles.
„ Horn of Rhinocerus ...	... Mr. A. L. Corbett.
Polycistina	... „ „
Plant Hairs and Crystals	... Mr. T. Curties.
Volvox globator, *Chætophorus*, &c. ...	... Mr. A. Dean.
Sponge, *Grantia ciliata*	... Mr. C. G. Dunning.
Zoophyte, *Crisia eburnea*	... „ „
Head of Cattle-fly, *Chrysops relictus* (male)	... Mr. F. Enock.
Flea of Fly, *Hypopus muscorum* ...	... Mr. H. Epps.
Circulation of Blood in a Tadpole ...	... „ „
Fern, *Lastrea spinulosa*	... Mr. A. Fieldwick.
Soundings H.M.S. Challenger ...	... „ „
Scales of Butterfly, *P. brassica* ...	... „ „
Diatoms from Cuxhaven	... „ „
Leaf *Pelargonium quercifolium* ...	... Mr. H. G. Glasspoole.
Young Water Newt	... Mr. W. Goodwin.
Stephanocerus Eichornii	... Mr. R. H. Gregory.
Melicerta ringens	... „ „
Bursella truncatella	... Mr. J. D. Hardy.
Desmids, Diatoms, &c.	... Mr. G. Hind.
Section of Upper Jaw of Mole ...	... Mr. J. J. Hunter.
„ Jaw of Cat	... „ „

Hydra fusca	Mr. J. Mackenzie.
Euglena viridis	Mr. A. Martinelli.
Section of Tail of Rat	Dr. Matthews.
„ Tongue of Cat	„ „
Mymar pulchellus and other species of *Proctotrupi*	Mrs. Michael.
Sphacelaria filicina	Mr. A. D. Michael.
Jungermanniea	„ „
Section of Labrador Spar	Mr. W. Moginie.
„ Syenite	„ „
„ Avanturine	„ „
„ Iron Sandstone	Mr. H. Morland.
Pond-life, from the Serpentine	Mr. J. M. Offord.
Diatom—*Campylodiscus*, n.s. from Crescent City	Mr. C. N. Peal.
Planaria lactea	Mr. C. Le Pelley.
Polycistina	Mr. G. D. Plomer.
Diamond Beetle	„ „
P. angulatum with 1-25in. oil-immersion O.G.	Messrs. Powell and Lealand.
Leg of Diamond Beetle, *Cyphus gemmari* ...	Mr. F. Reeve.
Elytron „ „ „ „ ...	„ „
Fern Scales	Mr. H. J. Roper.
Æcidium ranunculacearum	„ „
Section of Lemond-rind	Mr. J. W. Reed.
„ Leaf of Pineapple	„ „
„ Rhizome of *Pteris aquilina* ...	Mr. J. C. Sigsworth.
„ Leaf of *Yucca gloriosa*	„ „
Petal of *Viola odorata*	„ „
Section of "Gabbro," from Silesia	Mr. G. Smith.
„ Nephaline Dolerite	„ „
Cyclosis in *Vallisneria spiralis*	Mr. J. Smith.
Section of Cat's Tongue	Mr. T. L. Waterman.
Young Mussels	Mr. F. H. Wood.

Attendance—Members, 125; Visitors, 56.

May 28th, 1880.—Ordinary Meeting.

Dr. T. Spencer Cobbold, F.R.S., President, in the Chair.

The minutes of the preceding meeting were read and confirmed.

The following gentlemen were balloted for and duly elected members of the Club:—Mr. Samuel Bennett, Mr. William Groves, Mr. Andrew Miles, and Mr. J. M. Williams.

Nine gentlemen were proposed for membership.

The following additions to the Library and Cabinet were announced:—

"Proceedings of the Royal Society" ...	from the Society.
"Proceedings of the Geologists' Association"	„ „

"The American Naturalist"	in exchange.
"The American Monthly Microscopical Journal"	"
"The Midland Naturalist"	"
"The American Journal of Microscopy" ...	"
"The Analyst"	from the Publisher.
"Paper on the Valves of the *Diatomaceæ*"	" Mr. Julien Deby.
"Lubbock's Monograph of *Thysanuræ*" ...	" the President.
"Paper on Trichinosis"	" "
"Annals of Natural History"	Purchased.
A collection of 20 slides of Fleas... ...	from the Dinner Committee.
Mounted Specimen of Gigantic Flea, sp.?...	Mr. J. G. Tatem.

The thanks of the Club were voted to the donors.

Mr. Ingpen read a letter from the Secretary of the Ealing Microscopical Society thanking the members of the Club who assisted the Society on the occasion of their recent Soireé.

Dr. M. C. Cooke communicated a list showing the results of his excursions to Hampstead Heath, Mill Hill and Snaresbrook, and exhibited a large number of drawings of objects of interest which he had found. Some of these he presented to the Club.

The thanks of the meeting were voted to Dr. Cooke for his communication and donation.

Dr. Matthews said he was very glad to get such a good list as Dr. Cooke had presented them with, for it would be remembered that some few months ago he had taken occasion to publicly lament that so few of the results of their excursions should be allowed to appear.

Mr. Hardy thought that it might be a good suggestion that those who attended the excursions should follow Dr. Cooke's plan and make drawings of what they found as well as give in their individual reports.

Dr. Cooke said that paper uniform in size with that upon which he had made his drawings had been long ago provided, and might be had from the Secretary by any members who would make this use of it.

Mr. J. W. Reed asked if Dr. Cooke would allow these drawings to be made use of as references on future occasions?

Dr. Cooke said that the *Algæ* would be published at some future time, and he should require them, but the others were quite at the service of the Club.

Mr. Ingpen thought it only right to say that several attempts had been made from time to time to get the results of the excursions properly compiled, and that they had been more or less freely responded to by the members, but they had seldom obtained anything beyond mere lists of the most ordinary species. Anything new was made the subject of a special communication, probably to some other Society than their own.

Mr. T. C. White said he could corroborate what Mr. Ingpen had said as to the manner in which they had endeavoured to carry out this suggestion, and the results they had met with. In many cases they obtained lists of

genera without species, and there were often considerable doubts as to their accuracy. He thought that some sort of sub-committee might perhaps be appointed to carry out the suggestion, and thereby they might be better able to fulfil one of the objects for which the Club was originally started. It would not only be of interest to know what things were to be found in the districts visited, but it was of great importance to ascertain how far the same things were found in different years in the same localities.

Mr. Michael said it appeared to him that nothing was a greater waste of time than for a man to go out and collect a lot of things of various kinds, and then to attempt to identify all he had found. He might spend days in identifying an object, and find, after all, that he had only got something well known to others. Unless, therefore, the things found could be classified and handed over to specialists who were competent to "spot" a new thing amongst them directly, he was afraid very little practical value would come of the matter.

Mr. White said that the first difficulty which met them was that they got all sorts of things mixed up together, and it was often most difficult to separate them.

The following communication from Mr. J. G. Tatem to Mr. Curties, describing the large specimen of Flea presented to the Cabinet of the Club, was read by Mr. Ingpen:—

"In begging you to offer for the acceptance of the Quekett Club, and for deposit in its Cabinet the large Flea I send you, it is as well that it should be accompanied by such information as I am able to give concerning it.

"It was taken dead and almost decomposed from the fur of a ferret which had been dug from a rabbit-hole at Harpenden, near St. Albans, and has been in my possession since 1869. It is a species certainly very little known, and, is, I believe, as yet unnamed and undescribed, no notice of it being obtainable from either text book or periodical, so far as I am aware.

"Mr. Champion, however, exhibited at the Entomological Society's meeting on the 3rd of February, 1873, a large species of *Pulex*, taken by Mr. T. Walker in a mouse's nest, in the Isle of Sheppy, but no further reference to it occurs in the Society's Transactions. The Rev. W. Locock communicated to the December number of "Science Gossip" the capture of another large flea on a mole at Clifton, seeking information in regard to it. Now, these large fleas may be, and probably are, identical with my specimen, but without comparison or exact description of them there can be no certainty in the matter.

"Three years ago, a former female servant, residing at Nettlebed, Oxon, calling here, 'so regretted that she could not bring me the very large flea which hopped from her dress that morning, but which she could not catch,' calling it the 'grass flea,' and stating 'that it was not uncommon in her neighbourhood on the hay-makers while in the fields,' and adding, 'that it did not bite.' A liberal reward offered each year since, has, however, failed to procure me a single example.

"Accepting this information as correct, and applying to our subject, and seeing that it has (in all probability) been already met with on more than

one kind of animal, this rare species of *Pulex* may be looked for with more or less prospect of obtaining it on any one of them, you will see that its most noticeable peculiarities, beyond its unusual size—nearly ¼in.—are that the head has four rows of fine hairs arranged transversely, a frontlet armed with strong spines, the two anterior being somewhat directed forward to permit the movements of the large, rather feeble-looking trophi, and a spinose occiput. The dorsum and abdomen are hairy, the fifth, sixth and seventh segments banded with spines, that on the fifth crossing the dorsum, those on the sixth and seventh limited to the sides. The pygidium is overhung with long spinose hairs. The coxæ are very broad, the anterior pair hairy. The femora have a few scattered hairs, while the tibiæ are fringed with long spiny hairs, as are also the first joint of each tarsus. A remarkable point of internal structure may still be observed—it has two spermatothecæ! All other fleas, of which I have any knowledge, have but one, and that on the left side.

"This specimen is also of further interest, as still containing within it four of the *Hippopus (Acarellus) pulicis*, the subject of a paper in the M.M.J. for 1872, of Mr. M'Intyre's comments thereon, and of reference by Mr. Andrew Murray in his work on Economic Entomology."

The President said that the largest flea he had previously seen was one exhibited by Mr. Westwood at the Linnean Society, and which he called *Pulex imperitor*. But the one now sent to them by Mr. Tatem was a giant even to that one.

Mr. Michael said that almost all insects varied immensely in size, and this was especially the case amongst the *Lepidoptera*—some being nearly double the size of others. No doubt *size* was a guide, but, taken alone, it was one of the most unsatisfactory guides in determining species. Where, however, there were differences in structure, it was, of course, of more importance.

Mr. Ingpen said he had been asked to describe a little contrivance for straining out *Volvox* and other things from water. It consisted of an inverted glass syphon, with a piece of fine muslin tied over the shorter leg. The water it was desired to strain was poured gently into the longer leg and ran over the short end, the objects floating in it being retained by the muslin.

Mr. Reeves suggested that it was a photographer's albumen strainer—so, at least, Mr. Ackland called it.

Mr. Ingpen wondered whether Mr. Ackland had ever used it for collecting purposes, and, if so, that he did not let them know of it, as it seemed to answer the purpose very well.

The President said it was often noticed that ingenious devices struck ingenious minds at the same time, there being no collusion but only coincidence.

Mr. A. D. Michael read a paper on *Labidostomma luteum* and *Pygmephorus spinosus*, two species of *Acarina* hitherto unrecorded as British. The subject was illustrated by diagrams.

The thanks of the meeting were unanimously voted to Mr. Michael for his paper.

Mr. W. H. Gilburt remarked that this field of research which Mr. Michael had made so much his own, was a very wide one, and one in which there was much to be done. If every one would bear this in mind, they might be able often to help Mr. Michael by collecting such things, as they had opportunity. On two or three occasions he had come across mites, and had passed them over to Mr. Michael for examination. He suggested this, because, although it was very easy to find them, it was not so easy to say whether they were rare or not.

Mr. T. C. White enquired what was the most favourable method of transmitting these things when they were found ?

Mr. Michael said they would travel very well during a short journey in wet moss or lichen, but if some days would be occupied in transit, they should be put in glycerine or acetic acid.

Mr. Curties asked if they would keep for some days in moss ?

Mr. Michael thought they would not.

Announcements of excursions, &c., for the ensuing month were then made, and the proceedings terminated with the usual conversazione, at which the following objects were exhibited :—

Section of *Polythalamia*, from Bombay ...	Mr. F. W. Andrew.
Anchors and Plates of *Synapta* in situ ...	Mr. F. Coles.
Notonecta glauca	Mr. F. Enock.
Bog Moss, *Sphagnum*	Mr. A. Fieldwick.
Leaf of *Deutzia gracilis*, stained	" "
Spine of *Echinus*	Mr. A. C. Goodinge.
Ophrydium versatile	Mr. H. G. Gregory.
Acarus, *Pygmephorus spinosus*	Mr. A. D. Michael.
" *Labidostomma luteum*	" "
Mandible of ditto	" "
Amphipleura pellucida, in balsam, shown by 1-25in. oil-immersion O.G., and oil-immersion condenser	Messrs. Powell and Lealand.
Leaf of Sweet-briar, stained	Mr. J. W. Reed.
Section of Sweet-briar Leaf	" "
Diatoms	Mr. J. Woollett.

Attendance—Members, 84; Visitors, 4.

Further Observations on Micro-Filariæ, with Descriptions of New Species.

By Patrick Manson, M.D., Amoy.

Communicated (with a Prefatory Note) by the President.

(*Read June* 25*th*, 1880.)

PLATES VIII, IX, X.

The interesting letters which I have now the honor to submit to the Club must be regarded as a continuation of Dr. Manson's former communication. Not merely does Manson refer to an abundant confirmation of his discovery respecting the periodical emigration and immigration of the human larval filariæ, but he here supplies us with a new fact, pointing apparently to the lymphatic system as the probable home or head-quarters, so to say, of the sexually mature worm *(Filaria Bancrofti)*. For myself, this "find" has especial interest, inasmuch as it was the circumstance of my detection of the chorional envelope of an ovum in blood sent from Australia and my communication of the fact to Dr. Bancroft that led to the original discovery of the sexually mature worm. This has been acknowledged by Bancroft. Curiously enough, in a letter received only a few days back, Dr. Sonsino (who has largely contributed to our knowledge of the filariæ, as they occur in Egypt), requested my opinion as to the precise residence or "ordinary abode" of the sexually mature Filaria. I think Manson's find tends to confirm the view that I have already entertained, if not decidedly expressed, that the home of the adult worm is to be found in the lymphatic channels. I own that the circumstance of my original "find" is somewhat puzzling, but the presence of the ovum in blood sent to me from Australia may have been accidental. Dr. Bancroft's detection of the adult worm in an enlarged gland or "lymphatic abscess" and Dr. Manson's present "find" point to the conclusion just advanced. Not only as regards size, but also as regards contour, do the empty ova detected by Manson and

myself absolutely correspond. The instant I saw Manson's figure of the "ovum," I recognised its identity with the empty egg-envelope found in the blood of the Australian.

In the first of the two letters forming the present communication, Dr. Manson describes new parasites from birds that are common in China. As he has given them no names, I have called one of these *Filaria picæ mediæ* (also found in *Gracupica*) and another *Filaria corvi torquati*. I may mention that I have already applied the term *Filaria Mansoni* to another worm which infests the eyes of domestic fowls in China. ("*Parasites*," p. 441).

The subject of avian nematode parasites is already becoming sufficiently complicated. Long ago Dr. Sonsino, now resident at Tantah, communicated to me some account of his discovery of Micro-filariæ in the Egyptian crow, and the subject has since been much extended by Lewis in regard to the Indian crow, which, if I recollect rightly, is the same bird by another name (*Corvus splendens*). In fact nematoid hæmatozoa have been found in a great variety of birds, and not unnaturally those found in crows have been conjectured to hold some genetic relation with the very common *Filaria attenuata* which infests, indiscriminately, crows, rooks, nutcrackers, magpies, and even also the ground woodpeckers (*Colaptinæ*). Evidently we are only on the threshold of this enquiry, and the elucidation of the subject is beset with practically endless difficulties. In reference to the specimens sent by Dr. Manson, I regret to say that the bottle containing adult filariæ from *Corvus torquatus* arrived broken up into a hundred fragments, but the bottle on the table, as the label states, shows a number of "Chinese magpies' hearts, with parent filariæ in the semilunar valves, both aortic and pulmonary." The pen-and-ink illustrations sent by Dr. Manson were accompanied by brief indications of their separate nature. These I have carefully collected and arranged in such a manner as to form special plates. I have also ventured to amplify the descriptions in order to explain the plates made up from the sketches. The latter, though little more than outlines, have evidently been executed with great care, and thus they will become especially valuable to systematists and others desirous of studying the genesis of avian filariæ.

In connection with Dr. Manson's previous paper, I may mention that, as supplementing the ordinary and large circulation of our Transactions, separate copies have been transmitted to *savans* resident in

foreign countries, and although acknowledgments on the part of investigators are now generally held to be unnecessary, several foreign gentlemen interested in Manson's researches have expressed their sense of gratification at the progress helminthology is making at the hands of our countryman in China.

T. S. Cobbold.

"Amoy, 19th April, 1880.

"T. Spencer Cobbold, Esq., F.R.S.

"Dear Sir,—I read in the *Lancet* of 6th March, with much interest, the short account of the meeting of the Quekett Club, on the previous week, and the discussion on Filaria. My only regret is that I did not supply you with fuller details of my observations and more decided proof of my assertion about the periodicity of the filaria's appearance in the blood. I am very grateful to you for the trouble you have taken in bringing these forward, and cannot but feel that, unless for your kind assistance, my work would lie entombed in the 'Customs Gazette,' and be of little use to any one. The paper I hope to send herewith, though prepared seven or eight months ago, is only just printed. It contains a short account of my observations on periodicity, and abundant proof of my position. I believe it will have some interest for you, especially that part which describes the formation of the sheath of the embryo hæmatozoon of *Corvus torquatus*, and the discovery in the lymphatics of the ova of *Filaria Bancrofti*.

"Believing they are new to you, I send, under the care of Dr. Faulkner, surgeon of the SS. 'Agamemnon,' specimens of the parents of the hæmatozoa of *Corvus torquatus*, and also a number of hearts of the Chinese magpie, *Pica media*, containing very ingeniously located parent worms of a species of filaria common to that bird and to *Gracupica nigricollis*. I also enclose in this letter some rough sketches illustrating the embryos, etc., and will, in the sequel, give you a brief account of what I have made out about these interesting parasites.

"*Hæmatozoa of Pica media.*—I have examined many, I suppose thirty or forty, magpies, and have never failed to find hæmatozoa in any of them. But though I searched diligently in all the viscera and large vessels, I was a long time in discovering the habitat of the parents. At last I came across a female larva in a small clot

in the right ventricle, which by rough manipulation I must have displaced. This find put me on the right track, but many birds were sacrificed in the hunt before I could find a second specimen, and definitely pronounce on the exact spot they occupy. At last I observed a minute white tubercle, the size of a No. 6 shot, apparently lying in the pocket of a semilunar valve, and, on trying to turn this out, had the satisfaction of finding it was the much sought-for worm lying coiled up with its mate, either free in the pouch of the valve, or just under the endocardium. By splitting up the pulmonary artery and aorta from the ventricles, one or more of these pale yellowish tubercles can be found in every magpie. I have seen the valves nearly all occupied by them, some of considerable size, so that the circulation must be interfered with to quite a serious extent. The worms are found sometimes in the pulmonary valves, sometimes in the aortic, and often in both. A perfect tubercle contains a pair, male and female. I think they are encysted, or at least under the lining membrane of the valve, but their presence causes so little irritation that the delicate membrane covering them is quite transparent, allowing good eyes to see distinctly through it the coils of the worms. To see these one must look into the opened pouch. I believe the young are emitted into the circulation through a minute aperture in the covering. In case the specimens I send do not turn out well, I give you a short description of the parents :—

"Male.—Length, $\frac{3}{4}''$
Diameter at neck, $\frac{1}{400}''$.
Greatest diameter, $\frac{1}{135}''$.
Diameter of alimentary canal, $\frac{1}{400}''$.
Ditto testicle, $\frac{1}{300}''$.

"Tail strongly incurvated. Double spicule. One or two very minute caudal papillæ. Blunted and slightly bilobed tail tapering down from body. Mouth simple. Œsophagus straight, $\frac{1}{50}''$ in length, terminating in alimentary canal by gradual dilatation. Alimentary canal parallel to testicle, straight, and filled with dark granular material. Integument in both sexes covered with minute characteristic tubercles or bosses ; these are largest about the middle of the animal, and less marked towards head and tail.

"Female.—Length varies very considerably—about $1\frac{1}{2}''$ is the average.

Greatest diameter, unimpregnated, $\frac{1}{125}''$.

Ditto ditto, impregnated, $\frac{1}{80}''$.

Anus, $\frac{1}{206}''$ from caudal extremity.

Vagina, infundibuliform, opens $\frac{1}{100}''$ from mouth.

Mouth œsophagus and alimentary canal as in male.

Uterine tubes unite anteriorly to form vagina which runs forward in a straight course.

Expressed embryos measure $\frac{1}{200}''$ by $\frac{1}{5500}''$; they are naked and have truncated tails.

"Free embryos. If one examines the blood of the magpie, there is usually no difficulty in finding plenty of embryos, and at first sight seemingly of two different kinds, one minute species, $\frac{1}{250}''$ by $\frac{1}{5000}''$ or thereabouts, the other larger, $\frac{1}{110}''$ by $\frac{1}{3000}''$. The smaller are languid, the larger active in their movements. A jerking, pouting, oral movement is characteristic of both. In both the mouth seems quite simple and the tail sharp and pointed. In neither have I seen any trace of lash or double outline. Betwixt the extremes of length I have given, intermediate sizes can usually be found. Neither extreme corresponds exactly with the dimensions of the embryos in the vagina of the presumed parent. There is also considerable variation in the breadth of the smaller specimens. Query—Do the embryos found in the blood belong to the same species, and are they thus early commencing development and separation into male and female? Last December I examined a female parent from the heart-valves, and found in her vagina embryos of $\frac{1}{200}''$ by $\frac{1}{5000}''$, and having truncated tails. In the same bird were two male worms, and another unimpregnated female. I found no large free embryos in the bird's blood, only numerous small ova very short and very stout, $\frac{1}{225}''$ by $\frac{1}{3000}''$; therefore, if the valve worms were the parents of the embryos free in the blood, their offspring must have diminished in length, increased in breadth, and have had their tails sharpened. And if the larger specimens of free embryos are also the progeny of the valve worms, they too must have had their tails sharpened and grown in length at the same time.

"You will require to use great gentleness in removing the worms from their cysts, as they are very delicate and easily broken. I have half extracted the worm in some instances as a guide to the

situation the rest of the body occupies. The ventricles and vessels have been split up, and unless the spirit has altered appearances very much, you will have no difficulty in finding the parasites. Perhaps before attempting their removal it would be well to soak the heart in some solution of about the specific gravity of blood. I find urine answer very well for this purpose ; it restores the proportions lost by exosmosis.

"*Hæmatozoa of Corvus torquatus.*—About one third of the crows I have examined contained two kinds of blood worms. These two kinds are quite unlike each other, but whether they are of distinct species or only different stages of the same I am not prepared to say. Of the two kinds the larger measures from $\frac{1}{100}''$ to $\frac{1}{120}''$ by $\frac{1}{5000}''$, the smaller $\frac{1}{165}''$ by $\frac{1}{5500}''$. The former is very active and has a lashing, free, vigorous style of movement ; the latter is languid and has a slow, wriggling, worm-like motion. The oral movements in both kinds are very distinct, and when it is open four papillæ can be distinctly seen surrounding the mouth. In the larger species a bright line extends backwards from the mouth into the body suggesting an œsophagus. The tail of the larger kind is gradually tapered down and pointed, and the general contour of the body and habits of this embryo resemble very closely those of the embryo of *Filaria immitis.* The tail of the smaller kind tapers but slightly and is abruptly truncated, and by careful focussing one can in most specimens detect a thin skin extending like a loose bag or hood from the head. The truncated tailed and hooded embryos die very soon after being placed on the slide, but their companions I have seen alive and active in an oiled slide ninety-six hours after their removal from the host. Though the proportion of these two kinds of embryos varies considerably in different birds, yet where one is found the other is sure to be present also.

"Parents are sometimes found in the right ventricle, but most commonly in the pulmonary artery and its branches. The best way to find them is to open the pericardium, and after dragging the heart well up with a hook transfixing its apex, scrape with a blunt knife as much as possible of the soft lung tissue from the pulmonary arteries and then divide them deep in the lung. They can then be easily split up or divided at intervals and the worms expressed. Those I send you were thus obtained, and are the produce of one bird.

"Male—Length $\frac{3}{8}''$
Greatest diameter $\frac{1}{150}''$
Diameter of neck $\frac{1}{400}''$
Length of œsophagus $\frac{1}{40}''$
Diameter of alimentary canal $\frac{1}{600}''$

"The body in both sexes is smooth and very transparent. Mouth simple. Œsophagus very wide near its termination in the intestine. Spicules double. No papillæ. Tail tapering to blunt extremity. Testicle extends to near œsophagus where it is doubled on itself. Arms close to end of tail.

"Female—Length $\frac{3}{4}''$ to $1''$
Diameter $\frac{1}{90}''$

"General appearance the same as the male. The vagina spans about $\frac{1}{100}''$ from the mouth. If the female is placed in a suitable medium such as aqueous humour, she retains her vitality for some time, and the movements of parturition can be distinctly seen. At short intervals a peristaltic contraction commencing in the uterine horns and increasing in force as it descends to the vagina expels every few seconds a small group of embryos of the blunt-tailed hooded description. A section of the worm some distance from the vagina permits the escape of embryos, plainly showing the gradations of stretching that converts the chorional membrane into the sheath of the free embryo (see illustration). Do you consider the sharp tailed, vigorous and larger hæmatozoa of the same species and advanced in development as specifically distinct?

"*Hæmatozoa of Gracupica nigricollis.*—This bird harbours two, if not three, distinct species of hæmatozoa. One, such as I have described in the paper, I send you, measuring about $\frac{1}{95}''$ by $\frac{1}{3500}''$, with a tail not quite sharp, very vigorous and destitute of lash or hood. Another measuring in length $\frac{1}{160}''$, and a third kind (associated with the valve worm), $\frac{1}{200}''$ by $\frac{1}{7500}''$, probably the same as those of *Pica media*—though offspring and parents were more minute in the birds I have examined. The valve worm is exactly like that of *Pica media*, having the characteristic bosses studding its integument.

"*Hæmatozoa of Goura coronata.*—This bird comes from the Malay Archipelago. It lived in confinement in China for almost a year, but last winter died—apparently from cold. Its blood contained a fair proportion of hæmatozoa with head and tail lashes exactly like those of *F. sanguinis hominis.* I examined the heart, large

vessels and viscera, but found no parent form. The embryos measured about $\frac{1}{90}''$ by $\frac{1}{5000}''$. Its tail was unlike that of *F. s. h.* being truncated and slightly bulbous like the point of a "Bougie Olivaire." I observed that there seemed to be a sort of articulation (and something of the same sort I have seen in *F. s. h.*), about $\frac{1}{2000}''$ from the tip of the tail, for when in motion this part was often bent at an angle and not in harmony with the sweep of the rest of the body. The integumental character of the lash was very evident, and double outline could be recognised in the body. Often the bag or lash could be seen most distinctly long distances from the tail. There was no trace of vessel in the body, which appeared to be quite homogeneous even under a high power.

"I trust these notes, along with the specimens and paper I hope to send you, may be of some interest, and I would again request you to make what use of them you see fit.

"Apologising for the trouble I give you, and again thanking you,

"Believe me,

"Yours faithfully,

"PATRICK MANSON."

DESCRIPTION OF PLATES VIII, IX.

1.—Outline representation of large Hæmatozoa *(a, b)* and three blood corpuscles *(c)* of *Corvus torquatus*. × 350 diameters.

2.—Outline of an ovum of *Filaria Bancrofti* found in the inguinal lymphatics. × 350 diam.

3.—Seven illustrations *(a—g)* showing the mode of formation of the sheath of the smaller hæmatozoa infesting *Corvus torquatus*. × 350 diam.

4.—Mature examples of the male (*a*) and *(b)* female *Filaria corvi torquati* (Mans. and Cobb.) Natural size.

5.—Mature examples of the male *(a)* and *(b)* female *Filaria picæ mediæ* (Mans. and Cobb.) Natural size.

6.—Head *(a)*, tail *(b)*, and section of the body *(c)* of a male *Filaria corvi torquati* (Mans. and Cobb.) × 350 diam.

7.—Head *(a)*, tail *(b)*, and section of the body *(c)* of the male *Filaria picæ mediæ* (Mans. and Cobb.); the head of the female worm *(d)* being also represented to show the narrow œsophagus and also the outlet of the vagina immediately below the mouth. × 350 diam.

8.—Outline representations of nematoid hæmatozoa from *Pica media* (*a*), from *Gracupica nigricollis* (*b*), from *Corvus torquatus* (*c*), from *Goura coronata* (*d*) and from the dog (*e*), showing their relative sizes and forms. × 350 diam.

"Amoy, 4th May, 1880.

"T. Spencer Cobbold, Esq., F.R.S.

"Dear Sir,—I hope you will excuse me troubling you with another letter so soon; but it is only because I think you are interested in the subject of worms even more than I am, that I venture to tax your patience so frequently.

"First, I am sorry to say that the paper I intend sending you has not arrived yet.* I regret this the more as it would partly explain what I write about now. Briefly—from observations in the day I have some reason to think that the embryos of *F. Bancrofti*, while absent from the general circulation during the day, are resting in pulmonary circulation. To test this idea, I have for a long time been on the look-out for cases of hæmoptysis, that I might obtain lung blood at the proper time. Hitherto I have never met with a blood-spitting filarious patient. But some time ago a Chinaman consulted me about some eczematous patches on his face and legs. While he was speaking to me I observed that his voice was very rough, and that once or twice he hawked up sputum tinged apparently with blood. I thought he had a chance of being filarious, and so put a little of the sputum under the microscope. But instead of finding it swarming with filariæ, I found it plentifully besprinkled with the ova of some other parasite.

"Enquiring about his history, I learned that he was a secretary in the salt mandarin's office in comfortable circumstances; that he was a native of Foochow, where he had resided till he was 21 years of age. He is now 35. Eight of the intervening years he spent in North Formosa, at a town called Tiek Tcham, and it was in this place, a year after his arrival there, or about 13 years ago, that hæmoptysis first began. The history of the hæmoptysis he describes as follows—When 22 years of age it began. Every day he spat from an ounce to half an ounce of blood for 19 days in succession. He had very little cough. At first the expectoration was pure blood, but after three or four days it became mixed with mucus. Hæmoptysis returned six months afterwards; the blood was smaller in quantity, and appeared in the sputum for three or four days only. Since then he has spat blood for a few days at a time every two or

* Since Dr. Manson's paper was read, I have received the printed communication referred to. It came to hand July 28, 1880, and is entitled "Additional Notes on *Filariæ sanguinis hominis* and Filaria-Disease." The paper is illustrated by four photographic plates of Elephantiasis Arabum.—T. S. C.

three months, without cough, the blood being mixed with mucus after the first mouthful of pure blood. He is in good general health. His eczema he attributes to a severe attack of scabies. His father is dead, but never had cough; his mother died ten years ago of cough. Two brothers and two sisters alive and well. Though he is thin, there was no auscultatory sign of phthisis, and I could not but associate the parent of the ova and the hæmoptysis as cause and effect. He has no filariæ in his blood.

"From November 5th to December 18th, 1878, I had in hospital here a Portuguese, for many years a resident in North Formosa. He came over from Formosa sick. I diagnosed thoracic tumour, probably aneurism. He improved with the rest and returned again to Formosa. In June, 1879, he died suddenly, and Dr. Ringer made a post-mortem examination, with the particulars of which he kindly furnished me. Death was caused by rupture of an ascending aortic aneurism into the pericardium. He found the lungs slightly congested, and on making a section, came across a small parasite lying on the lung tissue, which he says might have escaped from a bronchus.

"When my Chinese patient told me he had been long resident in North Formosa, and that his hæmoptysis began there, I thought it not at all unlikely that Dr. Ringer's parasite and that in the lungs of my patient were identical. Dr. Ringer kindly, in reply to my letter, sent me the parasite—the only specimen he obtained—and in the sediment of the spirit I found ova of the exact dimensions and general appearance of those I found in the sputum of the Chinaman.

"I could not find in your 'Parasites' a worm to correspond, and as I have some idea that this worm is not an unfrequent cause of hæmoptysis in Chinese, I turn to you for more information. I send the worm—evidently a fluke—and also a sample of the Chinaman's sputum. I also enclose drawings of eggs and outline of the parasite in case my package miscarries. I fear the worm is somewhat mutilated, but, I trust, not past recognition.

"Yours faithfully,

"PATRICK MANSON."

NOTE BY THE PRESIDENT.

"On returning home from the Q. M. C. Meeting, I found that Dr. Manson's 'package' had arrived. The sputum I have not

examined at present ; but on the 27th of June I satisfied myself that the fluke was new to science, and accordingly I propose to call it *Distoma Ringeri*, after the discoverer. Though mutilated, the oral sucker was well shown, as also were traces of an organ which I regarded as the remains of the ventral acetabulum. When flattened on a glass-slide, the capsules of the vitellarium were well seen, and occupied fully four-fifths of the body, lying deep under the dermal surface. The worm reminds me very much of the fluke *Distoma compactum* which, many years ago, I detected in the lungs of an Indian Ichneumon, but it is much larger and evidently a distinct species.

"T. S. Cobbold."

DESCRIPTION OF PLATE X.

Fig. 1.—Outline of a fluke obtained from the lung of a Portuguese. (*Distoma Ringeri*, Cobb.) Nat. size.

Fig. 2.—Eggs of a fluke from the lung of a Portuguese. × 350 diameters. *a*, *b* with the operculum detached; *c* with the contained embryo.

Fig. 3.—Five separate views of ova taken from the sputum of a Chinese; *a*, *b* and *c* with their opercula detached; *d* and *e* with the shells ruptured by the covering glass. × 350 diameters.

Helminthological Observations upon the Endemic Disease Developed among the Labourers in the Tunnel of Mount St. Gothard.

By Eduardo Perroncito, M.D., Turin.

Communicated (with an Appendix) by the President.

(*Read June* 25, 1880).

The observations already made by me * authorise me to declare that amongst the workmen of Mount St. Gothard, together with symptoms of Oligæmia perniciosa, are found (abstracting the common *Ascaris*, *Oxyuris* and *Trichocephalus*) three different helminthic species, in greater or lesser number in their intestines, producing identical clinical phenomena. These three species are : the *Anchilostoma* or *Dochmius duodenalis* of Dubini, the intestinal *Anguillula* and Bavay's *A. stercoralis.* I have observed that some individuals are affected only by anchilostomes, or chiefly by these parasites ; others are affected only by anguillule, or chiefly by anguillule, without being able always to determine the differential diagnosis between the two affections according to the facts hitherto acquired by science. My deductions are essentially based on the fact of having found individuals, who evacuate nearly exclusively eggs more or less abounding with the characteristics of those of the *Anchilostoma ;* other individuals who evacuate eggs more or less in number, with the anatomical characteristics and the very irregular opening, like those of the *Anchilostoma*, which, cultivated, give origin to embryos and larvæ with anatomical characteristics and habits different from those of the *Anchilostoma*, and which I declare to belong to the *Anguillula intestinalis* of Bavay. In patients specially affected by *Anguillula intestinalis* I have repeatedly found in the substances newly evacuated, amongst a greater or lesser number of eggs, numerous larvæ, moving rapidly in divers ways, having the anatomical characteristics of those denominated by Bavay the *Auguillula stercoralis.*

* See Appendix.

ON THE LARVAL DEVELOPMENT OF THE ANCHILOSTOMA OR DOCHMIUS DUODENALIS OUT OF THE HUMAN FRAME.

The eggs of the *Anchilostoma* are oval, thin shelled, sometimes so thin as to appear only veiled, of simple form, transparent, the medium longitudinal diameter being 52μ. and the transversal 32μ. Cultivated by proper means and necessary heat, they proceed more or less rapidly in their process of segmentation, and thence to the formation of the embryo. Already, after from 12 to 14 hours of incubation, the first larvæ are very rarely found ; after a day and a half to two days the greater part of the eggs are open, or present the embryo in different stages of development.

At the second, third and fourth day of incubation, the number of larvæ always augments in progressive stages. Besides, the maturation and hatching of the eggs never happens regularly, and even after many days of incubation embryos are formed, and the hatching of new larvæ effected.

I frequently saw the larvæ make their exit from the shell head first in more or less time, according to the temperature at which I kept the preparations. Keeping the mature eggs at the heat of 28 to 33 degs. centigrade, the opening may be seen to occur in two or three motions, which succeed each other in less than a minute. The larva with its head usually opens the egg rather laterally from the point ; springs half out, and then with strong lateral movements of the whole body holding by the head to the shell of the same egg. The newly-born larvæ usually seem torpid ; in some cases they repeat the same motions as when they were enclosed in the shell. Thus, the new larvæ execute movements which may be called automatical, and employ different lengths of time before being able to extend themselves fully. If one observes the embryo through the egg-shell before hatching, one sees it already formed like the newly-disclosed larvæ or like those that are two, three, four, or more days old. As soon as hatched the larva is about 200μ. long, and the greatest transversal diameter is 14μ. It presents itself as more slender upwards from the bulb of the pharynx ; it terminates downwards with the tail lessening and awl-shaped. The head is three-lobed and the mouth is represented by a small rectangular tube 12μ. long, which is continued into the pharyngeal canal. The pharynx has an anterior dilatation, which is gradually restricted to form afterwards a fresh globose dilatation, or pharyngeal bulb furnished

with chitinous (?) teeth, bounding a triangular space in the central portion. The pharyngeal canal has very strong and muscular partitions. It is continued in the intestine of a cellular nature, with its internal cavity disposed in zigzags, more or less wide, and terminates in the arms situated upon a small external lateral projection. Towards the middle, on the oral side of the larva is already to be seen a small ovoidal body which pushes inward the intestine and is found on the external part, niched in a corresponding depression of the muscular-dermical layer of the larva. This small body is the rudiment of the genital apparatus which appears very conspicuously in the embryo, and is observed more or less distinctly in the different periods of development of the larva towards the free state. When one day old, the larvæ are already 250μ. long, and, in the mean, I have calculated that, if the temperature does not exceed 24 to 25 deg. centigrade, with temporary diminutions, they attain about 50μ. each day. At a higher temperature and under more favourable conditions, they may even attain from 80 to 100μ. in length, and 2μ. in transversal breadth per day. Their greatest length, however, is about 550μ. and breadth from 20 to 24μ.

After eight hours' life of the larvæ, I have seen the waving zigzag disposition of their intestinal canal disappear with increase of growth, the intestines become straight and indicate the longitudinal axis of the body. The larvæ, at first weak and moving only in the temperatures adapted to them, become robust, and in a few days have a snake-like motion, even at a temperature of 14 to 16 deg. cent. They undergo no change; but when they have reached the maximum length and breadth, a great change manifests itself in their pharyngeal canal. It may be said that this canal melts, to be transformed gradually (in a day and a half to two days) into another pharyngeal canal differing in its structure to that met with in the new-born larvæ before the incapsulation. Whilst the pharynx is greatly modified, the skin separates a substance chitinoid (?) glassy, transparent, which in a very short time is condensed, and forms a capsule which encloses the living larva. This is seen to move freely in its capsule or cyst, which completely repeats its shape. The incapsulation having taken place, the mouth changes, presenting already the rudiments of the hooks and stings; the new pharyngeal canal is perfected, whilst the intestine loses its primitive structure, the number of granules diminishes, becomes more transparent, with very fine granules and particular disposition of the elements. Be-

tween the 6 deg. anteriorly and the $\frac{5}{6}$ posteriorly appear the representatives of the papilla which are found laterally in the perfect *Dochmius duodenalis*.

At first the body of the larva is not perfectly adapted to the capsule ; between the one and the other is a vacant space which sometimes diminishes by degrees, so as to succeed in being better adapted, especially at the two extremities of the body. After from one to two days, their skin separates from the salts of chalk (particularly from the carbonate of chalk) which, at first under the form of granules, and after of corpuscles, shining, rounded, rectangular, become one with the capsule. Thus this becomes always more rigid and friable, is sometimes easily broken by the movement of the capsuled larva or in manipulating the preparations. At other times it constitutes a protecting cuirass that resists rather strong pressure.

Arrived at this point, the calcified capsule is easily dissolved by the gastric juice and by dilutions of chloridic acid without producing effervescence, and thus is set at liberty the beautiful larva, of yellow colour, full of life. But its development stops here, and its death is inevitable, unless it be carried into the human organism. The capsuled larvæ resist a desiccation of 24 hours, and with the addition of liquids, indifferent to preparations allowed to dry for that lapse of time, they were seen to revive and become gradually as lively as before. This particular resistance of the mature larvæ to protracted desiccation demonstrates how the capsules containing the living parasite can, by their great fineness and resistance, be sometimes transported by the wind to a great distance, with the dust suspended in the air, and infect localities previously healthy. Once that the larvæ are mature, or nearly so, that is, capsuled, they live in limpid or in muddy water, explaining thus an infection even to a distance with the translation of living larvæ. In waters containing little albuminous material or chalky salts, I kept some that were most lively for more than 17 days after the incapsulation. The intensity of the infection from waters containing them is shown in my own preparations, in some of which in less than one drop of liquid more than a hundred mature larvæ might be counted. After two days of desiccation, by adding water, I obtained the return of the larvæ to their normal physical state ; but though I warmed them to the proper point, there was only in one any signs of vitality.

ON THE DEVELOPMENT OF THE SO-CALLED ANGUILLULA INTESTINALIS OF BAVAY.

The eggs of the so-called *Anguillula intestinalis* are more ovoidal, less elliptic, that is, with the ends less acuminated, less obtuse ; they have, however, very variable diameters, like those of the *Dochmius duodenalis.* Their longitudinal diameter is between 50 and 58μ. and rarely reaches 60μ., the transversal between 30μ. and 34μ., rarely 36μ.

The eggs scarcely emitted present themselves with the yolk segmented in 2, 3, 4, 5, 6, even 8 cellules. Placed in incubation in places adapted, and at a temperature of 25 to 26 deg. cent., they are developed rapidly, though in an irregular manner. For these also the rapidity of the development essentially depends on the degree of heat in which are maintained the substances of incubation. After 12 to 16 hours of incubation, many eggs are found with the embryo nearly or entirely developed, which rolls in different ways inside the egg, and after 14, 16, to 20 hours, more or less, numerous embryos will be found issued from the respective eggs. These entirely developed embryos appear already through the shell of the eggs with greater brightness than those of the *Anchilostoma*, and have more rapid motion. They adapt themselves, like the others, to the convexity of the sides of the eggshell, and reach a length about four times that of the egg. The hatching is rapidly accomplished, and usually by means of the head. Once, however, I saw an embryo issue tail first from the egg ; the tail was straight and without motion, because, with the hope of finding the larvæ at the moment of opening the egg, I examined the preparations at a comparatively low temperature (10 to 12 deg. cent.).

The embryo is usually torpid for a short time after first issuing from the egg, but not always. Soon afterwards the larva moves in different directions, with a rapid, serpent-like motion, particularly if the preparation be maintained at a proper heat. The larvæ, as soon as born, have a length of 200 to 240μ., a transversal diameter of 12μ. ; are slender anteriorly, and terminate with a very sharp tail, so that it is difficult to distinguish them from the larvæ of the *Anchilostoma.* They have also an apparently three-lobed head, a rectangular mouth-like cavity, which is contained in a first swelling of the pharynx, which becomes restricted, to constitute afterwards an inferior swelling or pharyngeal bulb. The intestine is also cellular,

first in zigzags, and then straight with the lengthening of the larva. It presents on the anal side, towards the middle part of the body, between the intestine and the muscular-dermal stratum, an ovoidal corpuscule smaller than in the larvæ of the *Anchilostoma*, evidently the representative of the genital rudiment. The larvæ of the *Anguillula intestinalis* are distinguished from those of the *Anchilostoma* by their different habits and mode of life. Whilst the larvæ of the *Anchilostoma*, before incapsulation, do not live in liquids, those of the *Anguillula* seem to need them. Substances rather hard put in incubation, after 24 hours, gave a strong contingent of open larvæ, which were, however, for the most part dead. This is always revealed, as in the larvæ of the *Anchilostoma*, by a fatty granular degeneration of the tissues constituting the larva, so that the change supposed or described by others for the larvæ of the *Anchilostoma* becomes simulated even in these dead larvæ of the *Anguillula*. Repeated experiments convinced me of the necessity of changing the mode of cultivation for the *Anguillulæ*.

And this method was especially suggested to me from having observed that the larvæ of *Anguillulæ* lived capitally in preparations with distilled water, common water, and with dilutions of chloride of soda and sulphate of soda in different degrees of concentration up to 5, 6 and 7 per cent., as will be the better proved by the description of the experiments made thereof.

If to the substances containing eggs of *Anguillula* water be added, so that the larvæ as soon as born can swim and freely exercise their serpent-like motion, after 24 hours they may be found of the length of 480μ. So that, supposing the medium length of the newly hatched larva to be 240μ. it grows in one day to double its length. In a very short time they present a transformation in their internal organisation. They still maintain the same breadth of 12μ. and arrive at most to 16μ. on a length of 400 to 500μ. Their head becomes rounded, the pharynx and the mouth are completely changed, and are substituted by a granular protoplasmic substance, which supposes the formation of other organs. The internal cavity of the body, for the whole length of the larva to the anus is seen to be granular and compressed between the muscular-dermic structure of the two sides forming the skin. With the transformation of the alimentary canal, analogously to what succeeds in the larvæ of the *Anchilostoma* is produced the capsule that encloses and takes the form of the larva. This capsule, observed with my pupil in the laboratory, acting as assistant, Dr.

Vittore Carità, is 503μ. long, and the maximum diameter 16μ. It is chitinoid, very thin like a veil, so that it easily escapes observation if it be not very intent. With the maturation of the larvæ comes the calcification of the cyst or capsule like that of the *Dochmius*. Previous to the calcification of the capsules the *Anguillulæ* are still more lively than the *Anchilostomata*, and move very rapidly in the water.

ON THE LARVAL DEVELOPMENT OF THE SO-CALLED ANGUILLULA STERCORALIS OUT OF THE HUMAN BODY.

The eggs of the *Anguillula stercoralis* develop the embryo in the maternal uterus, and the larvæ are emitted with the excrements in divers degrees of growth, sometimes already capsuled. Generally, however, they are found in varying number, very lively, and not capsuled in newly evacuated excrements. Having measured several of these larvæ, I have found them to be from 200 to 260μ. long, and 14 to 16μ. broad. They have the anterior part of the body more uniformly large than the larvæ of the *Anchilostoma* and of the so-called *Anguillula intestinalis ;* the head is larger, the buccal cavity shorter, the pharynx more dilated but shorter, the intestine wider and longer, with swellings or tumours, the genital rudiment very distinct, of navicular shape, very characteristic, about 25μ. long, in the middle 3μ. wide. These larvæ, after one day of free life, are usually found capsuled.

Experimenting on the larvæ of the three helminthic species briefly described, the action of a graduated temperature with a Schultz's table, I have repeatedly seen that they die at 50 degs. cent. in a space of time never more than 55'.

On the larvæ of the *Anchilostoma* I have experimented the action of different medicated substances, whose action will be described in my work with illustrative figures. Meantime the fact is that in all the individuals affected by Oligæmia perniciosa coming from Mt. St. Gothard and examined by me (and they are numerous) I have found in their evacuations more or less number of the eggs of *Anchilostoma* and *Anguillula intestinalis*, and in some also innumerable larvæ of the *Anguillula stercoralis* of Bavay. In all the cases the *Anchilostoma* and *Anguillula* are in such considerable number as to explain by their presence alone a more or less serious Anæmia. For which I believed myself justified in asserting that the Anæmia perniciosa becomes epidemic among so many poor creatures

obliged to work in conditions favourable to the development and multiplication of the above parasites, (as I can better demonstrate in my complete work,) has been sustained by a helminthiasis for *Anchilostoma*, or *Anguillula*, or for all three specimens simultaneously in the same individuals. It would seem to be an endemic of a nearly parasitical nature. The mode in which especially the *Anguillula intestinalis* is developed authorises me to take this nematohelminth from the genus assigned it by Bavay. It should be placed in the genus *Strongylus*, and might opportunely be named "*Strongylus papillosus*," as I hope to prove.

Appendix by the President.

The foregoing observations on the part of Professor Eduardo Perroncito were originally communicated to the Science Academy at Rome (May 2, 1880). So important are Perroncito's researches in themselves that they are worthy of republication in their present form in the Transactions of our Club; but, apart from their intrinsic merits, it is of some moment that their relation to other records of parasitism should be made clear. Endless confusion exists on this subject.

I may observe that, notwithstanding the admirable clearness of Professor Perroncito's descriptions, there are some few passages I have not quite understood. However, I have taken as few liberties with his English manuscript as possible, altering only such words as were absolutely necessary. It may be as well to add that the symbol employed by Professor Perroncito (namely, the Greek μ,) means the thousandth part of a millimetre.

Through its Geneva correspondent, the *Times* newspaper recently called the attention of the English public to the so-called Mount St. Gothard outbreak of "Tunnel Trichinosis." It was in this way that an unwarrantable use and abuse of the term Trichinosis originated in this country. Had the error stopped where it commenced, no harm would have been done; but, to make matters worse, our leading medical journal fell into a similar mistake, and described yet another form of parasitism—which had no more to do with Trichinosis than with Anchylostomosis itself—as Trichinosis! In an article entitled "Trichinosis and Trichinosis," the *Lancet* included a parasitic affection which was found to be associated with an outbreak of typhoid fever on board H.M. training ship "Cornwall." Not a single Trichina was found in any case, not even in

the exhumed body, and moreover, the symptoms did not correspond with those of Trichiniasis. It will scarcely be believed that in spite of all this, the official reporter to the Government actually had the boldness to affirm, in the title of the report, that the "Cornwall" fever was "proved to be Trichinosis." As the subject had been brought before Parliament on several occasions, I felt it to be fairly within my prerogative to correct the error. Accordingly, in the *Times* newspaper I was permitted to contradict the major conclusion sought to be established by the Government report, and subsequently in the pages of the *Sanitary Record* I repeated the same statement. It was this that brought the *Lancet* into the field, and in the article entitled "Trichinosis and Trichinosis," directed against myself, that journal sought to screen or modify the palpable error of the Government reporter. The professional public at home having thus been misled, the error did not stop here, for after a short interval an American professional periodical followed suit, and quoted the "Cornwall" outbreak as a genuine instance of Trichinosis.

Not less than half a dozen kinds of nematoid parasites have been falsely relegated to the genus *Trichina*, and as if this fact were not in itself sufficiently misleading, we have now to deal with a new set of yet more grievous misconceptions. I do not stop here to indicate again the probable source of the rhabditiform larval parasites found in the "Cornwall" fever patients, but I may state that in reply to a letter from Dr. Buchanan I suggested to him that the new worm described in the Government report should be named *Rhabditis Cornwalli*. It is questionable if they be not immature examples of *Rhabditis terricola*.

In the presence of so much confusion of terms, it may be desirable by-and-bye to catalogue the misnomenclatures of the genus *Trichina*, but at present I will only refer to one of these in connection with the supposed disease. I allude to the error of Herr Borell, who, in Virchow's Archiv for 1875, has permitted himself to call the micro-filarial infection of crows a form of Trichiniasis! It is satisfactory to see that Dr. T. R. Lewis has recently exposed the folly of this proceeding. It is needless to say that the avian disorder would be more correctly designated Filariasis. It is impossible to conjecture when the literary absurdities to which I have alluded will cease; but to those of us who are interested in the advance of Helminthology it seems a waste of time to occupy oneself in correcting misrepresentations. These errors are mostly incurred by individuals who, though highly cultured, have no practical

knowledge of the parasites about which they write so authoritatively.

In his introductory remarks, Professor Perroncito alludes to a former paper (written in conjuction with Prof. Concato). As he has been good enough to supply me with a copy of that paper, in French, I think its republication will materially add to the value of his present contributions. I append it accordingly.

T. S. Cobbold.

The Anchylostomosis of St. Gothard.

(Communication que MM. les Professeurs L. Concato et E. Perroncito ont fait à la R. Académie de Médecine à Turin, dans la séance du 27 Février, 1880, sur une maladie produite par l'Anchylostome duodénas).

À la clinique dirigée d'un de nous (Concato), ont été accueillis, en peu de jours, trois individus affectés d'Anchylostomiose. À ce qu'on peut juger par l'examen des fèces, le nombre des anchylostomes qu'ils tiennent dans leur intestin, est assez grand, et y correspond l'état du patient. Ces individus sont tous extrêmement dénourris en suite de grave et menaçante oligoémie. Aussi faisant abstraction du fait même de la multiplicité des cas de cette maladie, jusqu'ici retenue bien rare, ce que nous exposons maintenant se fait très-important parce que tous ces malades sont des ouvriers travaillant au tunnel du Gothard. Ils nous rapportent que leurs camarades s'y trouvent en centaines affectés par la même maladie, et cette assertion nous vient d'être confirmée par Mons. le Médecin d'Ajrolo, à qui nous avons écrit pour d'autres renseignements.

Nous nous faisons devoir d'appeler l'attention sur l'insurger épidémique, et en proportions si considérables, d'une maladie qu'on croyait rare. De nouvelles études nous renseigneront plus exactement, et nous nous empresserons de faire part à l'Académie du résultat. En attendant, nous appuyant aux observations expérimentales faites d'un de nous (Perroncito), selon lesquelles les anchylostomes soumis à l'échauffement ne survirent pas à la température de 45 à 46° C., nous avons tenté l'intéroclisme avec l'eau chaude à 48—50° et plus C. Les preuves déjà faites sur les animaux et hasardées sur l'homme nous font espérer un heureux succès.

First—The rapidity of the current is diminished in the recumbent posture, and (*in women and children at least*) still further during sleep. It seems probable that there may also be an integral change in the relation of the red and white corpuscles approaching that which takes place when the circulation is retarded in the web of a frog's foot. This modification of the internal constitution of the main current may cause the *Filariæ* to adhere to the sides of

DIRECTION TO BINDER.

Pages 65-6 and 81-2 of the last number are to be cancelled, and their places supplied by those reprinted herewith.

help to determine the location of the *Filariæ*.

Third—The temperature of the blood is probably lower, *relatively to that of the tissues* (or it may be higher) during sleep than in the alternative state, consequent on the presence, or absence, of special elements derived from the food.

It does not seem likely that there can be any considerable change of condition consequent upon the periodic or occasional discharge of lymph and chyle into the blood; but it may happen that when the circulation is slow and the body lies recumbent, the parasites are thrown into the main current and therefore appear in greater numbers. It is premature to speculate on the causes of a phenomenon which may yet prove to be exceptional, but if the conclusion arrived at should be maintained, it will certainly be the duty of physiologists to pursue further into detail, than they have ever yet been carried, certain neglected inquiries as to the altered conditions of the blood during sleep, and when the brain and body are awake.

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First—The rapidity of the current is diminished in the recumbent posture, and (*in women and children at least*) still further during sleep. It seems probable that there may also be an integral change in the relation of the red and white corpuscles approaching that which takes place when the circulation is retarded in the web of a frog's foot. This modification of the internal constitution of the main current may cause the *Filariæ* to adhere to the sides of the vessels during rapid circulation, and to fall into the stream when it moves more slowly.

Second—The oxygenation of the blood at night and in repose is supposed to be less complete than during the day; although some experiments made by Pettenkofer and Voit point to an opposite conclusion, and make it appear that of the total amount of oxygen taken in during twenty-four hours 67 per cent. is taken in by night, and only 33 per cent. by day; 58 per cent. of the carbonic acid eliminated during twenty-four hours being given off in the day, and 42 per cent. by night. From these results Somner drew the inference that sleep was caused by exhaustion of the reserves of oxygen during the waking state, that oxygen was stored during sleep, and that when the equilibrium was re-established by accumulation the subject awoke. This hypothesis is barely tenable, but it is worth while to mention it in this connection because it accords with the presumption that the blood is more—or less—abundantly charged with oxygen during sleep; and this may help to determine the location of the *Filariæ*.

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Letter by Dr. Manson.

"Amoy, 20th June, 1879.

"T. Spencer Cobbold, Esq., F.R.S.

"Dear Sir,—Last mail brought me your kind letter of 28th April, and enclosures. I am glad your new work is about coming out, and hope my London agents have forwarded a copy long ere this time. Had I been in possession of it, I would not have troubled you with questions about *Distoma crassum*. I suspect you are very often annoyed in this way, and I am very much obliged for your courtesy in noticing my letter.

"I will forward by this mail filaria-impregnated mosquitos. They are preserved in glycerine, and were fed on the blood of the man whose case I append. His scrotum I sent to you some time ago in charge of Dr. Holmes, a surgeon in one of Holt's steamers, who kindly promised to hand it to you. I hope you will pardon the delay in sending the mosquitos; being in general practice here, the many interruptions this entails make work of this sort exceedingly difficult to carry out quickly.

"I read in the *Lancet* lately an account of the discussion on a Lymph scrotum sent from India, and felt disappointed that the *Filariæ* were not found. I determined to send you the first scrotum I amputated, and in which I had unquestionable evidence of *Filariæ*. The scrotum I send is the result, and to complete the case I send particulars of the man's history, and the result of the examination of his blood before and after the operation. The case is one of much interest, as it exhibits, first, the transition from Lymph scrotum to Elephantiasis; secondly, it demonstrates unmistakably that the parent worm is not necessarily present in the affected tissues themselves, though probably in close proximity. I had hoped you might find the *Filaria Bancrofti* in the scrotum, but the embryos persisting in the blood weeks after the operation show that this is unlikely. Thirdly, it illustrates well a new fact in the history of the *Filaria*—the young escape into the circulation at regular intervals of twenty-four hours, the discharge commencing soon after sunset and continuing till near midnight, from which time till the following noon their numbers gradually decrease; by two or four o'clock till six they are nearly completely absent. This is a striking and most suggestive fact, and in connection with it one might be tempted to speculate on the causes of the periodicity of

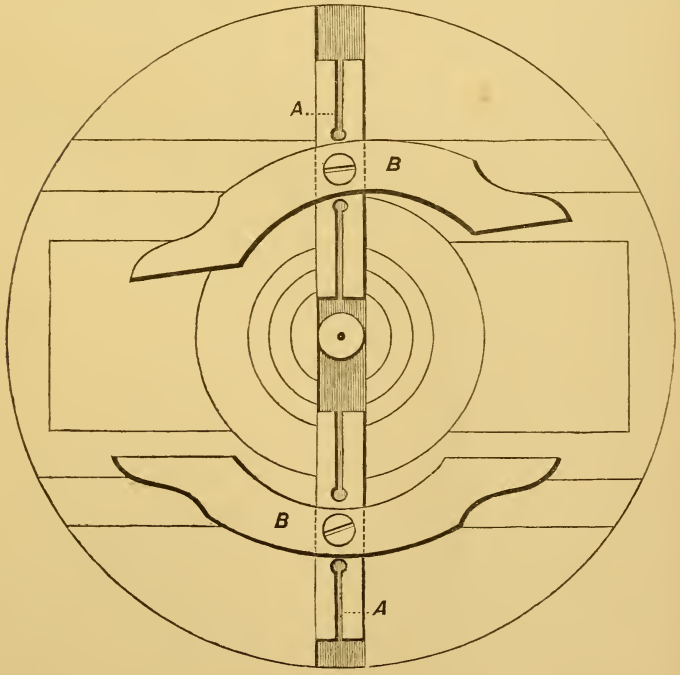
Description of an Improved Microscopical Turntable.

By Chas. G. Dunning.

(Read February 27th, 1880.)

It has occurred to me that some modification might with advantage be made in the ordinary form of Microscopical Turntable. The principle involved in the various self-centering and clipping arrangements is good so far as it goes, but the sphere of action with all these is more or less limited, owing to the fact that, however desirable it may be, you cannot possibly work *out of the centre* with them, and it is with a view to overcome this inconvenience that I have devised the form I now bring to your notice.

The design consists of the usual circular table as shewn in the figure,



with the addition of a dovetail groove across the centre, in which work the two sliding guides AA. To these guides are attached the clips BB. One of the clips is fixed at right angles to its guide, the other being pivoted in order that it may adjust itself to any little irregularity which may occur from the edges of the slides not being quite parallel. The ends of the guides are cut and "sprung," so as to give sufficient tension to secure a firm grip of the slide; this tension can, of course, be readily increased to compensate for wear. Guiding lines and circles are ruled on the table for the purpose of centering the slides, but, as will be readily seen, any non-central position may be easily obtained even with slides up to two inches in width, thus facilitating the application of the finishing varnish to, or the repair of any slide, the covering glass of which may not have been accurately centered.

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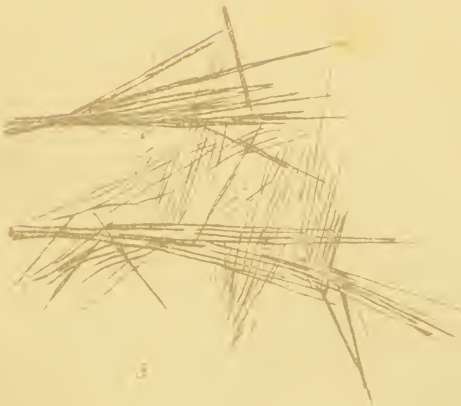

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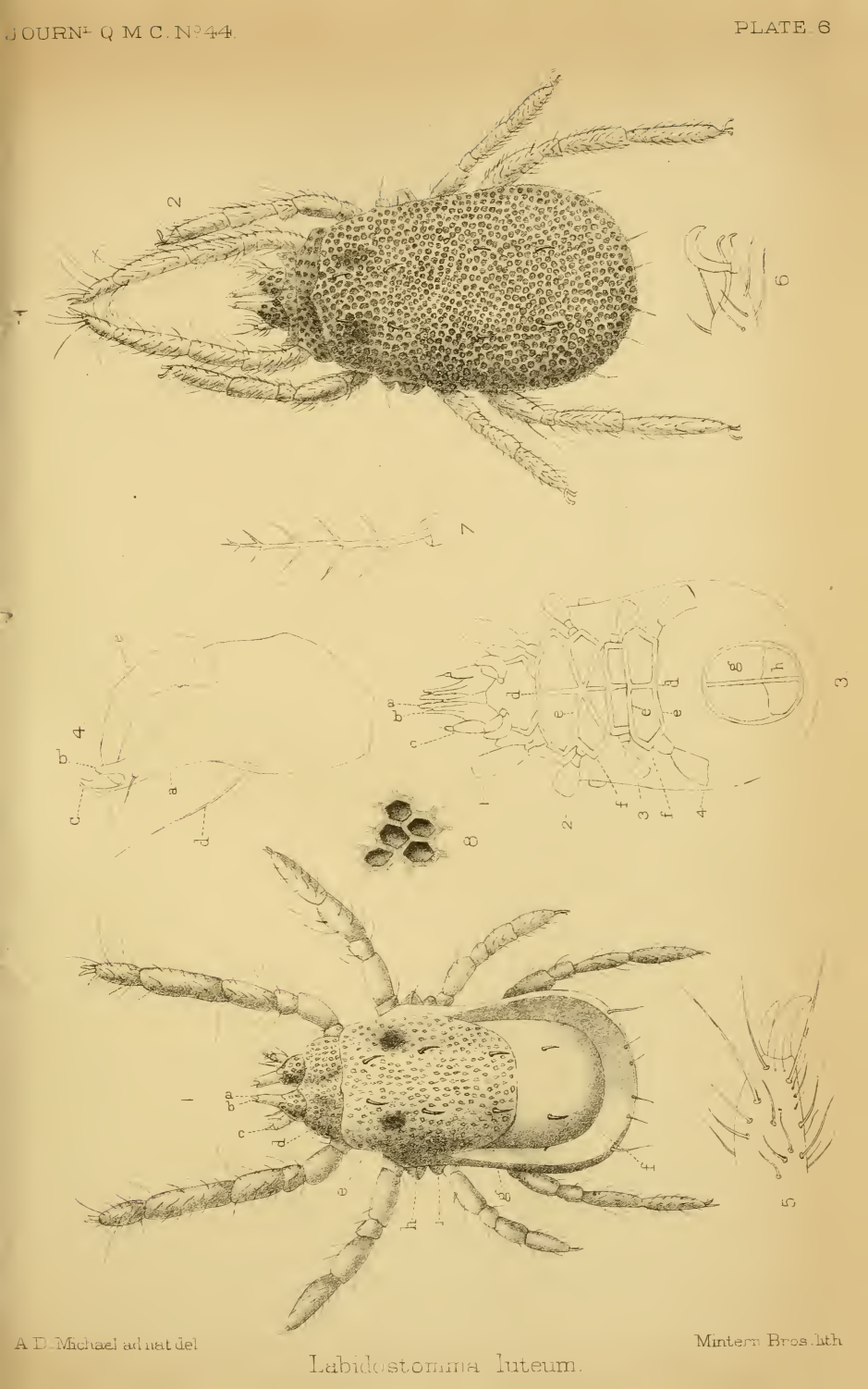
J. C. Waller del



A D. Michael ad nat del

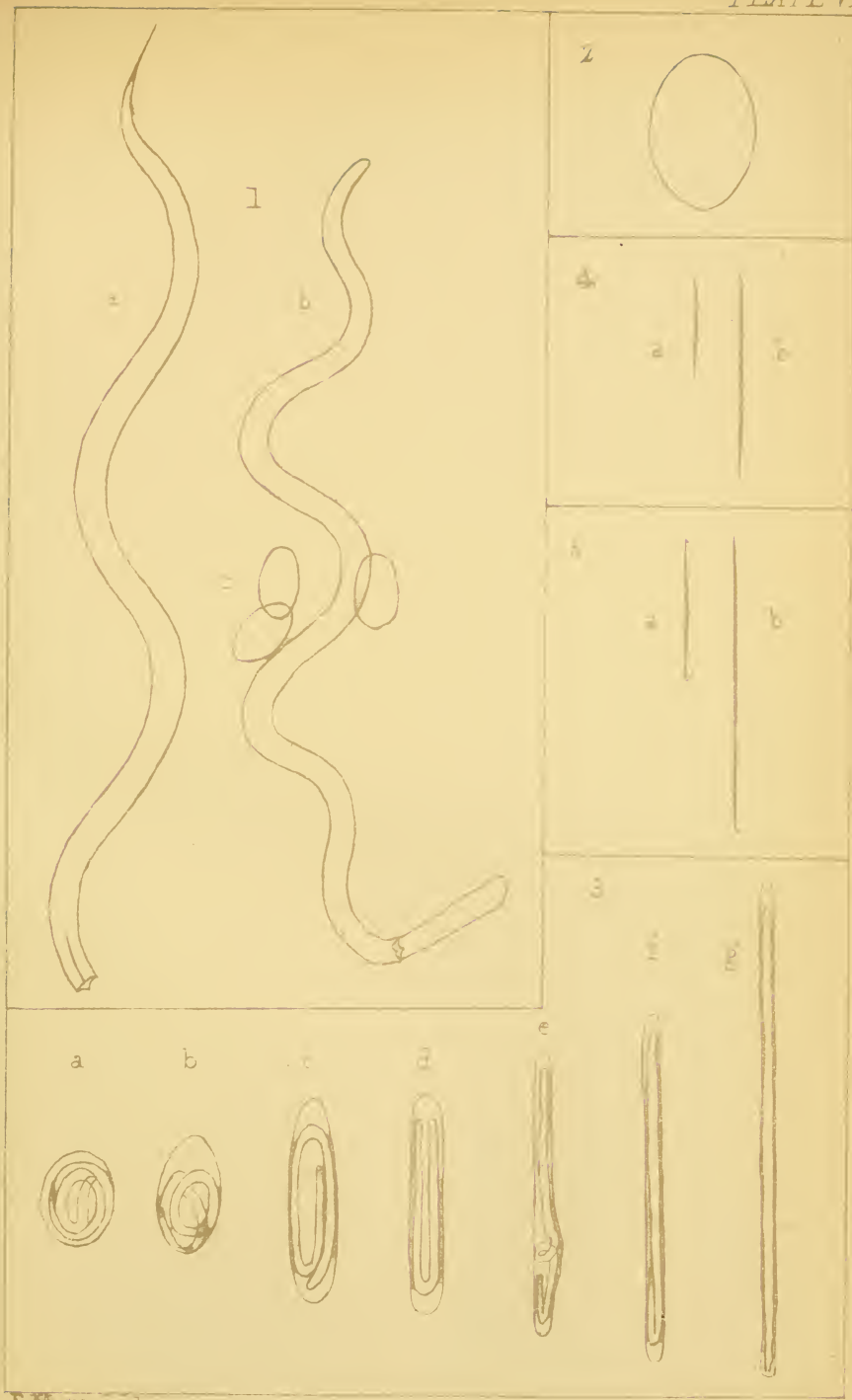
Mintern Bros. lith

Labidostomma luteum.

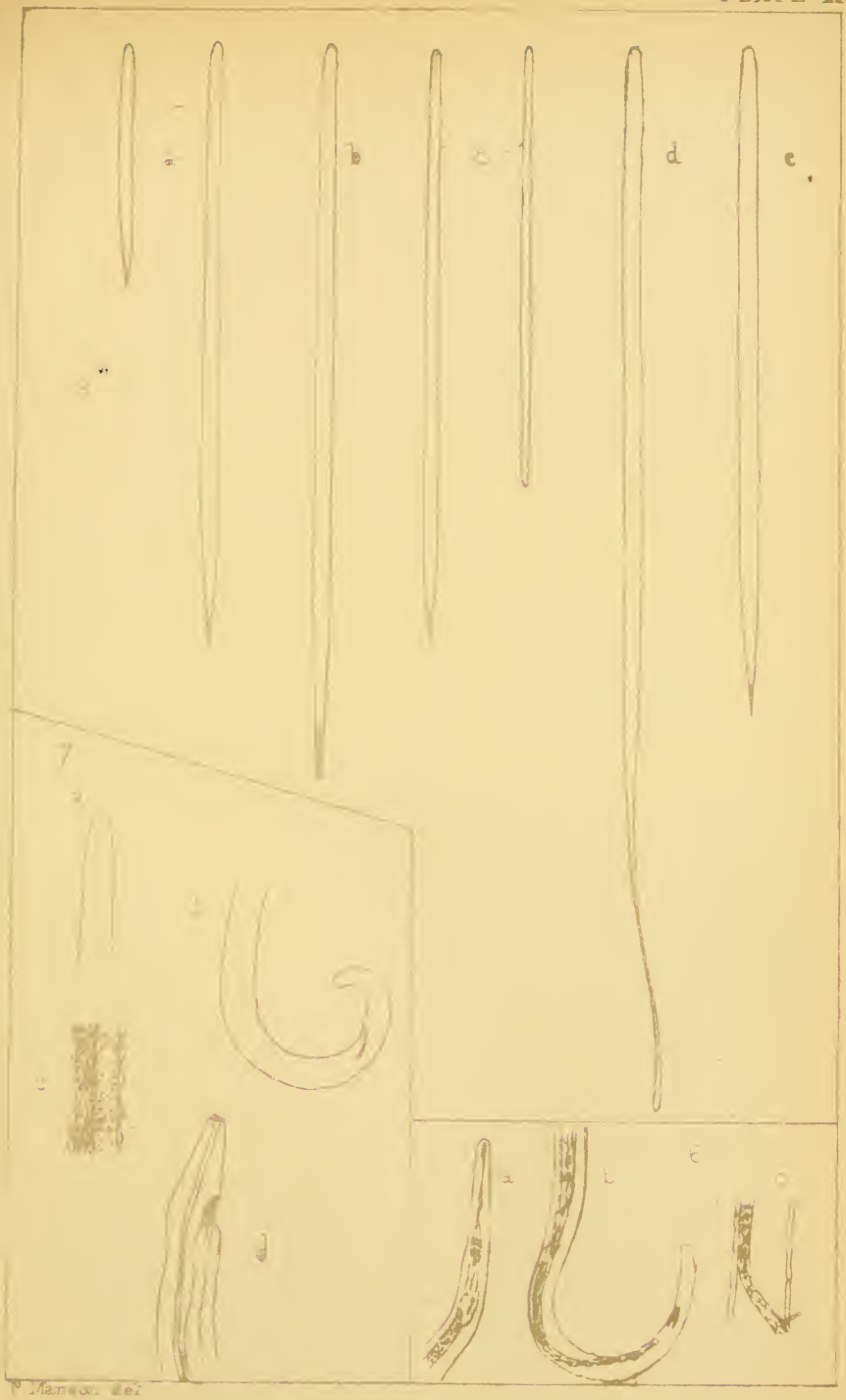
A. D. Michael ad nat del.

Mintern Bros. lith.

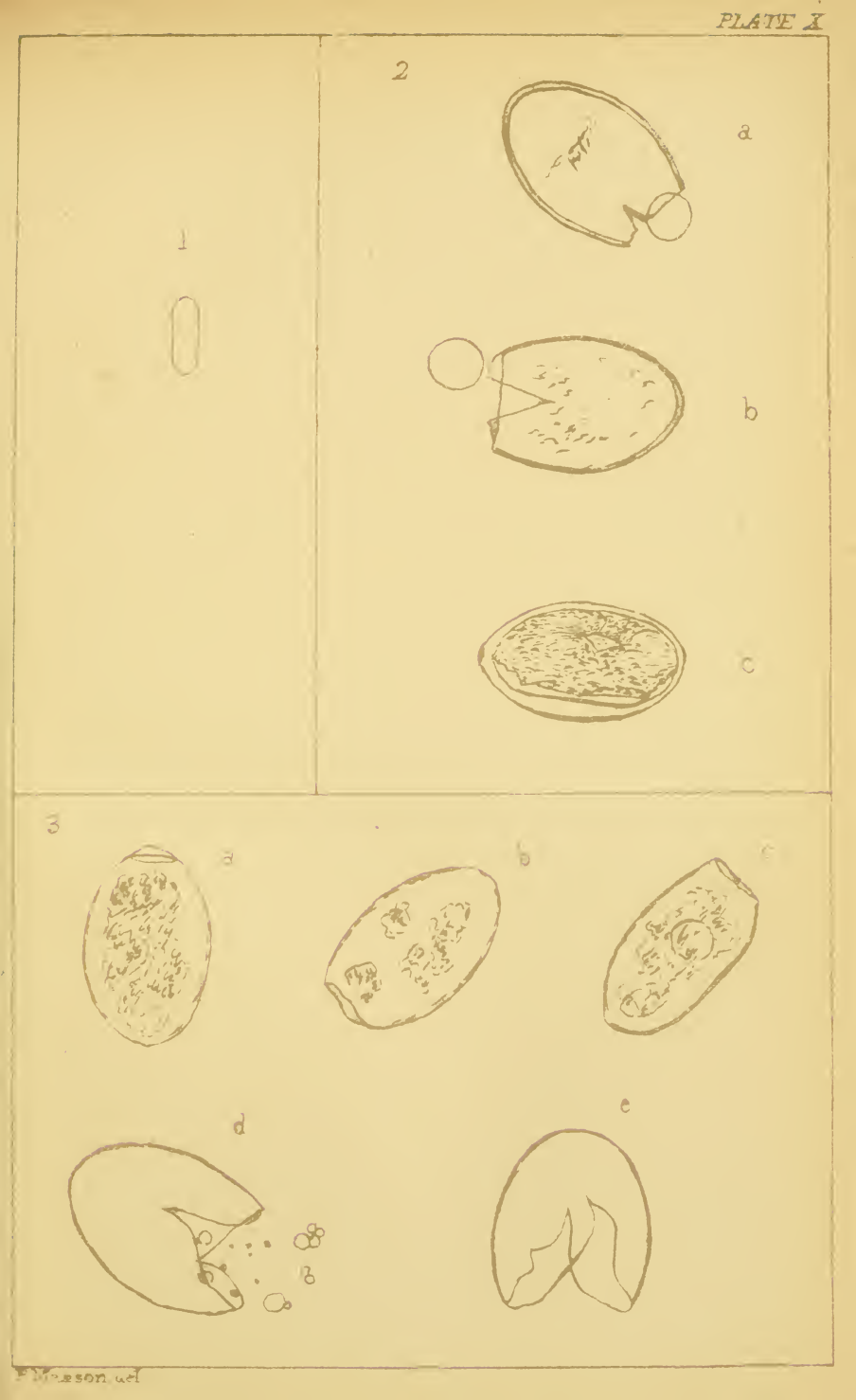
Pygmephorus spinosus.



F Manson del



P. Mancini del.



F. Wilkinson del

Notes on the Histology of Pitcher Plants.

By W. H. Gilburt, F.R.M.S.

(*Read June* 25, 1880.)

PLATE XI.

In the "Midland Naturalist," recently, a series of papers by Dr. Lawson Tait have appeared, entitled "Notes on the Structures of Pitcher Plants."

In the first paragraph the following sentence occurs :—"Some of the observations are, I know, not new, and others, I am equally certain, will not be admitted without further corroboration." With the opinion here expressed, I most certainly agree ; as some of the structures described are so different to anything hitherto known to exist, and the origin ascribed to others so opposed to that which is generally held, that any one familiar with vegetable histology would at least hesitate and wait for corroborative evidence before accepting such descriptions as correct.

There is one point to which I would refer before proceeding further, and that is, the use by the author, whether intentional or otherwise I am unable to say, of the term "epithelium" instead of "epidermis." If it be intentional, it appears to me altogether unnecessary and uncalled for. The term at present in use is one which our best authorities employ, and it, moreover, expresses the analogy which exists between the layer of cells referred to, and that covering which is continuous over the exterior surface of the animal body.

The first structures referred to by Dr. Tait are the branched hairs which are found, for example, on the exterior surface of the pitchers of *Nepenthes*, and which he regards and describes as having the function of absorption. Concerning this particular point, I have had no opportunity of forming an opinion, as the pitcher upon which my observations were made had been severed from the plants for some

time before coming into my possession, so that any conclusions as to function at which I might have arrived would have been altogether unreliable. However, there is no doubt as to their morphological value, viz., that they are trichomes or hairs, being developed from and outgrowths of a single epidermal cell. For these organs Dr. Tait proposes the name of "Multifids," from their similarity to the four-armed hairs existing in Utricularia, and which Dr. Darwin has called "Quadrifids." The author then goes on to say that in some cases the multifids are only raised slightly above the surface of the epidermis, when he speaks of them as "multifid buds," and continues :—"In certain pitchers the multifid buds, instead of appearing wholly above the epithelial surface, are seen to dip partially under it, and this may be seen in favourable instances to advance till the epithelium almost meets over the top of the bud. In this case the protoplasm of the bud may be seen marked by distinct divisions, varying in number from two to nine, the latter being the largest number which I have seen. These divisions of the cell seem to send up processes which appear at the surfaces between the interstices of the epithelium, and such modifications are generally associated with a peculiar system of intercellular canals to be afterwards described. This involution of multifid buds is seen in many surfaces, but it is especially associated with the absorption of decayed or digested animal matter. When the epithelium completely covers these structures I propose to call them included glands, for similar, if not absolutely identical glands, are found in the tissues of many plants, some of which are already known as digesters, as in *Drosera* and *Pinguicula*." And again :—"In very many cases where they are included they may be seen to occupy lacunar enlargements in the system of intercellular canals, and even where no such canals can be seen they occupy the spaces between the large cells of the parenchyma (as in *Pinguicula*) in a position where their aid would be almost as effectual."

Now the theory implied here, though not stated, can hardly be considered satisfactory, and is simply this : that these trichomes or hairs, surface glands, and sub-epidermal glands in pitcher plants and in the other plants referred to are but modifications the one of the other. That this estimate of their value is unreal, will, I think, readily be seen, if we look for a moment at the origin of the several structures, and remember that trichomes or hairs—no matter how complicated or elaborate their ultimate form may be—result from

the outgrowth and subsequent division of a single surface cell ; that surface glands may consist of a single surface cell, unaltered in form, but assuming a different function, or divisions may arise in one or more of these cells prior to or at the same time that the new function is assumed ; while sub-epidermal glands are the result of the modification of cells which originally occupy that position.

Another curious thing is that Dr. Tait should refer to *Drosera* and *Pinguicula* for examples of included glands. In the former we have only two forms of glands, viz., the large ones at the summit of the tentacles and the small sessile ones which are found both on the upper side of the lamina of the leaf and on the tentacles as well. The latter, wherever they exist, are certainly surface glands, the upper cells being slightly elevated above the general level of the surface upon which they are found.

But the reference to *Pinguicula* is the most extraordinary ; and how our author could have arrived at the conclusion that the glands of this plant "occupy the spaces between the large cells of the parenchyma," passes my comprehension, as they are most undoubtedly glandular hairs, having a distinct unicellular pedicel.

Farther on we have another paragraph, which appears to me as very remarkable. It runs as follows—"Another variety of epithelial absorbent is the tubular trichome found in certain pitchers. It is always associated with a system of intercellular canals, and seems really to be developed from the protoplasm contained in these canals more than from a cell, the cell wall apparently going to constitute the lining membrane of the tube, its protoplasm disappearing. At the upper side of the margin of the base of the trichome its protoplasm can be seen to be continuous with that of the intercellular canals ; and in the growth of the hairs this can be seen to be deepening in colour and increasing in quantity at the lower part, so as to form the process of the trichome."

In the next paragraph he also says :—"The system of intercellular canals to which I have referred are best seen on such surfaces as absorb digested food. Thus on the inner surface of a *Nepenthes* pitcher examination by high powers will demonstrate these canals beyond dispute. They are walled and contain protoplasm, for its columns may be seen broken at irregular spots." And again :—"The most complete proof of the actual existence of these canals is to be obtained from diseased epithelial surfaces where

fungous growth is found to be extending into them from an ostiole and distending them."

The structures here described and the origin ascribed to them were so at variance with anything of which I had read or observed, that, I confess, a doubt arose in my mind as to their existence, and yet they were described so circumstantially that I could not reject them. I therefore applied to Kew for specimens, and by the kindness of the Curator obtained all I required, and was thus enabled to satisfy myself as to their existence or not.

It was not long before I arrived at the conclusion that Dr. Tait was mistaken in his observations ; that his intercellular canals were not present, and that the tubular trichomes described must have originated as do all such organs ; but what it was which he had interpreted as a canal I was at a loss to make out, till that portion of his article treating of *Nepenthes* appeared, when I obtained a clue which seemed to explain it all, save the statement that he had seen " fungous growth " in the canals.

That he was mistaken will, I think, be made apparent as we proceed in dealing with the several species.

With regard to the general histology of all the genera, it will be sufficient to say that in the main they agree with ordinary leaves, the epidermis is continuous over both surfaces, and the arrangement of the intervening tissues, the mesophyll, is very similar, those cells next the outer surface of the pitchers being smaller and closer fitting, thus corresponding with the pallisaded layer of the upper surface of a typical leaf ; adjoining that and extending to the inner surface cells is a very loose parenchyma, enclosing many and large intercellular spaces, the vascular system ramifying amongst the cells in all directions. The stomata are found in great abundance upon the exterior of the pitchers and likewise on the upper zone of their interior surface.

The Pitcher plants belong to four different genera, viz., *Sarracenia, Darlingtonia*, *Cephalotus*, and *Nepenthes ;* and, together, constitute a group as interesting as they are unique.

The species of *Sarracenia* of which Dr. Tait gives the fullest description, is *S. purpurea*. The interior surface of this pitcher is, as he points out, divided into four zones. On the first one, or that nearest the mouth of the pitcher, are numerous stomata, and also a large number of strongly developed rigid hairs, which point down-

ward. The second zone is characterised by the fact that each cell of the surface is prolonged downward into a short mammillary process, its wall being striated longitudinally. We next come to a division which is smooth, hairs are entirely absent, and the cells are sinuous in outline. The fourth division is by far the longest, and is crowded with long hairs, the points of which are all directed towards the base, but they are not so stout or strong as those found near the mouth of the pitcher.

In speaking of the upper zone of this species, Dr. Tait says :—"There are numerous stiff hairs, not tubular, but made up of long rod-like cells." In Fig. 2 is shown an actual section of one of these hairs, by which it will be seen that it agrees in all respects with an ordinary trichome, being simply the outgrowth of a single cell. I can understand how Dr. Tait was deceived, and led to describe them in the words quoted. These hairs on their exterior surface show a few deeply cut longitudinal striations—in fact, so well marked are they that the hair might almost be described as fluted. Taking each of these divisions to represent a cell, he has been led to describe the hair as made up of a bundle of rod-like cells ; had he, however, made a section of one, their true nature would have been at once apparent.

The next point to which I would refer is to the structures called by Dr. Tait "multifid buds," and which you will remember he regards as modified or arrested "multifids," the name he gives to the branched hairs found on the exterior of some pitchers.

Speaking of the outside of the pitcher, he says :—"The outer surface was scattered with stomata and multifid buds," and when describing the second internal zone—"On this surface the intercellular spaces are evidently canalicular, and multifid buds abound, but they are covered by the altered epithelium." In Figs. 1, 3, 4 are shown some of the so-called "multifid buds," Fig. 1 being a section of a gland from the interior surface of *S. purpurea*, Figs. 3, 4 a surface view and section of one from the exterior of *S. Drummondii* ; and they show without doubt that instead of their origin being akin to that of a hair, the external gland is produced by a differentiation of one or more epidermal cells, while in the formation of the interior glands some of the sub-epidermal cells are also involved. In a section they are at once distinguished by the darker colour of the contents, and in all cases it will be noticed that

they are in close contact with the surrounding cells of the parenchyma. Both forms of glands are peculiar in that the cell-walls are somewhat strongly thickened.

We now come to the intercellular canals and absorbent hairs described by Dr. Tait. At the risk of repetition, I think it will be better to quote what is said concerning them—"Another variety of epithelial absorbent is the tubular trichome found in certain pitchers. It is always associated with a system of intercellular canals, and seems really to be developed from the protoplasm contained in these canals more than from a cell, the cell-wall apparently going to constitute the lining membrane of the tube, its protoplasm disappearing."

Also in his description of the inner surface of *S. purpurea* he states that these intercellular canals are present in the three lower zones into which it is divided.

Taking this species, which he states is the best for observation, after long and patient examination I have failed to find anything which could be looked upon as a canal. Sections horizontal to the surface and in every other direction have been made. I examined them with the cell contents in place, and after they had been removed, but still without success. I, of course, naturally looked to find them, as they had communication with the hairs, coming up to the surface from the deeper layers of the leaf; but that could not possibly be the case, the very form of the two outermost layers of cells precluding it. The arrangement here is the reverse of that which usually obtains. In Figs. 6, 7 are shown the forms of the cells of these two layers, Fig. 6 being the surface layer of the second zone, and Fig. 7 the layer immediately beneath, the latter being sinuous in outline, a character which we generally find belonging to superficial cells. Between the cells of this second layer there are no openings, so that no canals could ascend from the deeper tissue; therefore, if they exist in connection with the trichomes, they must be confined to the epidermis, but there was nothing that I could recognise as answering to the description. When, however, I came to his account of similar structures in *Nepenthes*, I saw how in all probability he had been misled. The epidermal cells in *Sarracenia* have thick, highly refractive cell-walls, and it seems to me that it is these which Dr. Tait has interpreted as canals.

This conclusion receives support from what he says concerning the origin of the tubular trichomes. He observed that the hairs

appeared to possess a double cell-wall, the outermost one being more refractive than the inner, in fact presenting the same appearance as the so-called canals, the inner being evidently different in texture, and wholly enclosed. This inner layer Dr. Tait refers to the epidermal cell, and the outer one to the protoplasm of the so-called intercellular canals, for their origin. Fig. 5 is a section of one of these hairs, and it is seen that there is no communication between it and the adjoining cells. In Fig. 2 their structure is distinctly shown. The section from which this figure was drawn, after having the cell contents entirely removed, was stained in aniline blue. The whole of the tissue took the colour with the exception of the cuticle, which remained colourless and highly refractive. The inner layer of the hair was stained, but the outer one was not.

In the process of bleaching, contraction of thin-walled cells often takes place, and the cuticle sometimes separates from the cells which it overlays. This has partially happened in the case of this hair ; a separation has taken place at two points, and we have in section what appears as two colourless loops projecting from the blue interior cell-wall, and a moment's examination will suffice to show that this outer layer is of the same nature and continuous with the cuticle which covers the whole of the epidermis.

I cannot for one moment think that these trichomes are in any sense absorbents, those figured being evidently fitted to serve another purpose. It must be remembered that all surface appendages in the pitchers of *Sarracenia* point in one direction—that is, downward toward its base ; that the first zone is furnished with a considerable number of the strong hairs shown in Fig. 2 ; that then we have another space in which each of the small epidermal cells is prolonged outward and downward into a strong and thickened mammillary process. Next we have a zone with a smooth, highly-polished surface, the remainder of the walls of the deeper portion of the pitcher being furnished with the strong thick-walled trichomes shown in Fig. 5, closely set together and inclined at an acute angle. Now, all these modifications of surface are, without doubt, of value to the plant, and in this direction: that while they will allow an insect to enter and pass down the tube, it is almost impossible for it to return. They thus become veritable insect traps. The pitchers of many species contain fluid, but nothing corresponding to a digestive fluid has been detected in them ; so that if the insects which perish in the pitcher are of any value to the plant and afford any

nutriment, it must be simply by maceration, and the glands can be regarded as absorbent only.

One other little matter should be noticed in passing. Dr. Tait says :—" I have not seen spiral vessels in the tissue of *S. purpurea.*" This could only have been because his sections were unfavourable, as there is an abundance of both spiral and reticulated vessels in the vascular bundles. They are, however, of a smaller calibre than usual.

We now come to *Darlingtonia.* Of this genus very little need be said. It is a most extraordinary plant, being quite grotesque in form.

Thickly scattered over the upper part of the pitcher are curious patches, where the structure is reduced to three layers of cells, none of which at maturity contain either protoplasm or colouring matter. They are therefore translucent. In between and around them the vascular system is to be found surrounded by a greater or less quantity of ordinary chlorophyl bearing parenchyma. From the mouth of the pitcher, which is placed some little distance below the summit, depends a curious two-lobed organ, the structure of which I was unable to examine owing to its bad condition in my specimen.

The inner surface of the pitcher is divided into two zones ; the upper one is furnished with short, thick, spike-like trichomes, comparatively wide apart, while the lower one has the same kind and arrangement as exists in *Sarracenia.*

Dr. Tait describes certain epidermal cells containing brown protoplasm, and having a bright nucleus, which he found in the curious appendage to the mouth referred to above. These he regards as nectaries, which may well be the case, as he says that Dr. Hooker, on the authority of Professor Asa Gray, states that this peculiar organ is found smeared with honey.

The glands of *Darlingtonia* are the simplest in structure of any found in the group, and appear to have been overlooked by Dr. Tait, who states, when speaking of the upper zone of the pitcher, that " there is an abundance of spiral tissue, but no brown cells, stomata, or glands were found." The epidermal cells of this division of the surface have the common sinuous line, but scattered among them are a considerable number of large spherical cells, one portion of their wall being exposed at the surface, and the remainder dipping below the epidermis into the subjacent tissue. These glands are very inconspicuous when the tissue is in its natural condition, but if the

colour is discharged from a portion of the plant by means of alcohol, they are at once apparent, and their contents are seen to be different from that of the surrounding cells, the chlorophyl corpuscles being absent. These I take to be glands, but what their function may be, if any, is rather difficult to imagine.

In this plant also Dr. Tait failed to find any evidence of a true digestion.

Our next species is *Cephalotus follicularis*, the smallest, but one of the most interesting of the group. It has two forms of leaves—ordinary unaltered foliage leaves and ascidiform leaves or pitchers.

An account of the structure of the latter was given by Dr. Dickson in the "Journal of Botany" for January, 1878, with which I agree in all particulars. For a general description, therefore, of the pitcher I would refer you to his paper. While, however, he describes the various forms of glands possessed by the plant, he does not figure them, neither does he in either case give certain details which I am now able to supply.

Cephalotus possesses no less than four forms of glands, one of which (Fig. 11) is to be found alike on both surfaces of the unaltered leaves and on the outside and upper portion of the inside of the pitcher, the other three forms (Figs. 8-10) being confined to the secreting and absorbing surfaces of the interior.

Dr. Tait, in speaking of the unaltered leaves, says :—"Beside [stomata] there are papillary prominences with deep crypt-like cavities. In a young leaf the occurrence of transition forms between these craters and the stomata make it certain that they are developed from the latter, and ought, therefore, to be regarded as respiratory organs. We might call them tracheoles, for stomata are sometimes visible within them."

Now, the only organs beside the stomata which are to be found on the unaltered leaves are the glands shown in Fig. 11, which are thus described by Dr. Dickson when treating of the exterior of pitcher and lid—"Here occur stomata of ordinary type and peculiar glands, each consisting of a group of small cells. Each group as viewed from the surface is of oval form, two cells forming a central oval, with their line of contact across the short diameter, these two cells being surrounded by four others. Similar six-celled glands are to be found on the inner surface of the pitcher lid, on the corrugated rim of the pitcher, and on both surfaces of the nonascidiform leaves."

To this description of the gland I would only desire to add that the walls of the surface cells are much thickened, and that beneath them, forming part of the gland, is a more or less spherical basal cell with a thin wall. Such, then, being their structure, it follows that they cannot possibly possess the function ascribed to them by Dr. Tait.

Another form of gland is that which is to be found on the general secreting surface of the pitcher, and is represented in Fig. 8. You will observe that in section there are three cells, the ends of which are slightly elevated above the general surface, and whose greatest length is at right angles to it. These might be called the neck cells. Below them a variable number of thin-walled irregular shaped cells make up the body of the gland, and among them there are no intercellular spaces or passages.

On the lateral walls of the pitchers near to the base there are two crescentiform raised patches inclined forward and downward towards the front of the pitcher at a very acute angle. These are without doubt the most active secreting organs of the plant. In mature pitchers these patches are coloured a deep crimson; whether they serve in any sense as a bait to lure the insects into the pitcher I do not know, but such an idea is not improbable.

Imbedded in these coloured patches are a number of very large glands, one of which is shown on section in Fig. 9. Here we have five neck cells exposed in section instead of three, as in the smaller gland, and the body of the gland is much larger. Another modification, and one which points to a higher differentiation, is that the whole of the deeper portion of the gland is surrounded by an envelope of small flattened cells, not glandular in character; these I propose to call the gland sheath. Dr. Dickson calls attention also to another peculiarity on these glandular patches, viz., that "among the pigment cells are numerous oval bodies, each consisting apparently of a central, somewhat elevated, oval cell, surrounded by two or four others. These bodies are colourless, or slightly yellowish, with brilliantly refractive cell walls."

In a postscript, speaking of some notes he had received, he adds:—"Sir J. D. Hooker has called them stomata, and certainly they sometimes, especially in young pitchers, are often puzzlingly like them. I have no doubt, however, of the centre of each being filled with a 'central cell,' and from the observations I have made, I am disposed to think that, in a sense, they may be stomata, for

the central cell seems to be one bulging up from a somewhat lower level between the 2-4 peripheral cells of the body which would otherwise constitute a stoma-like opening."

I am pleased to be able to confirm this conclusion of Dr. Dickson's, and to give a figure (Fig. 10) of one of these stoma-like glands. That this central cell is glandular, I have no doubt—both from its appearance and from the fact that, treated with aniline blue, it takes the colour much more quickly and intensely than does the surrounding tissue.

Dr. Dickson, in conclusion, adds :—" If the above surmise be correct, these bodies may be regarded as analogous to the ' Wasser Spalten,' recently described by De Bary, in which case their secretion would probably serve to dilute the other secreted matter ; to which an interesting parallel might be found in the dilution of the secretion of the urinary tubules by the water given off from the Malpigian tufts of the kidney."

In *Cephalotus*, as in the other species described, there are special appliances for preventing the escape of insects after they have once entered the pitchers. In this species we have, first, the corrugated rim, which is involute ; then a mass of tissue projecting downward into the cavity of the pitcher, and having a sharp edge—this Dr. Dickson calls the " conducting shelf "—affording, as it does, special facilities for the entrance of the insect, but assisting most effectually to prevent its return. Below this there is a series of strong close set hairs, the direction of which is still downward, and, together, these three structures must present an insurmountable barrier to the escape of the poor creature when once it has passed their lowermost limit.

With regard to the digesting powers of the plant, Dr. Tait says :—" In two pitchers I found insects bathed in fluid with a strongly acid reaction, and this fluid digested shreds of albumen exactly as I found the fluid of *Nepenthes* pitchers did. I conclude, therefore, that a true digestion of its victims is carried on by the *Cephalotus* pitchers."

We now come to our last genus, *Nepenthes*, in which the pitchers are formed, not by the transformation of an entire leaf, as on the three genera already dealt with, but by the modification of the upper portion of a leaf, a spine-like projection at the hinge of the lid representing its true apex. In some species the whole, and in others the greater part of the interior surface is covered with large

and remarkable glands. They differ in three important respects from any yet described. A sectional view of a small portion of the glandular surface of *N. chelsoni* is given in Fig. 12.

All the glands we have hitherto treated of are imbedded; these project entirely above the surface. They are also over-arched by a canopy crescentic in form, and have each of them direct communication with a twig of the vascular system. The arrangement of the position of these glands is quite irregular and unsymmetrical. The canopies or hoods, however, of those nearest the mouth of the pitcher, cover the glands more completely than do those lower down, while at the base the glands are wholly exposed; the one figured shows the relation of hood to gland about midway between the two extremes.

The glands vary very much in size, and are composed of five or six layers of thin-walled cells without intercellular spaces. The cells of the superficial layer have their longest diameter at right angles to the surface, those of the next layer are about equal in all directions, while those beneath are flattened horizontally, and have walls of extreme thinness. At the base of the gland are generally to be seen one or two spirally-marked cells, in a group of which the vascular twig always terminates.

Nepenthes has a true digestion, and in some species the fluid secreted is extremely active.

We must now return to a consideration of the so-called intercellular canals.

Dr. Tait, speaking of the pitcher of *N. Rafflesiana*, says:—"The epidermal surface is composed of irregularly polygonal cells, which in the young pitcher are regularly nucleated; between these run continuous interspaces, forming a network over the whole surface. On the surface of the hoods the cells are elongated, and the spaces run up between them at right angles to the lip of the hood, where a canal seems to run, into which they all enter." "The stream of protoplasm in the canals can occasionally be seen broken, and in such a state the reality of their canalicular structure can be demonstrated." In another place he says:—"In a few cases I have seen appearances as if the intercellular canals had direct communication with the spiral tissue." "Examination by high immersion power has convinced me that these intercellular canals are really walled, and that they contain streams of colourless protoplasm which is in a state of slow movement."

Now all this is so circumstantial that it is difficult to suppose that the author could have been in error. Yet, I think, that in what he says about the structure of the hood, we have a clue as to what it is which he has seen, and which, misinterpreting, he has described as canals.

He states that the hoods are formed of elongated cells, between which canals run, having communication with another canal running along the edge of the lip ; that these canals contain protoplasm, the column of which can be sometimes seen broken at intervals. In Fig. 13 a group of these cells are shown, having been first bleached and any cell contents that might have been present removed, and the preparation afterwards stained.

It will be observed that the cells of the lip are elongated, as described, and that they are greatly thickened, of which fact no mention is made ; that in the secondary or thickening deposit a number of simple pits are present, extending to and sometimes appearing to pierce the primary cell-wall, which, being more highly refractive, is easily made out. In Fig. 12 a section of one of these lip-cells is shown in section, exhibiting the same features and also the presence of the greatly developed cuticle which overlays them, but which gradually decreases in thickness, till just before reaching a gland it entirely disappears. So, also, the surface cells, which all have thickened walls, showing simple pits (though not nearly so thick as those forming the lip of the hood), become thin as the glands are approached.

Now it seems to me that it is either these thickened cell walls or else the primary cell wall which Dr. Tait has described as canals containing protoplasm, the breaks in its column being the simple pits which are always found in such thickened cells, and which, when seen in section, seem to indicate a break in the continuity of the substance. At least this is the only way in which I can account for his being so misled ; but as to the non-existence of the canals I am perfectly satisfied.

One other point before I conclude. In the mesophyl of *Nepenthes chelsoni* there are some curious structures, the interiors of which are lined with a number of very coarse spiral fibres—in one instance I counted as many as seven strands. They cannot be regarded as true vessels, as they are comparatively short, and their outline very irregular, appearing as though they occupied intercellular spaces. Their diameter often varies somewhat abruptly

within very wide limits, and their two ends terminate in several angles, as though filling up the space formed by the partial union of a number of rounded cells, and the spiral fibres are continuous over their angular terminations. They appear to have no connexion with the vascular system, sometimes passing across the bundles at a higher or lower level. Their average diameter is often five or six times that of the true vessels.

As to the nature of these structures and their value to the plant, I am not in a position to offer an opinion, and probably no reliable view can be arrived at, save upon developmental evidence.

I regret that so much of this paper has been taken up by matter which largely partakes of a controversial nature ; still it is in no carping spirit that I offer it, and trust that with it I have been enabled to bring before you something of more general interest.

EXPLANATION OF PLATE XI.

Fig. 1.—Section of gland from interior surface of *Sarracenia purpurea*.
„ 2.—Section of hair from upper zone of same.
„ 5.— „ „ lowest zone.
„ 3-4.—Surface view and Section of gland from exterior of *S. Drummondii*.
„ 6.—Outline of surface cells; 7,—of deeper layer of *S purpurea*.
„ 8.—Small gland from interior surface of *Cephalotus*.
„ 9.—Large gland from crescentric glandular bodies of same.
„ 10.—Small gland produced from modification of stomata.
„ 11.—Superficial aspect of exterior gland of same.
„ 12.—Section of hood and gland of *Nepenthes chelsoni*.
„ 13.—Thickened cells from margin of hood of same.

Figs. 1-9 × 225 reduced one half.
„ 10-11 × 382 „ „
„ 12 × 98 „ „
„ 13 × 225 „ „

"Receipts for Microscopists."

By Julien Deby, C.E., F.R.M.S.

(*Read June 25th*, 1880.)

PLATE XII (Lower Part.)

All those who have had practice with the microscope have, through personal experience, discovered for themselves some special "dodges" which have facilitated their researches, or enhanced the efficiency of their instruments. If such persons would condescend to publish their results in this respect, they would render service to others labouring under difficulties which they have overcome. It is in order to induce members of the Quekett Club to follow my example, that I this day draw their attention to a few simple adaptations of means to ends.

I.—When allowing all but adepts in the use of the microscope to peep through my high-power glasses, I have often felt a certain degree of uneasiness, not to say of alarm, regarding the fate of valuable test-slides, or still more valuable objectives. Many others here present have no doubt experienced the same discomfort which I find an easy matter to attenuate to a considerable extent, by focussing from the eye-piece instead of from the coarse or the slow motion. All that is needed for this is a rack and pinion to the eye-piece of considerable length. An inch or two up or down corresponds here to a fraction of a turn of the fine adjustment of the microscope, so that very little danger exists of any sudden contact with the covering glass. As soon as an indistinct view of the object is obtained through the ordinary coarse adjustment of the microscope body, the focus is brought to exactness by means of the coarse motion of the eye-piece without much difficulty. For demonstrations or exhibitions in public, microscopes could thus be made without the ordinary fine motion.

II.—When mapping with Micro-spectroscope, the difficulty of measuring exactly the position of fine lines or absorption bands is

often great, even when using the admirable micrometers invented by Mr. Browning and Mr. Sorby. I find that in most practical cases the micro-spectrum can be thrown upon a sheet of white paper by means of an ordinary camera lucida placed over the eye-piece of the spectroscope. Strong light by means of a condenser has to be thrown through the liquid under examination. By means of an ivory rule, finely divided, and brought back to a known line, say D, all other lines or bands may be directly measured off on the rule, and, if desired, the exact results in millionths of a millimetre may then be computed by any of the known interpolation formulæ, such as are given in Suffolk's useful little book.*

III.—The arrangement of small microscopic objects, such as diatoms, foraminiferæ, etc., on slides in regular lines, circles, or patterns, can be much facilitated in the following way:—Draw with a pen and ink cross lines, or circles, or any other figure required on the surface of the plain mirror of the microscope; then focus down until the image of these lines is seen on the upper surface of the top lens of the condenser. By means of a mechanical finger, or of a steady hand with a rest, no difficulty will now be experienced in placing the objects in perfectly regular order.

IV.—I now obtain excellent condensed monochromatic light by means of a bull's-eye of unusual external shape, the internal portion of which, however, is filled with glycerine or oil of cloves coloured to suit. This bull's-eye has a plane back and a concavo-convex front, and the liquid is introduced through a hole in the flat side, closed by a small ground stopper. This apparatus is furnished with universal motions, and has a rack and pinion foot. It was made for me by Mr. J. Browning. When using blue light, produced by ammonia sulphate solutions, I have resolved, by means of this monochromatic bull's-eye amphipleura, with objectives in my possession, which will hardly show *Pleurosigma angulatum* under ordinary condenser illumination.

V.—Some time ago, Mr. J. E. Ingpen, on my behalf, made a communication to the Club in regard to a growing slide I had devised for some special researches I was following at the time. Some difficulty seems to have been found in the making of these slides, so that it is with pleasure I now offer a still more simple contrivance for obtaining the same results. Here is the receipt:—Take an

* "Spectrum Analysis as Applied to Microscopical Observation." W. T. Suffolk, F.R.M.S. London, John Browning, 63, Strand. 1873.

ordinary glass slip with a circular hole, say half an inch or more in diameter in the middle; lay this slip on an ordinary glass slide, not perforated. Then grease the top of the upper or perforated slide just a little way around the circular hole, and join the two slips of glass by means of two rubber rings. The object is then placed on a thin cover-glass, somewhat larger than the hole in the slide; it is then covered by a thin glass cover, $\frac{1}{4}$ inch in diameter; the whole is then turned down and fastened to the slide by the adherence with the grease, while the small cover prevents the running of the liquid. The plant or animal under examination finds itself confined in a sort of miniature Ward's case. When not under observation, the growing slide is laid flat in a shallow plate with water just above the line of junction of the two slips of glass, where, by capillarity, it creeps up to the central cell, where evaporation keeps the contained atmosphere in a state of constant and healthy saturation. (See Plate XII, lower portion.)

VI.—*Copal Varnish.* I find this varnish dries very rapidly if slightly heated, or even if placed on a previously warmed slide. I have many hundred slides of diatoms prepared in copal varnish, and my friend, Mr. Van Heurck, of Antwerp, who was the first to use this material, has many thousands. The varnish to be used is what is called the "pale copal," and its consistency ought to be that of oil.* It is much pleasanter to use than Canada balsam, does not make bubbles, and its refractive index is not very different from that of balsam, and does not interfere with the solution of diatom markings. I have of late made many preparations in copal dispensing with the cover glass altogether. The drop of copal is placed on the diatoms and heated lightly over the spirit lamp. It soon takes the consistency of amber, and is hard enough to sustain wiping and brushing with a soft brush with impunity. The optical aberrations produced by the cover glass are thus done away with.

I hope at some future day to add a few more "Receipts for Microscopists" to the above list; may the above, however, in the meantime lead to similar communications from brother microscopists.

* This varnish can be obtained from Wallis & Co., 64, Long Acre, London. It is very much cheaper than balsam.

Note on some Peculiarities of a Flea.

By R. T. Lewis, F.R.M.S.

(*Read June 25th*, 1880.)

It will, no doubt, be remembered by those who were present at the last meeting of the Club, that a remarkably large specimen of *Pulex*—species undescribed—was then presented to the Cabinet, on behalf of Mr. J. G. Tatem, of Reading. Thinking that perhaps a drawing of it might be useful for future reference, as an aid to its identification, I took home the slide for the purpose of making one. The sketch—merely made with pen and ink—is, I fear, somewhat rough, but it is, I believe, made accurately to scale under a 1in. objective, by Dr. Beale's reflector, and is offered to the collection of the Club for what it may he worth.

Mr. Tatem mentioned, in the note which accompanied the slide, that it was interesting as containing, within the body of the flea, four specimens of *Acarellus*, which he had described and figured in the M. M. J., for December, 1872. The careful attention, however, which drawing demands, soon showed that the body of the insect was tenanted by a much greater number of these minute creatures—how many it is not quite easy to determine with accuracy—but the mean of six separate counts under a ½in. objective, gives the number as 51, distributed throughout the abdomen. (Those situated in the 6th and 7th segments only, are lightly indicated in the sketch).

My attention was, however, chiefly arrested by a pair of organs or processes situated immediately above the Pygidium, not altogether unlike Palpi, and the use or nature of which is by no means clear. One of them is seen upon the upper surface, and the other is by deeper focussing fairly well seen through the double thickness of the flea's cuticle. A drawing of the Pygidium and its appendages is annexed to that of the Flea, and will convey some idea of these processes and their well-marked structure.

On communicating the observation to Mr. Tatem, he replied as

follows :—" The Pygidial appendages you enquire about have altogether escaped my notice, but then I am not aware that I ever examined the object with a higher power than 1in. In the Rabbit Flea I find something analogous situate on the last segment above the Pygidium—but the slide shall be sent for your inspection. I have not the smallest notion as to the probable uses of these appendages. They are non-existent in any other Flea in my collection, which numbers ten species." Mr. Tatem was kind enough subsequently to send me the slide of Rabbit Flea referred to, and the sketch of the same now submitted is made upon exactly the same scale as the larger one. The appended sketch of its Pygidium is, however, on a considerably larger scale. The two small processes which he mentions are easily seen, but neither in position, relation, nor structure do they bear any resemblance to those noticed in the giant specimen. A noticeable feature of the Pygidium of the large Flea is the great number and comparatively small size of the areolæ. Those of the Rabbit, Cat, Mole and Hedgehog Fleas respectively, count 28, 28, 28 and 24, as against 64 in this.

The observation may not be of any particular value, but I should like to make use of it to add further point to the recommendation so often urged in this room, that our members should make drawings of what they see. In no other way can things be so well impressed upon the mind, nor is there any better training than this for habits of careful observation; the minute attention required in filling in the details of a drawing will often reveal as literally as in the present instance that, however simple may be the object, there is very much more in it than at first appeared.

On a Swinging Sub-stage for the Microscope.

By James Mackenzie.

(Communicated June 25th, 1880.)

Plate XII., Upper Part.

In the sketch, A shows a portion of the fixed stage-plate of a microscope, B is an angular plate fixed to under part of A, and having a swivel joint at C, on which the stem with rack F swings, and can be tightened by the nut or screw G. A pinion D, works on the rack, and carries an arm, H, with either a single or compound lens, E, which should be so adjusted as to be central with the optical axis of the objective of the microscope. I is an ordinary small concave mirror.

It is obvious that the condensing lens E may be of any convenient focal length, (I have used $\frac{1}{2}$ inch,) and it may be raised or lowered at pleasure by the pinion D, and can be swung aside to any angle either below or above the stage. The angle-plate B should be made and fixed so that the centre of the moveable joint or swivel coincides with the top of an ordinary object-slide when it lies on the stage.

THE PRESIDENT'S ADDRESS

Delivered at the Annual General Meeting, July 23rd, 1880.

By T. Spencer Cobbold, M.D., F.R.S., F.L.S.

Gentlemen,—In selecting a subject on which to address you, I must apologise for stepping out of the more or less well beaten track of my predecessors. Doubtless the great success of this Club arises from the fact that its practical working rests upon the broadest possible basis ; that basis being but an expression of the principle of equal giving and receiving. As long as this principle of action is retained, and as long as its office-bearers continue to be animated by that unselfish spirit which formed so conspicuous a feature in the career of John Quekett, so long will the Club that bears his respected name continue to flourish.

As I do not despise the humblest efforts in microscopic investigation, you will permit me to remind you that the ultimate aims and profits of science do not solely rest either with the power of appreciating the loveliness of the objects presented to view, or even with the accuracies of description that may be made to accompany specimens. We neither undervalue the beauties of external form nor the mechanical adaptations shown by the complexities of internal structure, when, taking all the characters of any given organism into view, we draw what may be termed the *higher conclusions* which their consideration legitimately yields. It is only by the philosophical method of which I speak that the full value and significance of Nature's teachings are arrived at ; and, moreover, in this way only can the area of science become enlarged. To enlarge the borders of science is the object of every scientific association, and we think that the practical work, as embodied in our proceedings and in the Journal of the Club shows that, however inconspicuous that work may be, we have at least some clearly defined part and lot in this matter. The Club does not unduly flatter itself by fearlessly asserting that it contributes towards the "extension of the known." Viewed

broadly, that extension involves issues of the highest possible consequence to society in general ; for, it not only helps to advance the material comfort of individuals, but at the same time it enlarges the capacity for intellectual enjoyment, carrying with it a higher sense of the value of this present life. I should not be true to the views I hold of the exalted aims and objects of science did I not deliberately express the belief that the discipline of natural science exerts an immeasurably greater power for mental and moral culture than all the inculcations of ancient dogmatic systems of theology rolled together into one.

Other conditions being equal, the relative degree of personal superiority which one individual acquires over another is dependent upon and in strict accordance with the amount of culture and discipline of the mind. With this proposition I start ; and though the subject before us is a large one, even the few remarks I have to make will, I think, be sufficient to prove its truth.

Rightly or wrongly I am with those who hold that the intellectual culture and moral training of the mind should go hand in hand ; for the former process, unaided by the latter, is apt to induce a distorted view of the economy of nature, leading finally to an unsatisfying phase of materialism. Some people are sufficiently illogical to petition for a "right judgment in all things," who nevertheless take no steps to promote the culture of their own proceedings.

Now the most ordinary standards of mental and moral acquirements demand, above all things, that we should be open, honest, straightforward, and sincere ; and a yet higher principle teaches that we should be gentle and unselfish. In the prosecution of our various outside callings—no matter how humble they may be—we soon find ourselves possessed of power over the minds and hearts, so to speak, of those by whom we are surrounded. The higher our intellectual attainments the greater our responsibilities, and therefore also the more necessary that we should exercise such powers as we may possess discreetly and for the best ends.

Some may think that in matters of science this high standard of action is altogether out of place, and the caution therefore unnecessary. Pardon my freedom. All history proves that it is given to few men to exercise power wisely and well. If you have any doubt respecting the truth of this general statement, I invite you to consult Lecky's "History of Rationalism." Read it attentively. Think over its startling records. Generalize for yourselves. You will there find quoted abundant instances of misdirected power. You will note the

fact that relentless tyrannies have been employed solely for the purpose of supporting particular opinions. These opinions took the form of dogmas which at the present day comparatively few intelligent persons would for a moment entertain. They were the result of that most dangerous of all forms of ignorance, namely, an *educated ignorance.* I hope my meaning is fully understood. Ignorance which is the result of mere neglect of education, seldom injures anyone but its possessor ; but ignorance which is the result of erroneous teaching, spreads its fatal poison far and wide, cramping the intelligence of entire generations.

The love of power—political, social, and religious—is very fascinating ; and it is particularly worthy of remark that the gross persecutions of former times were perpetrated by men who in private life were rightly considered amiable, pious, and even learned. The evidence on this score is thoroughly trustworthy. It is certainly also most instructive. Some think this phase of human conduct peculiar to the past—a mere development of the so-called dark ages. Than this view, nothing could be more unphilosophical. The same phenomena show themselves at the present day, only their manner of display is somewhat altered by modern environments.

The evil results of misdirected power are, of course, best realised when exhibited as the deeds of strong organisations. A perfect parallelism subsists between the persecutions exercised by educated authorities of early times and the petty tyrannies exercised by bullying boys at public schools. Not only so, uneducated working men, when misguided by self-seeking trades-union leaders, lend themselves to unjust deeds of a precisely similar order. Rightly guided by men of high mental and moral culture, societies of the kind referred to might become, and, indeed, in some places, have already become centres of incalculable good. At present, however, it may be that our improvement is more imaginary than real. Power is the same dangerous weapon now that it ever was in olden time. It holds the same sway over the individual that it does over the organised community. It is an instrument for good or evil according as you wield it. Probably, if a fair estimate could be formed, relatively, of the motives which have led men to persecute their fellows in earlier and later times, we should have to own that, of the two, the baser sort characterise the present age. Intolerant and ignorant bigotry induced the former—"*educated ignorance,*" and vindictive selfishness the latter.

As already hinted, the weapon may be employed individually as

well as collectively. Armed with it the most amiable of men have been converted into veritable fiends ; and even in the ordinary affairs of every day life, it is rare to see power exerted with purely disinterested and unselfish aims. As a combination of intelligent men, however, I claim for the true votaries of science conspicuous virtue in this relation. Probably there are few walks in life in which the exercise of authority and party spirit for selfish ends are so little known. Occasionally our leaders in science, doubtless animated by the best intentions, act imprudently in their official recommendations. Something of the kind recently occurred at one of our learned societies, when the action in question was instantly disapproved by the rank and file of the distinguished body in question. It is not often that science apes the function of the autocrat; nor are the recommendations of scientific leaders either to be viewed uncharitably, or to be superseded without good reason. At all events I can with confidence assert that there is no calling—if science may be thus denominated—in which personal independence and individuality are so remarkable. Organisations to enforce particular views, dogmas, or modes of thought are almost entirely unknown ; but where any great or good work likely to promote the social, moral, and intellectual welfare of the people is concerned, there you will find these lovers of science (however divergent their habits in respect of other matters which necessarily engage their attention) unite together as one man. Trickery of all kinds they utterly despise ; nor is it scarcely possible for a truly scientific man to indulge in speculative follies which will not bear the light of day. I have sometimes observed that persons, whose mental and moral culture has never been exercised, either in looking through a microscope or in acquiring the rudiments of biological and physical science, a positive inability to tell "the truth, the whole truth, and nothing but the truth."

If exhibitions of inaccuracy and untruthfulness are admitted to be humiliating and barbaric, let not those who disapprove flatter themselves that the practice of absolute integrity is easy. Unfortunately, criteria of smallness of principle are sometimes noticed in men of science, or rather in some who have worked in science, but who have missed the higher aims of science. Such displays are doubtless rare ; but when they occur they are not difficult of detection, since they appear without being sought for. Greatness of principle is all the greater by contrast. When on a former

occasion I had the honour to address you, we placed some of these elements of scientific strength and weakness side by side; and in particular I singled out the confession of the father of the healing art, who, in the interests of medical science, thought it his duty to make admission of an error. In like manner I pointed to the very similar conduct of other leaders in science, both past and present. With such splendid examples of generous conduct before us, I hold that a perfect reciprocity should characterise the dealings of all scientific associations, as well as individuals; for certainly, whatever mental endowments our generalised anthropomorphic ancestors displayed, a monkey-like selfishness lies at the bottom of all untruthfulness. Mental littleness so ill consorts with the pursuit of science, that where it exists it renders its unfortunate possessor one of the most unlovely objects it is possible to contemplate.

It must be clear to you that the attainment of high excellence in any walk of life is necessarily reserved for the few. Men having eight or nine feet of physical stature are not more rare than intellectual giants of the Shakespearian or Newtonian type. So long, however, as we aim at the highest improvements attainable under the varied conditions in which we are severally placed, we have no right to be dissatisfied with an elevation which may be extremely low when contrasted with that acquired by others more favourably placed. Think for a moment what a multitude of circumstances must combine in a man's favour to make him really eminent. The patronage of the great and wealthy will not accomplish it. Distinctions allotted by their capricious favour will only receive endorsement from an immediate and very limited posterity. The more enduring credit rests upon a securer basis. Even the comparatively dwarfed intellect may by the exercise of perseverance and its best powers secure a better future record than is likely to be obtained by the more fortune-favoured man of undoubted ability. If any one present be tempted to murmur at his narrow chances in this relation, I pray him reflect upon the thousandfold more limited opportunities of certain of his fellow men. I do not refer to the strangely conditioned inhabitants of remote geographical areas; but I simply allude to the uneducated peasantry of our own loved island, who, whatever may be their natural capacities, have not the vestige of a chance of rising above a level which many of us would, if we had to occupy it, think degrading. Yet we might descend much lower. I, for one, cannot doubt that amongst our myriads of

poor there are germs of greatness which—were all the circumstances favourable—would develop intellectual prodigies capable of astonishing the civilised world. The biographies of some of our so-called self-made men testify to the truth of this assumption. These self-made individuals achieved success and overcame the otherwise insuperable difficulties of their position not alone by their high mental and moral qualities. In the first instance, doubtless, these qualities attracted the sympathy or goodwill of benevolent and intelligent persons (higher up in the social scale). The patrons, again—themselves probably possessing sound mental culture—voluntarily promoted their advancement; but, mark you, success would, even now, never have followed, had not the essential elements of strength been afterwards supplemented by sustained energy and perseverance. Facts of this kind, duly weighed in our minds, inevitably lead to the conclusion, that for every one such favoured individual, ten thousand others, of equal capacity, have intellectually perished. If I may do so without offence, I would add that reflections of this sort, borne out as they are by similar dispensations affecting the welfare and even the existence of every living thing, whether plant or animal, should tend to make us active and diligent in improving the measure of means and capacity we may severally happen to possess. If to rise be difficult, to sink is easy! The maintenance of a fair level in this struggle is not of ready accomplishment, especially if the point of departure has been moderately elevated. Certainly, it is a gratifying sight to see a man, however humble his outward position in life, hold his own either in an intellectual or moral point of view. It is refreshing to see him bearing down, though it be by painfully slow degrees, all opposition to his progress; for, rest assured, each individual success is an important contribution to the sum of human advancement, and who can tell that it may not be by such achievements—coupled with the side-by-side growth of a multitude of other social, political, and even religious developments—that the further progress of our race shall be secured, and ultimately precede or actually eventuate in that high destiny which has formed the subject of predication and hope by the most enlightened in all ages?

I have casually referred to the uncivilised of foreign lands. We all remember the strange effect which the sight of the ocean had upon the Makalolo followers of Dr. Livingstone. In one case the shock was so great that the native leaped over-board and dis-

appeared beneath the waves. This was the effect of the sudden inrush of new ideas. The remarks which some untutored minds utter when they look through a microscope for the first time, show a bewilderment which, though not leading to the same disastrous results, forcibly remind one of the stupidity of the unhappy savage. The mental phenomena are identical in kind, though differing in degree. The extreme case is, of course, the more striking, and therefore, in some senses, the more instructive. On my mind, at least, it forces the conviction that uncultured mental processes, like erratic meteors, are apt to fly off at a tangent when subjected to impulses that are entirely new to them ; but where the brain-processes are trained aright, they will, despite all accidents, maintain their own orbit and travel safely onwards in that legitimate sphere of activity which Nature has assigned.

Let me now offer you some other reflections. As society is at present constituted, a very palpable want of sympathy exists between different bodies of educated men. This arises from the fact that we are hopelessly specialised, both as to our modes of thinking, as well as upon the general subject-matter of our thoughts. The majority are only interested in those things which belong to, or rather, are supposed to be proper to their particular calling. They will converse on little else than mere business or professional topics ; consequently they naturally tend to group themselves in coteries whose dimensions are commensurate with their necessarily abridged sympathies. In some cases there exists a positive antagonism, more or less strongly pronounced. Perhaps this is best seen in the respective attitudes of the men of theology and science. What a painful process it is to wade through the "History of the Conflict between Religion and Science," even as it is recorded in the attractive little volume by Professor Draper, of the New York University. In spite of all this I sometimes do not feel very sure that we ought to deplore this antagonism, since the economy of things in general seems to imply that all progress is the resultant of mutually conflicting agencies. Be that as it may, the facts of the case are palpable. Let us take an illustration from ordinary daily life. It is only a false delicacy which refuses to face a feature representing a palpable blot in our social system.

Fifty-two days in every year a large proportion of the inhabitants of this country are induced by choice or habit, blended with a sense of duty, to listen to pulpit teachings. I have followed and enjoyed

the same privilege. The clerical body abounds with scholars and learned men; and from personal knowledge and friendly relations, I can testify that it contains many of the most estimable, gracious, and gifted of our race. We are proud to number some of them amongst our members. Why, therefore, it may be asked, should there be any impropriety in unveiling impressions which contact with their persons, and, as a rule, honestly enough imparted instructions are intended to supply? The reason is very simple. It is the sight of our manifest divergencies, coupled with the fear of perfect freedom of utterance. Of course no rightly constituted mind would desire to give needless offence. Let me state the case more fully. The clergy and ministers looking back, not without legitimate pride, to the time when their predecessors were almost the sole instructors of our race, naturally advise in a ruling way; whilst, at the same time, they submit their own intelligences to preconceived opinions which the necessities of their position oblige them to entertain. The contrast between them and men of science thus becomes striking. Our fetters are of the slenderest kind; their's are as links of iron. The bond of union between us is human sympathy; yet our several studies and pursuits tend to disunion. There is even an antagonism in the method and subject-matter taught here, as contrasted with the educational antecedents of those who are placed over us by the verdict of what is called "Society." Here, for example, we dare to think for ourselves, and neither up nor down to any particular standard of authority; and, moreover, in view of supplying ourselves with the means of mental improvement, we seek to acquaint ourselves with some of the grandest truths which the microscope, aided by the study of Nature in the field, is capable of unfolding. Thus it is that the biological and physical sciences open up to our view the character and uniform working of some of those laws by which all existing things are sustained from day to day. By the method pursued in our Club and elsewhere, ordinary facts, which to the common vacant mind, have no sort of definite meaning or significance, are marshalled together so as to constitute an unbroken sequence or harmonious whole. By-and-bye the relations subsisting between these facts become more and more evident; whilst, eventually, the ultimate intention of the relations themselves, and even also sometimes the particular why and wherefore of their being bursts upon the mind with all the glowing influences of a newly acquired truth. Thus, also, it becomes clear that the power

of perceiving scientific truth and its actual acquirement together involve a large amount of moral discipline; and it is nothing but daily and hourly contact with those whose intellects are unduly bowed down by the business of mere money-getting that the gratifications afforded to a mind thus taught are lessened.

How different is the case with those of our clerical friends or ministers who do not cultivate scientific tastes. Taking an average pastor, what is the net result of his collegiate career? The educational environment has of necessity exercised its differentiating power, and in cases where natural amiability has not operated to lessen the divergence, he stands quite apart as a highly specialised individual, sometimes so painfully so as to be quite unapproachable. If, for example, in conversation, the bent of your mind should suggest comment on a recent scientific discovery, see what difficulties you would have to encounter. You refer to the record, let us say, of an eclipse of the sun on one of the Assyrian tablets; unfortunately, that is likely to throw doubt on his ordinarily received chronology. You change about, and speak perhaps of a remarkable fossil recently discovered in the lowest palæozoic strata; it must have lived eons and eons of years gone by, and therefore (contrary to his notions) enables you to affirm that death occurred millions of years before the appearance of the race of man. One step further, and you venture to remark upon the "evidence as to man's place in Nature," his alleged antiquity, and the distinguishing characters between the lowermost types of the human race and those of the anthropomorphous apes. Well, now, you are not necessitated to believe all that has been said or written upon this subject; but certain it is that the pastor, unless he be of the Canon Kingsley type—happily increasing in numbers and influence every year—will by this time have classed you with those dangerous individuals, geologists and the like, who are of all men to be avoided. Meanwhile, the conversation has become restrained and without much further ceremony you respectfully bid each other adieu. In plain terms, the results of scientific discovery do not accord with his views, and he entertains a profound suspicion as to the safety of your evolutionary doctrines.

A few words more. I think it one of the chief glories of biological or Natural History Science that it affords the most readily accessible means of invigorating the mind, at the same time that it regulates the moral and intellectual process. The carefulness,

patience, self-discipline, and general accuracy which the pursuit of any one of its various branches begets is remarkable. The man whose mind is totally deprived of such aids is apt to become dogmatic and narrow in the extreme. His views of Nature are inadequate, and dwarfed by a thousand prejudices. Popular errors sway his mind to and fro after the fashion of an angler's float upon the ruffled stream. Day dreams of the past are to him as present realities. He may even look to the form and visage of the moon to guide him as to probable changes in the weather, and he is entirely unaware how much he remains the child of a diluted superstition. Clearly it is nothing to him, that "the highest meteorological authorities, after a series of minute observations, continued through many years, have come to the conclusion that no influence of any sort can be traced" in this relation. Ignorant of his own ignorance, he is minded to remain so; and he fortifies his position by a record of the experiences of his fellow men, who, guided by the same teachings, are necessarily as unenlightened as himself. I am free to confess that it is not pleasant to unveil truths, the enunciation of which implies defects so generally prevalent. Yet, how can those of us who love science for its own sake do otherwise? It is a disadvantage to the votary of such knowledge that his sense of its value constrains him to invite others to share the intellectual feast; for you must perceive that the mere assumption of his legitimate position lays him open to the charge of immodesty. Be it so. I am fully sensible of the tendencies of the present hour; yet I believe that even wealth, without "mental and moral culture," is a poor possession. What painful proofs of the want of scientific culture does "Society," in the so-called upper ranks, afford. To kill time, its members are obliged to saturate themselves with frivolous pursuits. An enlightened daily press even ventures to condemn their craze for *tableaux vivants* and private *corps de ballet* competitions with theatrical managers. Far be it from the votaries of science to seek to lessen personal delights and social enjoyments. We contend that whilst science does not lessen life's pleasures, its votaries rarely become the victims of a frothy and unsatisfying ambition.

Not without strong convictions have I ventured thus to utilise the honoured position which your suffrages have so kindly conferred. If I appear to have exceeded my official liberty, you will lay it down to my desire to err rather on the side of zeal than on that of

indifference to the cause we all have at heart. I would say to each fellow-member, "go on seeking knowledge, microscope in hand, and never mind the toil and trouble involved." In some shape or other reward will sooner or later follow, but I neither dare nor care to promise that it shall end in pecuniary increase. In the future, as in the past, let every true representative of natural or physical science claim a measure of your esteem and regard ; and should you at any future time realise more fully than you do now, the advantages you have derived from joining the Quekett Microscopical Club, do not forget that most of these were due to the hearty and disinterested efforts of as genial and devoted a set of office-bearers as it was ever a President's privilege to work with. Gentlemen—I bid you farewell.

PROCEEDINGS.

June 11th, 1880.—Conversational Meeting.

The following objects were exhibited:—

Substance taken from the inside of the Glass Cover of a Miniature Painting	Mr. F. W. Andrew.
Larval Cestode *Micrecystis paradoxus*, from intestinal wall of Night Heron	The President.
Anchors and Plates of *Synapta*	Mr. F. Coles.
Desmidiaceæ—Closterium obtus-angulum ...	Mr. T. Curties.
Wing of Butterfly (exotic) ...	Mr. A. Fieldwick, jun.
„ Dragon-fly, *Neurobasis chinensis*	
Leaf of *Deutzia gracilis*... ...	
Floscularia cornuta, *Limnias*, &c. ...	Mr. H. R. Gregory.
Melicerta ringens	Mr. R. Hailstone.
Dileptus (developing)	Mr. J. D. Hardy.
Section of Cat's-eye Mineral	Mr. H. Morland.
Euchlanis (unarmed species)	Mr. J. M. Offord.
Aquatic larva, species unknown ...	Mr. F. A. Parsons.
Section of Acicular leaf of *Pinus pinaster*	Mr. J. W. Reed.
Section of Stem of *Ulex europæus* (Furze)	
Section of Toe of Mouse	Mr. J. Woollett.

Attendance—Members, 67; Visitors, 8.

June 25th, 1880.—Ordinary Meeting.

Dr. T. Spencer Cobbold, F.R.S., President, in the Chair.

The minutes of the preceding meeting were read and confirmed.

The following gentlemen were balloted for and duly elected members of the Club:—Mr. Chas. A. Adams, Mr. John Cambridge, Mr. Charles L. Curties, Mr. Walter I. Curties, Mr. C. F. George, Mr. H. S. H. Hancock, Mr. Walter Jacques, Mr. Henry J. Waddington, and Mr. W. D. Wickes.

Five gentlemen were proposed for membership.

The following Donations to the Club were announced:—

"Proceedings of the Royal Society" ...	from the Society.
"Journal of the Royal Microscopical Society"	„ „
"Report of the East Kent Natural History Society"	„ „

"American Journal of Microscopy" ...	in exchange.
"The Midland Naturalist"	,,
"The American Naturalist"	,,
"The American Monthly Microscopical Journal"	,,
"Science Gossip"	from the Publisher.
Part 1 of Dr. Braithwaite's "British Moss Flora" (special proof copy) ...	,, Dr. Braithwaite.
Paper "On Parasitic Diseases in Salmonidæ, &c."	,, The President.
"Balfour's Comparative Embryology" ...	,, Mr. T. C. White.
"Grevillea"	Purchased.
"Annals of Natural History"	,,
"Quarterly Journal of Microscopical Science"	,,
24 Slides	from Mr. John Cocken.

The thanks of the meeting were voted to the donors.

The Secretary read the following list of nominations for officers of the Club to be elected at the annual meeting:—For President, Mr. T. C. White; Vice-Presidents, Dr. Cobbold, Dr. Cooke, Dr. Matthews, and Mr. Stewart; Hon. Treasurer, Mr. Gay; Hon. Secretary, Mr. Ingpen; Hon. Foreign Secretary, Dr. Cooke.

The President intimated that Mr. Hailes had resigned the office of Hon. Secretary, and consequently his name did not appear in the list of nominations.

The members of the Club were then requested to nominate some of their number to fill six vacancies on the Committee, caused by the retirement of Messrs. Gilburt, Parsons, Priest, Spencer, Cottam, and White.

Mr. E. T. Newton, proposed by Dr. Matthews, seconded by Mr. T. C. White.

Mr. J. W. Goodinge	,,	Mr. Crisp	,,	Mr. Mackenzie.
Mr. G. D. Brown	,,	Mr. Dobson	,,	Mr. Mackenzie.
Mr. W. H. Gilburt	,,	Mr. Reed	,,	Dr. Cooke.
Mr. A. D. Michael	,,	Mr. Newton	,,	Mr. Alph. Smith.
Mr. W. J. Scofield	,,	Dr. Cooke	,,	Mr. Goodwin.
Mr. H. F. Hailes	,,	Mr. Michael	,,	Mr. Parsons.
Mr. W. W. Reeves	,,	Mr. Parsons	,,	Mr. Sigsworth.

Mr. E. T. Newton thought it desirable that the Hon. Librarian should be an *ex-officio* member of the Committee, and gave notice that he should move at the next meeting that the second rule which provides for *ex-officio* members of Committee should be added to for that purpose.

Mr. Parsons seconded the proposal.

Mr. Alpheus Smith said he was much obliged to Mr. Newton for proposing the matter, but thought his attendance at the Committee meetings would be a matter of inconvenience, because the hour at which the Committee met—from 7 to 8—was his most valuable time for attending to the issue of books and other matters connected with the Library.

Mr. Parsons said there would be no necessity for regular attendance, but the object was to give him the right to attend whenever he found it desirable.

Mr. J. W. Reed proposed to include the name of the Hon. Curator with that of the Librarian in the motion just made by Mr. Newton.

The Secretary said it would be necessary to appoint two Auditors of the accounts. Mr. Hainworth had been appointed on behalf of the Committee, and it was for the members to elect some other gentleman to act with him on behalf of the Club.

Mr. Hardy was proposed by Mr. Curties, and seconded by Mr. Sigsworth, and duly elected by show of hands.

Mr. Crisp said there was an impression amongst the members that the persons proposed for members of Committee were generally elected according to the position of their names on the Balloting list, so that whether a man was elected or not might depend upon whether his name began with an early letter of the alphabet. At first it might seem like a coincidence, but it had now become to be regarded as almost a settled fact, and he asked the Secretary whether he had ever taken out a list of the nominations at various elections to see if it were really as stated?

The Secretary said that some time ago he made such a list, and his impression was that unless the name of any person nominated either began with an early letter, or he was very well known, there was not much chance of his election.

After some further conversation upon the matter,

Mr. Crisp gave notice that he would at the next meeting move that the words "in alphabetical order" be struck out from Rule 3, and the words "in order to be determined by lot" be inserted instead.

The Secretary read the following communications from Mr. Julien Deby:—

"On Focussing with the Eyepiece."

"On Mapping with the Microspectroscope."

"On the Arrangement of Microscopic Objects such as diatoms, &c."

"On a Hollow Condenser filled with Glycerine as an illuminator."

"On an Alteration or Improvement in the Growing Slide."

"On the use of Copal Varnish."

The Secretary exhibited and described Dr. Edmunds' new parabolized gas slide.*

Mr. R. T. Lewis read a note "On some Peculiarities in the large Flea presented to the club by Mr. Tatem." Pen and ink drawings of this flea and also of a rabbit flea were presented to the Club.

Mr. J. Mackenzie described a swinging substage. This was arranged to screw on to the front of the stage.

Mr. Ingpen thought that the difficulty in the way of carrying out the idea might be the possible infringement of a patent.

Mr. Michael inquired how the stage was centered?

* For a description and illustration of this apparatus, see the "Journal of the Royal Microscopical Society," Vol. iii., p. 585.

Mr. Mackenzie said there was no special arrangement for centering.

Mr. W. H. Gilburt gave a *résumé* of his paper "On the Histology of Pitcher Plants," the subject being fully illustrated by diagrams.

The President said they must all feel very much obliged to Mr. Gilburt for having brought this subject forward. It was evident that Dr. Lawson Tate had fallen into some errors, but they were no doubt errors of interpretation rather than of observation.

Dr. Matthews said that this plant was interesting as having been at one time proposed as a remedy for small-pox. Was there any acid principle found in it?

Mr. Gilburt said it was altogether neutral, giving no acid reaction whatever.

Mr. J. W. Reed asked Mr. Gilburt if he had any theory as to the thickening of vegetable cells?

Mr. Gilburt thought the thickening of ligneous cells was for the purpose of strengthening them, and he could only suppose that this was the case in Pitcher Plants.

The President said if he understood Mr. Gilburt rightly, the so-called intercellular canals described by Dr. Lawson Tait were merely the effect produced by the thickening of the cells?

Mr. Gilburt said that Dr. Tait had not recognised the fact that the cells were thickened, but regarded all that was between them as protoplasm. But it was quite clear that the surface cells of all the Pitcher Plants were so thickened, and there was nothing else that could be taken for a canal. It was, however, quite certain that these were not canals. The thickening of the cell wall he evidently regarded as the boundary of the cell itself, and all else between he took for a channel; it was undoubtedly a case of misinterpretation.

The President read "Some Further Observations on Human *Filariæ*," by Dr. Manson, in which he not only confirmed his previous observations, but indicated the lymphatic tissues as the locality in which these worms were to be found. The presence of *Filariæ* in the brains and hearts of birds was also mentioned, and a bottle was exhibited, containing a number of hearts of Chinese magpies, each of which swarmed with these parasites.

The President also communicated translations of some recent papers by foreign helminthologists on the so-called Tunnel Trichinosis and other subjects, which he thought the Club would do well to publish. There was really no such thing as Tunnel Trichinosis; the disease to which the name had been applied bore no resemblance whatever to Trichinosis proper, and though this had been explained again and again by himself and others, the error was being constantly repeated in the newspapers and elsewhere.

Dr. M. C. Cooke said he could quite confirm the last remarks of the President from what he often met with in his own branch of science. He had come to the conclusion that it was a waste of time to combat such errors, and he believed that they would die much sooner if they were let alone.

The President said that in one of his communications Dr. Manson referred to a report in the *Lancet* of the meeting of the Q.M.C. at which his former paper was read. He hoped that they should at a future time have the pleasure of receiving other communications from him. It was curious that the hearts of birds as well as of carnivora should be found literally stuffed with these nematoid worms—the mature forms were usually found in the heart in birds, whilst the immature forms were found in the blood.

Mr. T. C. White proposed a vote of thanks to the President for the very interesting communications which he had brought before them. The subject was one which required a great deal of study, and they could scarcely hope that many of the members would take it up, but the President had given them a very interesting introduction to it.

Dr. Matthews having seconded the proposal, it was put to the meeting and carried unanimously.

Announcements of meetings for the ensuing month were made, and the proceedings terminated with a conversazione, at which the following objects were exhibited:—

Epsom Salts	Mr. F. W. Andrew.
Glands and Hoods of *Nepenthes Chelsoni* Gland of *Cephalotus follicularis*...	Mr. W. H. Gilburt.
Navicula angulatum, with a cheap substitute for a swinging substage ...	Mr. J. Mackenzie.
Section of *Luxullianite*	Mr. H. Morland.
Aspidogaster conchiola from an *Anodon* Section of Eye of Cray-fish ...	Mr. E. T. Newton.
Leaf of *Camellia japonica* ... *Parietaria diffusa*	Mr. J. W. Reed.
Proventriculus, stomach, &c., of *Lithobius vulgaris*	Mr. T. C. White.

Attendance—Members, 54; Visitors, 2.

July 9th, 1880.—Conversational Meeting.

The following objects were exhibited:—

Leaf of Rice paper Plant	Mr. F. W. Andrew.
Section of Sarsaparilla Root	Mr. W. R. Brown.
Argulus foliaceus	Mr. D. B. Cazaux.
Diatoms—*Rhipidophora nubecula* ...	Mr. C. G. Dunning.
Dissected Thorax of Blow-fly	Mr. F. Fitch.
Tongue of *Empis*	Mr. R. Hailstone.
Acarus—*Notaspis lucorum*, full grown nymph, showing perfect creature inside	Mr. A. D. Michael.
Section of Chalk from Co. Antrim Section of Crocidolite ...	Mr. H. Morland.

Spicular Cells in stem of *Araucaria imbricata*	Mr. J. W. Reed.
Æcidium Taraxaci	Mr. H. J. Roper.
Section of stem of Cherry	Mr. J. Woollett.

Attendance—Members, 56; Visitors. 6.

July 23rd, 1880.—Annual Meeting.

Dr. T. Spencer Cobbold, F.R.S., President, in the Chair.

The minutes of the preceding meeting were read and confirmed.

The following gentlemen were balloted for and duly elected members of the Club:—Mr. E. Carr, Mr. Jas. Funston, Mr. H. V. Shaw, Mr. A. S. Hardingham, and the Rev. William Reade.

On the recommendation of the Committee, Mr. F. H. Wenham was unanimously elected an honorary member of the Club.

The following donations to the Library and Cabinet were announced:—

"The Popular Science Review" ...	from the Publisher.
"Science Gossip"	,, ,,
"Part II. of the British Moss Flora" ...	,, Dr. Braithwaite.
"McAlpin's Biological Atlas"	,, Mr. J. W. Groves.
"Huxley's Cray-fish"	,, Mr. J. C. Sigsworth.
"Kirby and Spence's Entomology" "Curiosities of Entomology" ...	,, Dr. Matthews.
"Greene's Protozoa and Cœlenterata" ...	,, Mr. Ingpen.
"Ninth Report of the South London Microscopical Club"	,, the Club.
"Transactions of the Watford Natural History Society"	,, the Society.
"The Analyst"	,, the Publisher.
"Annals of Natural History"	Purchased.
6 Slides of Sponges	from Mr. Priest.
1 Slide	,, Mr. Morland.

The thanks of the meeting were unanimously voted to the donors.

Mr. Frank Crisp, in pursuance of notice given at the previous meeting, moved an alteration in Rule 3, by removing the words "in alphabetical order," and substituting for them "in order to be determined by lot, as drawn by the President and Secretary." He explained that it had been commonly observed, that when there were more persons nominated than vacancies for election, those who stood at the top of the list were almost invariably elected, and those at the bottom struck out, merely because of the position in the alphabet of the letter with which their names commenced; so that whilst Mr. White had no chance at all, Mr. Black was sure to be successful. The proposed alteration would determine the order of the names upon the ballot papers in another and, he thought, a more satisfactory way to the general body of the members.

Mr. Chas. Stewart seconded the proposition, which was put to the meeting by the President, and carried unanimously.

The Secretary said that having regard to the probability of this motion being carried, the President had drawn lots, and the names of the gentlemen nominated had been printed on the ballot papers in the order thus obtained; but there was also another set of ballot papers, on which the names appeared in alphabetical order.

Mr. E. T. Newton moved an alteration in Rule 2 and the other Rules dependent upon it, so as to include the Librarian as an *ex-officio* member of Committee. It had occurred to him and to others as singular that neither the Librarian, Curator, or Reporter had any voice in the management of the Club, although their work was of great importance. As his motion stood, it only referred to the Librarian, but as Mr. Reed had an amendment to propose which would include the names of the Curator and Reporter and he should support the amendment—he felt he need not alter the terms of his resolution.

Dr. Matthews had much pleasure in seconding the resolution, which he thonght was so obviously proper and right that it must commend itself to every one.

Mr. J. W. Reed having altered the terms of his amendment so as to make it an addition to the proposal of Mr. Newton, and include the Curator and the Reporter as well as the Librarian,

Mr. T. C. White seconded this proposition.

The President having put the two motions to the meeting, declared them to be unanimously carried.

The Secretary then read the 15th Annual Report.

The adoption of the Report having being moved by Dr. Matthews, and seconded by Mr. T. C. White, was put to the meeting and carried unanimously.

The Secretary read the Treasurer's Annual Statement of Accounts duly certified as correct by the Auditors.

Mr. Scofield moved the adoption of this Report, congratulating the Club upon the very satisfactory statement which had been laid before them.

Mr. Curties having seconded the motion, it was put to the meeting by the President, and carried unanimously.

The President then appointed Mr. Curties and Mr. Adkins to be scrutineers, and the ballot papers were distributed.

The President then read the customary Annual Address, taking as his subject "Science in Relation to Mental and Moral Culture."

Dr. M. C. Cooke said that during the past twelve months they had frequently had the pleasure of listening to the President, and now they had met to hear his farewell address. He believed that he spoke for all present when he said that they had listened to that address with great pleasure; but it was a matter for great regret that circumstances prevented Dr. Cobbold from holding the office of President for another year. It was no mere desire to flatter that led him to say this, for, from his own observations at excursions, at their convivial parties, under the high and dry

scientific as well as on the jovial side of their character as a Club, there was still the same feeling that they had a President after their own hearts. He asked them to join with him in thanking their President for his last words, and in asking him to allow them to be printed and circulated in the usual way. As regarded the Address which they had just heard, he had on some points felt inclined to join issue with the speaker, and on others to offer some comment and criticism, but he should refrain from doing so at that time; it was, however, clear to all that the President had struck out a new phase, and that they had heard an address different in many respects from all that had preceded it. It was a difficult matter to strike out a new course in an annual address—more difficult than most persons thought it to be. He asked them to join with him in a hearty vote of thanks to the President.

Mr. Ingpen said he claimed the privilege of seconding this vote of thanks, because it enabled him to bear testimony to the services of the President. He desired to refer to the great interest the President had taken in the welfare of the Club, his care in informing himself of all the circumstances connected with its objects and procedure, his constant attendance at meetings, and his anxiety to render the Club all the assistance he could both as President and otherwise. These were matters of which only a secretary could be fully aware, and for which the President deserved their best thanks.

Dr. M. C. Cooke having put the motion to the meeting, it was carried by acclamation.

The President said he felt extremely gratified by the kind way in which they had received this vote of thanks, and for the way in which it had been moved by Dr. Cooke and seconded by Mr. Ingpen. One observation, however, had been made, which led him to think that even Dr. Cooke was labouring under a delusion, for he seemed to think that on resigning his position as President, his connection with the Club was forthwith and for ever to be severed. Such a thing had never entered his cranium. It was an official severance, it was true, for reasons which he need not then explain; but for all that, whenever he had anything worth bringing before them he should count it a pleasure and privilege to be a contributor as one of their rank and file. He had only further to thank them for the kindness which he had always received, and to say that he should always look back upon the past as one of the most charming of scientific years, and that he should still continue to be with them in spirit, though absent in person.

The President then moved a vote of thanks to the Council of University College for their continued permission to hold the meetings of the Club in the Library of that building.

Mr. Ingpen had much pleasure in seconding this vote; he had more to do with the College in connection with the Club than any one else, and could therefore speak of the great kindness and courtesy with which, on all occasions, his communications with them had been received.

The vote of thanks was then put and carried unanimously.

Dr. Braithwaite moved a vote of thanks to the Officers of the Club for their services during the past year.

Mr. J. G. Waller seconded the vote, and in so doing made special allusion to the services rendered by the Hon. Secretary.

This vote of thanks was also carried unanimously.

Mr. J. W. Reed moved a vote of thanks to the Auditors and Scrutineers.

Mr. Moginie seconded the same, which was put and carried unanimously.

The Secretary then announced the result of the ballot to be as follows:—President—Mr. T. C. White; Vice-Presidents—Dr. Cobbold, Dr. Cooke, Dr. Matthews, and Mr. C. Stewart; New Members of Committee—Mr. W. H. Gilburt, Mr. J. W. Goodinge, Mr. H. F. Hailes, Mr. A. D. Michael, Mr. E. T. Newton, and Mr. W. W. Reeves; Hon. Treasurer—Mr. F. W. Gay; Hon. Secretary, Mr. J. E. Ingpen; Hon. Foreign Secretary—Dr. M. C. Cooke; Hon. Reporter—Mr. R. T. Lewis; Hon. Librarian—Mr. Alpheus Smith; and Hon. Curator—Mr. C. Emery.

The President said that in quitting his office it was some personal satisfaction to him to know that the chair would be occupied by one who had the interests of the Club so much at heart as Mr. White. In him they would find one who had borne the burden and heat of the day. The position was one of confidence, and was conferred as an expression of more than goodwill, but he could not fail to notice the accidental alternations in the list of Presidents by which an outsider and an insider seemed to follow one another, and he thought it rather a good thing, and quite right that it should be so. He had great satisfaction in leaving in the chair one who had worked in perfect harmony with himself, and had great pleasure in congratulating Mr. White on the occasion.

Mr. White having returned thanks, the proceedings terminated in the usual manner, the following objects being exhibited:—

Fredricella ... ... Mr. J. D. Hardy,

Citrus aurantium (transverse section of leaf) Mr. J. W. Reed.

Attendance—Members, 75; Visitors, 5.

DESCRIPTION OF PLATES XI. AND XII.

Fig. 1.—Diagrammatic representation of a sextant in *Actinia*.—(*a*) Primary, (*b*) Secondary, (*c*) Tertiary, and (*d*) Quaternary septa.

Figs. 2 & 8.—Fluted organ of *A. mesembryanthemum* (see text).—(*a*) Septum, (*d*) White spots.

Fig. 3.—Transverse section of a sextant of *A. mesembryanthemum*, made close under the disc.

Fig. 4.—Ditto, made half-way down.

Fig. 5.—Base of ditto.

Fig. 6.—Tertiary septum of *A. mesembryanthemum*, with eggs; craspedum cut away; fluted organ in wavy line.

Fig. 7.—Quaternary septum of *S. parasitica*; early ovarian stage (September). No craspedum carried by this septum; fluted organ seen lifted up.

Fig. 9.—Quaternary septum of *T. crassicornis*; craspedum at foot and edging septum, and followed by fluted organ running to back of stomach wall; eggs cover septum.

Fig 10.—Eggs of *S. parasitica*.

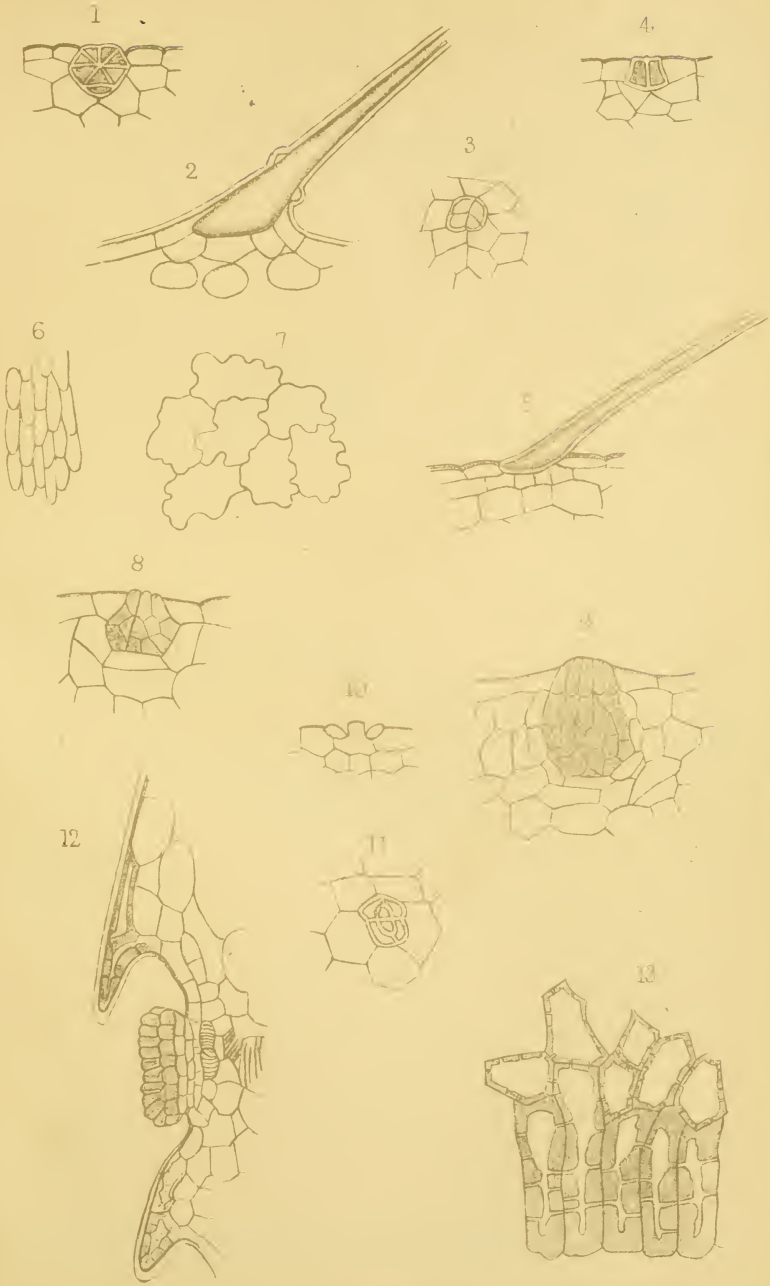
Fig. 11.—Quaternary septum of *S. parasitica*; advanced ovarian stage (November); fluted organ removed.

Fig. 12.—Fluted organ in *S. parasitica*, showing keel-like process.

Fig. 13.—Marks seen through disc of *A. mesembryanthemum* (see text).

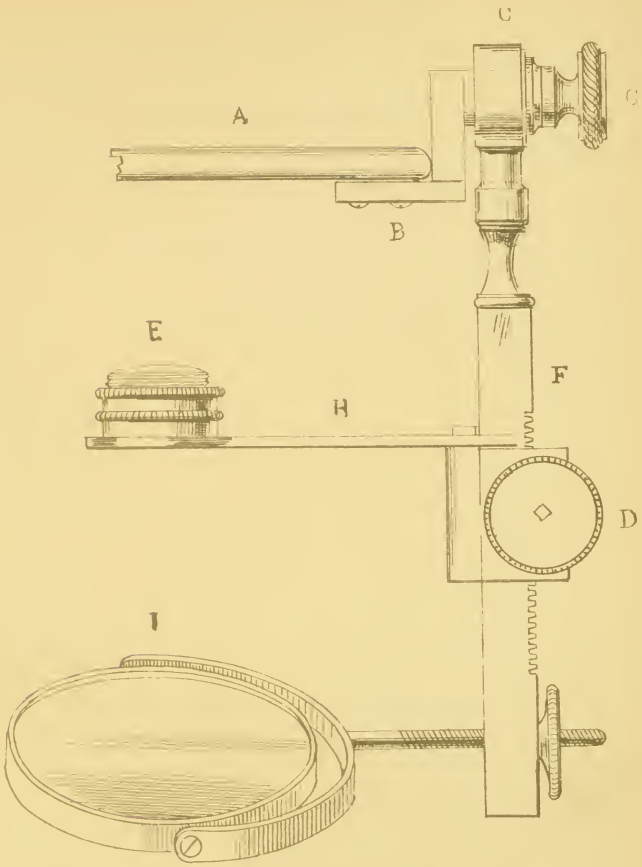
Fig. 14.—Relative shapes of the four septa in ditto.

Fig. 15.— Marks seen through disc of *S. parasitica*.

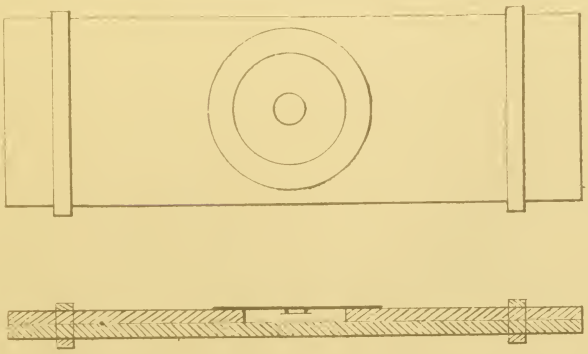


W H Gilbert del.

E Cooke lith.



J Mackenzie del.



J Deby del.

On Certain Immature Forms of Diatomaceæ.

By G. C. Karop, M.R.C.S., &c.

(*Read August 27th*, 1880.)

I should like the attention of Diatomists to be drawn at the present season, when field excursions are being organised, towards the elucidation of the true sexual generation in these plants. Whilst recently examining the rootlets of some duckweed, I was much struck by finding little groups of the tiniest diatom-like bodies, by far the smallest specimens of such forms I had ever seen. Having no means of measurement at hand, I should estimate them of the length of $\frac{1}{3}$ the width of a human blood-corpuscle—that is to say, if the blood corpuscle were square, three average ones would just cover it. They varied in size somewhat, and nearly all seemed in a healthy condition, possessing clear yellow-brown endochrome. In their immediate neighbourhood were some very small *Gomphonema*, usually only two on a V-shaped stipes, and one or two larger ones undergoing binary division. Altogether the whole group gave one the idea of a family, but for the fact that the bodies composing the mass of small frustules were distinctly navicular, and were lying flat on the cells of the rootlet; a very few only standing upright. On this account, and from finding no mature purely navicular forms anywhere on the duckweed—although, bear in mind, my stock was extremely small, being the washings of a bundle of watercress only—I conjectured them to possibly be the pseudo-navicellæ of some Gregarine inhabiting Entomostraca; so I got rid of the surplus water with blotting-paper, and added strong nitric acid again and again in the gentlest manner in small drops, sucking it up each time with paper, until everything but the diatoms was destroyed, the small bodies remaining intact; this proving them to be interpenetrated with silex or other powerfully resisting matter. I need scarcely say I could detect no markings which would have set the question at rest, but I feel convinced they were a brood of young

diatoms produced from a sporangium or gonidia following the sexual congress between two mature forms.

Of course this method has long been surmised, but to my knowledge never witnessed ; so I merely wish to point out to those microscopists who have sufficient means of research and leisure, a favourable opportunity of distinguishing themselves.

On a Method of Dry-Mounting for Opaque Objects.

By Henry J. Roper, F.R.M.S.

(*Read August 27th,* 1880.)

A former President of the Club once remarked that he should like to see more papers for beginners among the work done by the members. In offering a few observations on a very easy and simple method of dry-mounting, I feel that I am, at any rate, supplying one paper of this description.

The first attempts of the possessor of a microscope at mounting objects are generally in this direction, and to speak from my own experience, are not always satisfactory ; but a few hints on trifles which much practice has shown to be really essential, may prove useful to many.

The materials for mounting in the form suggested are neither many, expensive, or complicated. A supply of mahogany slides, 3 × 1in., with central circular cell pierced partially through the slide leaving a "floor" of the wood (these may be procured at 1s. per dozen), some square covering glass, some sheets of wax, such as is used for making wax flowers, which cost, I believe, 1s. 6d. per dozen small sheets (green and white are perhaps the most useful colours, black is not made), and some covering papers of the ordinary kind ; when some name labels are added, the whole of the necessaries are to hand, except a penknife, which everyone carries in his pocket.

To mount any easy opaque object—for example, a portion of leaf with a parasitic fungus on it—first cut a square, say about an inch across, of the green wax, and lay it over the aperture in the slide ; press it firmly down, and it will line the whole cell smoothly, and leave a margin of wax projecting all round the upper surface of the slide ; having made sure that the leaf has no foreign matter on it, cut it so as to nicely fit the sunken cell, now lined with wax, if preferred leaving the wax showing all round, and a very slight pressure with the forefinger will ensure its adherence to the floor of wax,

without in any way damaging the leaf or fungus ; now take a clean covering glass, place it over the wax cell containing the object, and press it firmly but gently down, then remove with the penknife all superfluous wax close to the edges of the covering glass ; place over this the covering paper, not applying too much moisture round the central aperture, and the slide is complete, and can be labelled and placed in the cabinet at once.

It will sometimes happen that a slide is bored so deeply that it is necessary for the convenient illumination of the object, that something more than one thickness of wax should be placed in the cell, so as to bring the object nearer to the covering glass ; this can be taken advantage of to produce a very pretty effect. Before proceeding to line the cell with the wax, place an ordinary wafer in the bottom of it, moistening only the *lower* surface, choosing one, say, of a deep red colour; place over this a square of the white wax, which is always semi-transparent, and the result will be a delicate pink ground, well calculated to show up to advantage many opaque objects ; other coloured wafers will produce at pleasure grounds of different tints, quite destitute of "glare" or "reflection," and "soft" and pleasing to the eye.

The advantages of this method, which is not new, except in slight but not unimportant modifications, are the unfailing certainty of the process, its celerity, total independence of turntables and varnishes, the lightness of the slides, the non-liability to breakage (for there is nothing frangible but the covering glass), and last, but not least, the permanence of the preparation.

I see that an American professor is discarding a somewhat similar method on account of, as he says, "the covering glass, sooner or later, becoming covered inside with a dew-like deposit, which, when illuminated, will glisten like so many minute points of quicksilver." I have myself noticed this occasionally in specimens mounted something in this style, on *glass* slides, but very rarely (not perhaps one per cent.) when mounted on wooden ones ; and then no doubt the wax was used when too new, sufficient time not having been allowed for its volatile properties to evaporate ; it is probable, too, that the wood itself may absorb the slight moisture which, in the case of the glass, can obtain no other refuge than the covering glass ; at any rate, speaking from one's own experience, I have found no inconvenience on this score, after mounting many hundreds of slides, extending over several years.

The result of this very simple, quick, and easy process is, that the object is enclosed in a cell at once air-tight and water-tight, the adhesion of the wax to the wood, and the covering glass to the wax, strengthened by the adhesive cover paper, ensuring immunity from damp, while I have never known an instance in which any object was in the least affected by contact with the wax itself.

On Mounting Opaque Objects with Bees-Wax.

By Henry Morland.

(*Read August 27th*, 1880.)

Although the plan of mounting certain microscopic objects with bees-wax cannot be called a new one, having been in use to my knowledge at least four or five years, yet I trust the few remarks I can offer on this subject may prove acceptable to the members of the Club.

It is not my intention either to enter into a history of this method of microscopic mounting, or to give details of the various plans which I have seen or myself adopt, but to confine myself to one plan only, the one which I find most useful for a variety of opaque objects, and which, if properly carried out, will, I am sure, give every satisfaction.

To begin *ab initio;* I procure bleached bees-wax in cakes, and colour portions of the same by melting them down in an oven with either ultramarine or vegetable black, and stirring the whole well together; after allowing the mass to cool, I have a stock of white and coloured bees-wax with which to commence operations.

Care must be taken not to use too much ultramarine, as any excess will crystallize out on the surface of the wax, and spoil any slides mounted with it. This remark does not apply to the vegetable black, this latter ingredient being amorphous.

To mount an opaque object, I take an ordinary thick tin ring, and place it on a $3'' \times 1''$ glass slip with a piece of wax in the centre; then moving the slip to and fro over a spirit lamp, for fear of cracking the glass, the wax gradually melts and forms a cup-shaped bottom to the cell; I then at once take the slip away and cool it under cover to exclude dust.

When cooling the wax-cell I always place the warm slide upon metal or marble, as the quicker the cooling is effected the finer the surface will be; there is little danger of cracking the glass slip, as

it is not heated to any extent, in proof of which I always hold the slip in my fingers when warming it.

Whilst melting the wax I sometimes find it advisable to stir it on the slip so as to evenly distribute any colouring matter employed ; it is always a good plan to lift out with a penknife the last portion of wax melted in the cell, as otherwise there will occasionally be left a sort of soil spot on the surface of the wax.

Having prepared my cells, which ought to be done only at the last moment, so as to ensure perfect freedom from dust, I then place the object or objects in the same. When this has been done to my satisfaction, I proceed to the fixing, which is effected, not by means of any cement, turpentine or benzole, but merely by placing the slide upon a block of iron, heated to about 140° Faht. ; this gradually softens the wax and fixes the object ; if, however, the object be *large*, it may require to be pressed slightly into the wax, whilst the same is still soft.

Immediately the object is fixed, I cool the slide on a cold surface; when cold, to test the fixing, I reverse the slide and rap it on a table or other substance.

I fix on the covers by soldering them down with wax, using a piece of brass wire, about $\frac{1}{8}$ inch thick, beaten out at one end, as a soldering "bit." The slides I afterwards finish off with white cement, &c., in the ordinary manner.

Each method of mounting has its own advantages. I claim the following for the present plan :—

1st. A particularly clean and uniform surface free from dust, the cell being prepared only at the last moment.

2nd. Provided the object be dry, perfect freedom from damp, heat being applied throughout the whole process.

3rd. The objects appear, even under the microscope, to be merely laid on the surface of the wax ; there is no danger of a "wall" ever appearing round the object if the cover has been hermetically sealed with the wax. I may here mention that this objectionable "wall" round an object is generally caused either by the background not being sufficiently dry or by the vapour of the solvents of the cements used for fixing down the covering-glass passing under it into the cell, and re-dissolving the background ; a good plan to meet this latter contingency is to employ a background having a solvent different to the cement used for fixing down the cover.

In arranging a number of objects in one of these wax cells, I

always place the deeper objects in the centre, on account of the greater depth in that part.

I can cordially recommend the use of blue wax as a background for dead white objects ; the effect is most pleasing, and is enhanced by illuminating the wax by throwing up a light from underneath by means of the mirror ; a proper thickness of wax is essential in order to produce the best effect ; this, of course, can only be learnt with a little experience.

I object to fixing *small* objects down with any cement, as either a "wall" will appear round the object, or a glistening surface will be produced, or else the surface of the wax is liable to be soiled.

On the Use of Arabin in Mounting Microscopical Objects.

By H. J. Waddington.

(*Read August 27th*, 1880.)

It will have been observed that, when a solution of gum Arabic has been used as an adhesive medium for attaching diatoms or other delicate material to slips, that there is often present a granular appearance, which is owing to the earthy matters contained in the gum. It is impossible to get rid of this by the most careful filtration, these earthy matters being soluble in the same liquids as the gum itself. As there is no adhesive medium so suitable as gum for microscopical purposes, I have thought that a preparation of perfectly pure gum, free from the objection thus mentioned, would be of some value to microscopists. Such a medium I find in the body known to chemists as Arabin, and which is in reality gum Arabic from which these impurities have been removed.

To obtain Arabin for microscopical use, gum Arabic should be selected as clear and white as possible. This is to be dissolved in distilled water to the consistence of thin mucilage. It should then be filtered, and the filtrate poured into rectified alcohol, and well shaken. The Arabin immediately separates as a white pasty mass, and the whole becomes semi-solid. It must be placed on filter-paper, and washed with alcohol, until the washings are perfectly free from water, and the alcohol comes off as pure as it went on. The Arabin may now be allowed to dry spontaneously. The edges of the surface of the mass will probably be found to be viscid, owing to the absorption of water from the atmosphere or from the alcohol —but the remainder will be a perfectly pure white powder. This should be shaken off the filter and preserved.

Arabin possesses for microscopical purposes all the properties of ordinary gum. It is freely soluble in water (more readily so than gum), insoluble in alcohol.

Like ordinary mucilage, it is very liable to become mouldy if kept in solution, but when once dry on a slip it undergoes no change, and shows, at least as far as my own observation is concerned, no dete-

rioration after a considerable time. It is undoubtedly a troublesome and expensive matter to prepare, owing to the quantity of alcohol required, but, when once obtained, a little of it goes so far that practically it costs little. Methylated spirit must not be used in its preparation, as, containing always a proportion of shellac, or other gum resins, this is sure to remain as an impurity.

For use, a portion should be dissolved in distilled water to any required consistence, and passed twice through filter-paper, which should have been previously washed with distilled water. It may then be placed on the slips, drained, allowed to dry, and the slips put away for use. In this condition, and with ordinary precautions as to dust and damp, it may be preserved indefinitely.

On a Simple Growing Slide.

By T. Charters White, M.R.C.S., &c., President.

(*Read September 24th*, 1880.)

As there is much to interest the microscopical observer in watching the developmental changes taking place in what are called the lower forms of life, such, for instance, as the Infusoria; and as the appliances for this purpose have not satisfied me, I have brought this evening a Growing Slide that is simple, easily constructed, and the use of which will enable the observer to keep his subject in the field ready for daily or even hourly observation. Most of the growing slides with which we are familiar, are made upon such principles that their removal from the microscope is necessary, and, therefore, when next placed under it the special subject of observation is not easily found; but this growing slide contains its own fluid, and may be left under the microscope for an indefinite period, and the observations and notes made of every change occurring from day to day; and though the idea is carried out roughly, I bring it more as a suggestion for others to work upon and improve, rather than as a perfectly devised contrivance. Its construction is simple; the sides, which may be of any dimensions for which you can get thin glass covers, are constructed out of the strips of thick plate glass which you can get from any glass-merchant's warehouse, and which have been cut off to reduce large plates to the required size for frames, and these are virtually waste pieces, and for a few pence may be procured in any quantity; having built up a cell with these, to a suitable and convenient size, then cement a piece of the same plate-glass in the centre of the cell with Canada balsam; you have now a water-tight cell, having a table of plate-glass in the centre, the space round which you may fill half up with water. Placing your Infusoria or whatever your subject may be, on this table in water, you cover it with the thin glass, and the water in the trough will keep up any loss by evaporation without any saturation of the table. The only drawback to this growing slide is, that it must always be used with the microscope in a vertical position, but as observations

may be made at frequent intervals, it does not necessitate standing over the instrument for long at a time. However, I bring up a roughly-constructed specimen of such a cell, as I knew we wanted a casual communication this evening, and perhaps others may improve on the suggestion.

On Some Desmids New to Britain in 1880.

By M. C. Cooke, M.A., LL.D., F.L.S.

(*Read October 22nd*, 1880.)

Plates XIII, XIV, XV, XVI.

My first intention was merely an enumeration of the *Desmidiæ* found in the British Islands, and especially in England and Wales during the year now drawing to a close. This seemed to be so uninteresting a method of spending an evening, that I resolved upon a more detailed account of some of the species belonging to one genus, hoping by this means to secure greater concentration, and to impart more clear and distinct views than by the former method.

I must premise that I am indebted to my friend, Mr. A. W. Wills, of Birmingham, for a knowledge of the species to be introduced to you as British species. A splendid gathering made by him at Capel Curig afforded a large number of species not before recorded in England or Wales, although some of them had been found in Ireland. Only a portion of the new species need be mentioned, as I purpose confining my remarks solely to the genus *Staurastrum*. Others may find a place in an Appendix.

It is unnecessary to introduce the subject by informing an audience like the present of the nature and affinities of the *Desmidiæ*. I take it for granted that all microscopists are acquainted, cursorily at least, with these interesting little plants; that they form a portion of fresh-water Algæ, are characterized by a green endrochrome and absence of silex, in which features they differ from the *Diatomaceæ*.

Most of you are aware that Desmids are found only in fresh water, and that the majority prefer clear to stagnant pools or running streams.

Desmids consist of but a simple cell, which is usually more or less constricted, and divisible in the centre into two equal and symmetrical halves.

A portion of the numerous genera is characterized by a grega-

rious mode of growth, the cells being united end to end in a continuous chain. These threads are at first attached to some object after the manner of Confervæ. We may, for convenience, call these the *fixed* Desmids.

Others, and by far the greater number, are unattached, free, floating cells, and these we may term *free* Desmids.

We have nothing further to do with the *fixed* Desmids on this occasion.

The *free* Desmids may also be subdivided into two artificial subgroups, in one of which the cell is elongated so as to be almost cylindrical, or fusiform, and in the other oval, or with a length but little exceeding the breadth. To the former belong as types *Closterium*, *Docidium*, and their allies ; to the latter, *Euastrum*, *Cosmarium*, and *Staurastrum*, with some others.

We may banish from our minds the cylindrical free Desmids, and concentrate our attention upon the sub-group, which includes *Staurastrum*, for *that* is the genus to which I am purposing to allude more in detail.

Before doing this you will permit me to refresh your memories with the distinctive features which characterize the different genera in this group. They are only six, or at any rate six will serve our purpose ; and these are *Micrasterias*, *Euastrum*, *Cosmarium*, *Xanthidium*, *Arthrodesmus*, and *Staurastrum*. The two genera *Scenedesmus* and *Pediastrum*, which are included in Ralfs's book, are not *Desmidiæ* at all.

In *Micrasterias* the cell is flattened, and almost lens-shaped, nearly circular, with deep sinuses, which are directed towards the centre, and a deep central notch on each side, nearly dividing the cell into two semicircular equal halves ; the side view is consequently narrow and but slightly constricted at the centre. There are no inflated prominences on the face, and consequently no projections in the side view.

In *Euastrum* the cells are usually longer in proportion to their breadth, with a deep notch in the centre on each side dividing the cell into two equal sinuated or lobed halves, generally with a notch at each end, and wart-like inflations on the surface, which show as projections in the side-view. Each segment is usually narrowed from the base upwards.

In *Micrasterias* and *Euastrum* therefore the frond or cell has a more or less lobed outline.

In *Cosmarium* the cell is more or less constricted in the centre, without sinuses or lobes at the margin, and each semi-cell as broad or broader than long (with a few exceptions). There is no notch at the ends, as in *Euastrum*, and the side view is a double circle or a double ellipse, whilst the end view is oval or elliptical, sometimes warted, but without spines.

In *Xanthidium* the general form, and the side and end views, are as in *Cosmarium*, except that the segments are spiny. It is, in fact, a *Cosmarium* with spines.

Arthrodesmus is a simple form of *Xanthidium*, each segment having but a single spine on each side.

We may now compare these three genera which have a simple constricted cell without lobes, and an oval end view, thus—

Cosmarium—spineless.

Xanthidium—many spined.

Arthrodesmus—with a spine on each side of each semi-cell.

We have now left to us the one genus *Staurastrum*, in which the forms are exceedingly variable, but uniformly consisting of a deeply constricted cell, with or without spines or projections, but the end view is angular, often triangular, sometimes quadrangular, or, if circular, then with a lobed margin. Hence it will be evident that the end view is of the greatest importance in determining this genus and its numerous species. In a front view some species might easily be mistaken for *Cosmarium*, others for *Xanthidium*, and others for *Arthrodesmus*, but the end view settles the question at once by its angular form.

Staurastrum includes more species than any other genus, and these again exhibit a greater variety of contour. In fact, so variable are they, that most elaborate modes of sub-grouping have been adopted, and although some method is absolutely essential, no one yet proposed is wholly perfect. To my mind it seems preferable to collect closely allied species around definite types, rather than to subject them to the hard and fast lines of an elaborate technical analysis. At any rate such a method will be all-sufficient for the purpose of this evening.

I have already said that the front view of some species closely resembles *Cosmarium*, such as the large species *Staurastrum tumidum*, and the smaller ones, *St. orbiculare*, and *St. brevispina*, notwithstanding the small projecting nipple.

Allied to these I have to record from Capel Curig the large *Stau-*

rastrum grande of Bulnheim ("Hedwigia," t. ix. A, f. 14), ·084-·088 mm. to ·1 mm. long, and ·08-·082 mm. or more broad, which is large for a *Staurastrum* ; each semi-cell is elliptical, without processes, and the end view triangular with obtuse angles, and slightly concave sides. The endochrome is banded. It was first found in Germany, then in Sweden, and now in Wales. The characteristics are so distinct that it cannot well be confounded with any other species.

A smaller species is *Staurastrum aversum*, Lund., which is somewhat similar to *Staurastrum brevispina*, Breb. It was found in Ireland by Mr. Archer, but this is its first appearance in Britain.

Its length is about ·045-·05 mm., and its breadth ·036- 042 mm. The semi-cells are somewhat elliptical, slightly concave on the outer margin, and bearing a minute rounded nodule on each side. The end view is three-sided, with rounded angles, and a rounded nodule at each angle ; the sides are slightly concave. By comparison of the figures with those of its nearest ally, *Staurastrum brevispina*, on the same diagram, the differences will be manifest.

A larger species, with somewhat similar outline, except that the outer margin of the semi-cells is slightly convex, is *Staurastrum longispinum*. It was first discovered many years ago by Bailey, in the United States, afterwards it was found in Sweden, then it was recorded in Ireland, and now in North Wales. It is certainly a fine species, with two spines on the outer margin on each side of each semi-cell. The end view is three-sided with rather obtuse angles, armed with a long straight-pointed spine, and the sides are slightly concave. The endochrome is in fillets, as in *Staurastrum grande*. The cells are from ·1 mm. broad and long.

Although this, and others, may be described as triangular in the end view, specimens may be met with in which the end view is quadrangular. This fact should be remembered, as species often vary in this direction.

A still more magnificent species is *Staurastrum brasiliense*, Nordst., first found in Brazil, afterwards in Sweden, and now in Wales. It has not been recorded in Ireland. The figure on the diagram will give a better illustration than a technical description. In the front view it certainly has a striking resemblance to a species of *Xanthidium*, but the five or six angled end view determines it to be a *Staurastrum*. In size the frond is nearly ·1 mm. long and about ·08 mm. broad.

Another species which, although once recorded in Ireland, is new

to Britain, is *Staurastrum arctiscon*, Ehr. It was first described by Ehrenberg. Then it seems to have been lost sight of for years, until it was found in Sweden, next in Ireland, and now in Wales. It is probable that Bailey found the same species in the United States.

This species forms one of a group of closely allied species, of which *Staurastrum furcigerum*, figured by Ralfs, is one, the present species another; *Staurastrum pseudofurcigerum*, Reinsch, is a third. *Staurastrum sexangulare*, Bulnh., is a fourth, and a species figured by Wood in his Fresh-Water Algæ, if really distinct from *Staurastrum arctiscon* would be a fifth. Of these, all except the last, have now been found in the British Isles. Mr. Wills found two at Capel Curig, *Staurastrum pseudofurcigerum* and *Staurastrum arctiscon*, the former for the first time, the latter had been found in Ireland, as also has *St. angulare*. The diagrams will convey a better idea of the complex forms of these species than verbal descriptions, special attention being directed to the end views.

Dismissing these we come to a singular form, in which the arms are all in the same plane, towards the apex of each semi-cell. This is *Staurastrum ophiura*, Lund. It is another large species, figured by Lundell with seven arms, but all the Welsh specimens have invariably eight arms, and the proportions of the cells seem slightly different, being longer than in Lundell's figure. Previous to its discovery in Britain, *Staurastrum arachne*, Ralfs, was the nearest species, but that is very much smaller, beside other differences.

Staurastrum cerastes, Lund., is a characteristic but smaller species. Each semi-cell is crowned by three or four stout ornate horns, which are bent towards the centre, until the tips of the horns of the two semi-cells nearly meet. This Swedish species had been found in Ireland previously, and now at Capel Curig. It was included in a gathering made also by Mr. Wills at Barmouth many years ago, but only recently determined.

Staurastrum Sebaldi, Reinsch., resembles *Staurastrum vestitum*, Ralfs, but is larger and more elaborately ornamented. Mr. Archer found it in Ireland, and Mr. Wills a variety of it at Capel Curig. I have compared the specimens from Wales with those on a slide mounted and named by Reinsch himself. The ordinary form is triradiate, but in the front view only two arms are usually seen at once at each semi-cell, one on each side. The Welsh form has longer arms, but the differences appear to be only varietal.

There is another closely allied species in the Capel Curig gathering, nearly of the same size, which I have been unable to refer to any described species. The general appearance is more like *Staurastrum furcigerum*, starved and reduced to three arms per cell. It has been determined to call it *Staurastrum anatinum;* Professor Nordstedt professes to be unable to refer it to any described species. Enough has been said already to show what a single gathering from a good locality may produce.

Nine species of *Staurastrum*, new to Britain, have been determined, of which six had previously been recorded in Ireland.*

Staurastrum arctiscon.
,, *ophiura.*
,, *Sebaldi.*
,, *cerastes.*
,, *aversum.*
,, *longispinum.*

And three quite new to the British Isles :—

Staurastrum brasiliense.
,, *grande.*
,, *pseudofurcigerum.*

I have intentionally confined myself to the species of *Staurastrum*, as being a sufficient number for which to draw the diagrams, which are all to an uniform scale of 5000 diameters. Incidentally I may mention that the accompanying list contains the species found in the gathering—some very rare and some new—but the whole of the gathering has not yet been exhausted.

LIST OF THE DESMIDIACEÆ FOUND AT CAPEL CURIG BY A. W. WILLS, ESQ.

* The asterisk (*) denotes the species which are new to Britain.

Aptogonum desmidium, Ehr.
Bambusina Borreri, Ralfs.
Didymoprium Grevillea, Kutz.
Desmidium Swartzii, Ag.
Hyalotheca dissiliens, Sm.
Sphærozosma vertebratum, Breb.
* ,, *pulchellum*, Archer.
Micrasterias furcata, Ag.
,, *papillifera*, Breb.
Micrasterias pinnatifida, Kutz.
,, *radiosa*, Ag.
,, *denticulata*, Breb.
Euastrum verrucosum, Ehr.
,, *pectinatum*, Breb.
,, *didelta*, Turp.
,, *ansatum*, Ehr.
,, *crassum*, Breb.
,, *binale*, Turp.

* Others have been determined since this communication was read, which will be found in an Appendix.

Euastrum gemmatum, Breb.
„ *elegans*, Breb.
* „ *erosum*, Lund.
**Cosmarium pseudoconnatum*, Nordst.
„ *ornatum*, Ralfs.
„ *cucurbita*, Breb.
„ *cœlatum*, Ralfs.
„ *undulatum*, Corda.
„ *botrytis*, Bory.
„ *cucumis*, Corda.
* „ *pseudonitidulum*, Nordst.
* „ *tetrachondrium*, Lund.
„ *phaseolus*, Breb.
* „ *cyclicum*, Lund.
* „ *variolatum*, Lund.
* „ *Nymannianum*, Grun.
* „ *truncatellum*, Perty.
* „ *Holmiense*, Lund.
* „ *quadrum*, Lund.
* „ *galeritum*, Nordst.
* „ *orthostichum*, Lund.
„ *granatum*, Breb.
„ *læve*, Rabh.
* „ *sphalerotrichum*, Lund.
* „ *globosum*, Buln.
* „ *coronatum*, Cke. & Wills.
* „ *cambricum*, Cke. & Wills.
Xanthidium armatum, Breb.
„ *fasciculatum*, Ehr.
Arthrodesmus incus, Breb.
„ *octocorne*, Ehr.
„ *convergens*, Ehr.
**Staurastrum Brasiliense*, Nordst.
* „ *arctiscon*, Ehr.
* „ *ophiura*, Lund.
* „ *cerastes*, Lund.
**Staurastrum aversum*, Lund.
„ *gracile*, Ralfs.
„ *dejectum*, Breb.
„ *vestitum*, Ralfs.
* „ *grande*, Lund.
* „ *longispinum*, Bailey.
„ *aristiferum*, Ralfs.
„ *arachne*, Ralfs.
* „ *pseudofurcigerum*, Reinsch.
* „ *Sebaldi*, Reinsch., variety.
* „ *anatinum*, Cke. & Wills.
„ *tetracerum*, Kutz.
„ *furcigerum*, Breb.
„ *cuspidatum*, Breb.
„ *muticum*, Breb.
„ *margaritaceum*, Ehr.
* „ *Pringsheimi*, Reinsch.
„ *paradoxum*, Meyen.
„ *punctulatum*, Breb.
„ *hirsutum*, Ehr.
* „ *megacanthum*, Lund.
„ *inflexum*, Breb.
„ *cristatum*, Breb.
Penium digitus, Ehr.
„ *cylindrus*, Ehr.
Tetmemorus granulatus, Breb.
**Docidium nodosum*, Bailey.
„ *baculum*, Breb.
„ *Ehrenbergii*, Ralfs.
Closterium setaceum, Ehr.
„ *lunula*, Mull.
„ *didymotocum*, Corda.
„ *cornu*, Ehr.

Finally, to give a practical turn to these hurried notes, permit me for a few moments to advert to the subject of mounting Desmids for the microscope. This has always been a great difficulty, but perhaps magnified too much. Let us ask ourselves what really is the most important object to be secured in mounting Desmids, and in answer I must say that I place less importance on the preservation of the endochrome and its colour than do those who mount pretty objects for the drawing-room. For scientific purposes the empty

frond is often of superior value to one filled with endochrome ; it permits you to see the punctæ or markings of the segments, which are obliterated whilst the endochrome remains, and in the genus *Cosmarium* this becomes daily of greater importance than ever.

I admit that for the study of the endochrome alone, its presence is, of course, the most important, but this can be done, and drawings made from the plant in the living state, and if specimens can be mounted with the endochrome unchanged and uncontracted, so much the better, but as yet I have seen no method entirely satisfactory. For twelve years I have kept some slides mounted in the silicates of potash and soda, but these were not satisfactory, as half the slides would persist in deliquescing. Far more successful was my friend Mr. Wills, for his slides, mounted much longer even than mine, surprised me. Of course I enquired the medium, and learnt that he simply used the water in which the Desmids had been collected, and was careful never to leave them exposed to the daylight.

One great difficulty in mounting objects with such thin and delicate cell walls as Desmids is to employ a medium of no greater density than the cell contents. If a denser medium, such as glycerine, be employed, the endochrome immediately contracts, and never expands again as before. Water, or water containing a little camphor, is of equal density, and no change can be detected.

After all, the preservation of the endochrome is of less importance than the perfect contour of the cell. If there is any contraction or collapse the objects are useless.

Supposing, therefore, that there is no necessity to preserve the endochrome, there is another feature to be remembered besides the preservation of contour, and that is that the medium employed should not render the delicate cell walls so transparent as to become ultimately invisible. I commend this to your notice as a warning. In simple water I encountered no difficulty in discerning the structure of the cell walls, after a period of not less than twelve years. So much cannot be said for glycerine. As a hint, I may add that I have seen empty fronds stained of various colours, both of Desmids and of Volvox, and these exhibited all the details in an unexceptionable manner.

Let me commend these little plants to those of you who are getting tired of *Stephanoceros* and *Melicerta*. There are plenty of discoveries yet to be made.

EXPLANATION OF PLATES XIII. TO XVI.

PLATE XIII.

Fig. A.—Types of *Cosmarium*; *a*, *Cosmarium pseudonitidulum* Nord., with side and end views; *b*, *Cosmarium cambricum*, C. & W., with side and end views.

Fig. B.—Type of *Xanthidium*. *X. antilopeum*, Breb., with *c*, side view; *d*, end view.

Fig. C.—Types of *Arthrodesmus*, *e*, *A. convergens*, Ehr., with end views; *f*, *A. incus*, Breb., with end views.

PLATE XIV.

Figs. 1-3.—*Staurastrum pseudofurcigerum*, Reinsch; 2, 3, end views.

Fig. 4.—*Staurastrum furcigerum*, Breb.; 5, end view with four arms.

Fig. 6.—*Staurastrum arctiscon*, Ehr., 7, end view.

Fig. 8.—*Staurastrum sexangulare*, Buln.; 9, end view.

Fig. 10.—*Staurastrum ophiura*, Lund.; 11, end view.

PLATE XV.

Fig. 12.—*Staurastrum anatinum*, C. & W.; 13, end view.

Fig. 14.—*Staurastrum Sebaldi*, Reinsch.; variety; 15, end view.

Figs. 16, 17.—*Staurastrum paradoxum*, Mey., var. *longipes;* front and end views.

Figs. 18, 19.—*Staurastrum cerastes*, Lund.; 20, end view.

Figs. 21 to 24.—Supposed varieties of *Staurastrum saxonicum*, Reinsch., of which no end views have been obtained.

Fig. 25.—*Staurastrum Brasiliense*, Nordst.; 26, end view.

PLATE XVI.

Fig. 27.—*Staurastrum grande*, Lund., Capel Curig form; 28, end view.

Figs. 29-31.—*Staurastrum megacanthum*, Lund.; 30, end view.

Fig. 32.—*Staurastrum aristiferum*, Ralfs.: 33, end view.

Fig. 34.—*Staurastrum brevispina*, Breb.; 35, end view.

Fig. 36.—*Staurastrum aversum*, Lund.; 37, end view.

Fig. 38.—*Staurastrum inflexum*, Breb.; front and end views.

Fig. 39.—*Staurastrum Pringsheimii*, Reinsch.; 40, end views.

Fig. 41.—*Staurastrum longispinum*, Bailey; 42, end view.

All the figures drawn to an uniform scale of 420 diameters.

On a New Vivarium.

By J. D. Hardy.

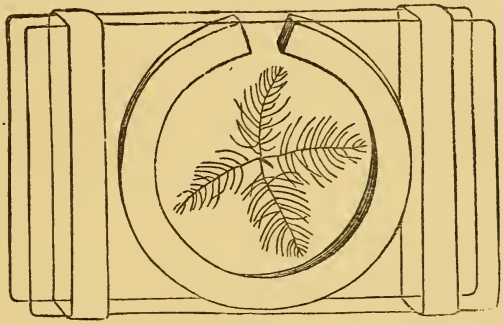
(*Read 26th November*, 1880.)

When using the ordinary zoophyte troughs, I have often considered that they had many objectionable qualities; I therefore set myself to work to see if something better could not be devised. At the last general meeting Mr. Crisp brought before the notice of the meeting a trough, known as "Botterill's," the existence of which I was ignorant of until that time, and although there now appears some similarity of construction between that and mine, I venture to think that in simplicity and general usefulness (as well as in the cost) that this will be found to be far superior. The main objections to the old Zoophyte trough were that it was necessary to employ one much deeper than what was absolutely required for the purpose of placing the object in the water without injuring it; secondly, that when you had got the object into a good position for viewing it, you had to take it out again and bottle it, if you wished to carry it anywhere for exhibition or otherwise; thirdly, the water in the trough (through its being open at the top) was always more or less susceptible to every movement, which caused some objects to have a constantly oscillating motion; also, the water being of a certain depth, was very objectionable in using the paraboloid—also non-reversible, and must be kept upright.

Now, *this* Trough—or Vivarium, as I shall call it, for it is *not* a trough—will be found to obviate all these objections, besides containing the elements of other uses and improvements.

The cell consists of two flat pieces of clear glass, 3in. × 2in., or 2in. square, to the lower of which is cemented either an indiarubber or glass ring of any desired thickness; this is covered on the upper side with some adhesive substance (if necessary), or it may be simply greased to render it impervious. A piece is cut out of the ring at the top, about a quarter of an inch wide and funnel shaped; the upper piece of glass is then placed on the ring, and the whole

is held together either with strong indiarubber rings or springs. To use it, take off the upper glass, and having cleaned both glasses, place the object on the lower glass, manipulate it to the best advantage, replace the upper glass, and then fill up with water through the hole at the top. It will be found that the cell is reversible and that it can be plunged into a beaker full of water in any position without any fear of losing the object.



"Receipts for Microscopists."—Correction.

The Interpolation formulæ for Spectroscopic bands will be found in "Watts' Index of Spectra," and not in Suffolk's work as stated. They also appear in "Silliman's Journal" for July, 1870, in which W. Gibbs first published them.

In Number IV. of the "Receipts" it is stated that the monochromatic bull's-eye condenser is of "unusual" form. It should be "of the 'usual' external shape," and differs from ordinary ones only in being hollow, so as to receive coloured liquids between the plane and convex surfaces.

PROCEEDINGS.

August 13th, 1880.—Conversational Meeting.

The following objects were exhibited:—

Spiked Eye of "Harvest-man" (*Megabunus insignis*)	Mr. F. Enock.
Red Crag Polyzoa, &c.	Mr. J. D. Hardy.
Solium exsculptum, front and side views ...	Mr. H. Morland.
Cuticle of Leaf of Lemon Thyme, showing oil glands	Mr. C. Le Pelley.
Analysing Crystals	Mr. H. J. Waddington.

Attendance—Members, 35; Visitors, 3.

August 27th, 1880.—Ordinary Meeting.

T. Charters White, Esq., M.R.C.S., &c., President, in the Chair.

The minutes of the preceding meeting were read and confirmed.

Mr. James A. Close was balloted for and duly elected a member of the Club.

The following donations to the library were announced:—

"Proceedings of the Royal Society" ...	from the Society.
"Journal of the Royal Microscopical Society"	" "
"9th Report of the Chester Society of Natural Science"	" "
"9th Report of the South London Microscopical Club"	" "
"Journal of the Microscopical Society of Victoria"	" "
"Inaugural Address of the Buffalo Microscopical Society"	" "
"The American Monthly Microscopical Journal"	from the Publisher.
"The American Journal of Microscopy" ...	" "
"The American Naturalist"	" "
"Science Gossip"	" "
"The Analyst"	" "
"Annals of Natural History"	Purchased.
"Quarterly Journal of Microscopical Science"	"

The thanks of the meeting were voted to the Donors.

The President read a letter from Mr. F. H. Wenham, in acknowledgment of his election as an Hon. Member of the Club, and expressed the hope that Mr. Wenham would come amongst them to see for himself what kind of work they were doing, and to give them the benefit of his experience.

A paper "On Some Immature Forms of Diatoms," by Mr. G. C. Karop, was read by the Secretary, and the thanks of the meeting were voted to the author.

Mr H. J. Roper read a paper "On a Method of Mounting Opaque Objects in Cells made of Sheet Wax." Specimens in illustration were exhibited in the room.

Mr. Henry Morland read a paper "On Mounting Opaque Objects with Bees-wax."

The President said he had listened with great pleasure to these two very useful papers on a similar subject, and he must say that the specimens exhibited by Mr. Roper were some of the neatest and best specimens of wax mounting which he had seen for a long time, and that his plan of using sheet wax was one which appeared likely to be very useful.

Mr. Ingpen said that Prof. Hamilton Smith gave them a paper some time ago on this subject,* but he had lately stated that he was obliged to give up the plan because of the dewing or exudation which collected under the covering glass. This was a matter of considerable interest. These cells were very useful, from the absence of granular structure in the background, which might easily be rendered a dead black, or any suitable colour.

The President said the structureless character of the wax was one of its most valuable properties, and personally he felt very much indebted to Mr. Stewart for introducing to their notice the use of Ozokerit for this purpose. Perhaps Mr. Stewart would tell them his experiences of it?

Mr. Stewart said he had not used this material for mounting purposes, but only for pinning down objects for dissection, in the way he had already described. He was not particularly partial to coloured backgrounds, because, however pleasing they might be to the eye, they were apt to produce a false idea of colour by the effect of contrast. He preferred to mount on the ordinary slip and cover the glass on the reverse side with Berlin black.

Mr. Roper said that although black wax could not be obtained, the surface could easily be coloured with Indian ink.

Mr. Gilburt said he had been in the habit of using wax for a long time past by building up the cells, and when made in this way the dewing which had been complained of, had not appeared. The plan adopted was that of spinning the wax up on the slide itself, using melted wax, and doing it upon the turn-table; the cover adhered by itself, and, so far as his experience went, there was no condensation of moisture whatever, the heating of the wax seemed to get rid of the volatile element. In finishing off he found it best to use first a thin coating of oxide of zinc in gum water,

* "Journal Q.M.C.," Vol. iv., p. 177.

and then put on the finishing coating afterwards, when the slides might be ornamented to any extent without difficulty.

Mr. Waddington read a paper "On the use of 'Arabin' or perfectly pure Gum Arabic" for attaching Diatoms, &c., in mounting.

Mr. Borrer said he had used Arabin himself, and found it to be all that Mr. Waddington had described it. Its chief merits were its great transparency and the remarkable readiness with which it absorbed moisture, and set again afterwards.

Mr. Ingpen inquired what was its refractive index, and what was the effect of the slight wave which collected round the sides of a small object placed upon it?

Mr. Borrer said he was not able to state the refractive index; but he had not observed any effect whatever arising from its collection round the edge of an object with any kind of illumination.

Mr. Ingpen said that in mounting Diatoms it was often necessary to bake the balsam so as to get it at its highest refractive index, and when Diatoms were fixed down with ordinary gum, the gum showed as a bright disc. Did Arabin show this, or did it remain quite transparent after heating with the balsam?

Mr. Borrer said that Arabin would stand the heat of an ordinary spirit lamp for eight hours, and no inconvenient effects occurred with any heat which would practically be applied in mounting.

Votes of thanks to the authors of the papers were unanimously carried.

Announcements of excursions, &c., for the ensuing month were made, and the proceedings terminated with the usual Conversazione, at which the following objects were exhibited:—

Papillæ in Tongue of Mouse, polarized ...	Mr. F. W. Andrew.
Stem of Thistle	Mr. W. Goodwin.
Chrysopa perla, the Lace Wing Fly (unmounted), showing the pygidium	Mr. R. T. Lewis.
Foraminifera from Dogs Bay, Ireland, mounted in wax cells in illustration of his paper	Mr. H. Morland.
A series of specimens of Stained Leaves, prepared by Dr. Hunt, of Philadelphia, in 1872, lent by Mr. J. Stewart	The Club Microscope.

Attendance—Members, 55; Visitors, 7.

September 10th, 1880.—Conversational Meeting.

The following objects were exhibited:—

Parasite and eggs found on leaf of Scarlet-runner	Mr. F. W. Andrew.
Specimens of Hafnarfiordite, a Lava from Iceland	Mr. E. Carr.
Head of Gad-fly, *Hæmatopota pluvialis*, showing brilliant eye... ...	Mr. F. Enock.

Section of petiole of Yellow Water Lily, *Nuphar lutea*, showing internal branching cells	Mr. W. H. Gilburt.
Leaf of *Drosera rotundifolia*, stained ...	Mr. W. Goodwin.
Exuvium of *Polyxenes lagurus*	Mr. H. Morland.
Melicerta ringens	Mr. J. M. Offord.
Grantia compressa, section showing ciliated cells *in situ*, $\frac{1}{6}$ objective ...	Mr. B. W. Priest.
Spores of *Puccinea graminis* (Wheat Mildew)	Mr. J. C. Sigsworth.
Larva of *Tipula* (?) showing bifid processes on the back	The President.
Leaf of *Drosera intermedia* (?)	Mr. F. Wood.

Attendance—Members, 49; Visitors, 3.

September 24th, 1880.—Ordinary Meeting.

T. Charters White, Esq., M.R.C.S., &c., President, in the Chair.

The minutes of the preceding meeting were read and confirmed

Mr. F. D. Rudkin was balloted for and duly elected a member of the Club.

The following donations, &c., were announced :—

"Science Gossip"	from the Publisher.
"The American Naturalist"	in Exchange.
"Grevillea"	Purchased.
"Annals of Natural History"	,,
"A Paper on the Lymphatics in Eastern Leprosy	from Dr. Hoggan.
"Calendar of University College" ...	,, the Council.
"President's Address, &c., of the Hertfordshire Natural History Society"	,, the Society.
1 Slide (Larvæ of Lady Bird)	,, the President.
4 Slides—(parasites)	,, Mr. H. E. Freeman.
50 Drawings—(Infusoria)	,, Dr. M. C. Cooke.

Mr. J. D. Hardy presented his photograph for the album.

The thanks of the meeting were unanimously voted to the donors.

The President called particular attention to Dr. Cooke's donation, which, he thought, deserved more than the commonplace vote of thanks. It consisted of a series of 50 original plates, and he was sure that everyone must be struck by the beauty and accuracy of these productions. The example set by Dr. Cooke was a most excellent one, and he hoped that many of the members would be induced to do likewise, especially as paper the same as that used by Dr. Cooke could be obtained for the purpose of the Librarian.

The President said that some time ago he was making a collection of the

eggs of insects, and amongst them he got some of the eggs of the Lady-bird. He put them for two hours or more into alcohol to kill them, and then mounted them in Canada balsam. Looking at the slide some time afterwards, he found that the whole of the eggs had hatched. The larvæ on the slide which he presented to the Cabinet were some of this batch; they were mounted in balsam; and he mentioned the matter as it was a curious fact that these creatures should have resisted the efforts made to destroy them in the manner described.

The President read a letter from the Secretary of the Croydon Microscopical Club, announcing that their Soireé would be held on Wednesday, the 24th of November, and asking the co-operation of members of the Quekett Microscopical Club on that occasion.

The President exhibited some button-moulds, brought by Mr. Simpson, of Ealing, for use as cells for dry mounting. They appeared to be very well made, and likely to be useful, and certainly had the recommendation of being extremely cheap.

Mr. Hailes said there was nothing new about them, as he had used them for years for the purpose.

The President read a short paper "On a Simple Growing Slide," which he exhibited in illustration.

Mr. Ingpen described the use of Zeiss's adjusting objective for low powers (called "a*" in Zeiss' Catalogue), practically illustrating his remarks by the exhibition of the apparatus.

The President called attention to some objects exhibited by Mr. J. D. Hardy. They were specimens of "Pond life," and appeared somewhat uncommon.

Mr. Hardy said that one of these was a species of *Vaginicola;* it was in a very different condition from anything he had been able to find figured or described. It had been very abundant in his pond during the year, appearing in groups of 50 or more tubes. He had thus been able to trace something of its life-history. It first appeared in pairs of very small bright tubes attached to the weed. From every tube a very slender cilium was thrown out on each side. It then developed a heart-shaped ciliated disc. Sub-division then took place until the group was formed, which, on arrival at maturity, became detached from the weed, and floated away in the water, revolving very slowly. It appeared to be most nearly allied to *Vaginicola grandis.* He promised to send drawings for insertion in the Club portfolio. Mr. Hardy also referred to a specimen of *Melicerta tyro,* which he was exhibiting, mentioning particularly its inability to construct a case, and the size and prominence of its two antennæ.

The President enquired if Mr. Hardy had detected anything like the usual valve, and observed that *Vaginicola* usually had a vase-shaped tube, and he thought the specimen just described was hardly like one of that genus. Certainly it must be a very uncommon variety.

Mr. Hardy thought that the variety to which the President alluded was marine.

The President thought this was a case in which a growing slide would be

of great use. It would be most interesting to be able to watch the growth and development of one of these creatures.

The President said that they had amongst them many members who were either new members, or were just beginning the study of the microscope. He wished to remind such members that although they met with many in that room who were very far advanced in the science, they should remember always that they belonged to a Club and not to any stiff and formal Society. He had the full permission of the Committee to say that they would heartily welcome everybody who was desirous of obtaining information, and would to the full extent of their abilities endeavour to help all who came to them. Demonstrations had been objected to on account of their causing some interference with the other business of the meetings, but he would, on behalf of the Committee and others, cordially invite anyone, who was seeking for information or help of any kind, to come forward to ask any questions they pleased.

Announcements were then made of excursions and meetings, and of the objects exhibited.

The President also intimated that Mr. E. Carr had brought for distribution a number of specimens of Lava from Iceland.

The proceedings then terminated with the usual Conversazione, at which the following objects were exhibited :—

Australian Algol, polarised	Mr. F. W. Andrew.
"Hafnarfiordite," a Lava peculiar to the locality of Hafnarfiord, Iceland	Mr. E. Carr.
Paludicella Ehrenbergii, a Fresh-water Polyzoon	Mr. W. G. Cocks.
Plant Bug from New Guinea	Mr. C. G. Dunning.
Leaf of *Drosera rotundifolia*, showing insects *in situ* (prepared without pressure)	Mr. F. Enock.
Spines of *Amphidotus cordatus*, the "Heart Urchin"	Mr. A. Fieldwick, junr.
Scales of *Dicranura vinula*, Puss Moth ...	" "
Ovipositor of *Acrida viridissima*, showing so-called Pygidia	Mr. H. E. Freeman.
Alcyonella Benedeni	Mr. W. Goodwin.
Vaginicola grandis	Mr. J. D. Hardy.
Melicerta tyro...	" "
Tongue of Hive Bee	Mr. A. Martinelli.
Palate of *Trochus zizyphinus*	Mr. W. Moginie.
Grantia ciliata, section of collar, showing ciliated cells...	Mr. B. W. Priest.
Phylloxera on root of vine (living) ...	Mr. J. W. Reed.

Attendance—Members, 82; Visitors, 2.

October 8th, 1880.—Conversational Meeting.

The following objects were exhibited:—

Hairs on Wallflower leaf	Mr. F. W. Andrew.
Section of Quillaija Bark, showing prismatic crystals	Mr. W. R. Browne.
Leaf of Nettle, stained	Mr. F. Coles.
Section of Porcupine quill	" "
Section of Tulip, showing ovary, stained ...	Mr. W. I. Curties.
Hydra vulgaris, transverse section, stained with Osmic acid, showing ciliated endoderm cells	Mr. T. Curties and Mr. E. T. Newton.
Lacinularia socialis	Mr. E. Dadswell.
Cocconeïs scutellum	Mr. C. G. Dunning.
Lampyris noctiluca, Glow-worm, showing illuminating organs	Mr. F. Enock.
Spiral vessels from Carrot	Mr. A Fieldwick, jun.
Scales of *Gonoptera libatrix*	" "
Cuticle of *Equisetum*, polarized	Mr. W. Goodwin.
Bramble brand	Mr. H. R. Gregory.
Melicerta pilula (or n.s.?)	Mr. J. E Ingpen.
Cyclosis in *Vallisneria*	Mr. A. Martinelli.
Lernæa, Parasite of Salmon, a curious example of so-called retrograde metamorphosis	Dr. Matthews.
Polyxenus lagurus	" "
Crystals of sublimed Arsenic	Mr. H. Morland.
Hairs of *Trichinium Manglesii*	" "
Podura scale × 3,000 under Powell and Lealand's 1-60th objective ...	Mr. E. M. Nelson.
Hydra fusca, killed with Osmic acid, and mounted in Acetate of Potash ...	Mr. B. W. Priest.
Section of Ovary of *Campanula*	Mr. J. W. Reed.
" " *Œnothera biennis* ...	" "
Pinnule of Maiden-hair Fern	Mr. A. S. Smith.
Crystalline matters in various red inks ...	Mr. W. Teasdale.
Native Sub-oxide of Copper, from Chili ...	Mr. H. J. Waddington.

Attendance—Members, 64; Visitors, 4.

October 22nd, 1880.—Ordinary Meeting.

T. Charters White, Esq., M.R.C.S., &c., President, in the Chair.

The minutes of the preceding meeting were read and confirmed.

Mr. William E. Milner and Mr. William Radcliffe were balloted for and duly elected members of the Club.

The following donations, &c., were announced:—

"Proceedings of the Royal Society" ...	from the Society.
"Journal of the Royal Microscopical Society"	" "
"Proceedings of the Belgian Microscopical Society"	" "
"Proceedings of the Geologists' Association"	" "
"Proceedings of the Royal Dublin Society"	" "
"Science Gossip"	" the Publisher.
"Popular Science Review"	" "
"The Analyst"	" "
"Journal of the Linnean Society" ...	" Mr. T. C. White.
A number of Photo micrographs of *Amphipleura pellucida* and *Pleurosigma angulatum*	" Dr. Woodward, Surgeon Genl. U.S. Army.
"The American Journal of Microscopy"	in Exchange.
"The American Monthly Microscopical Journal"	" "
"The American Naturalist"	" "
Saville Kent's "Infusoria," Part I. ...	by Subscription.
Ray Society's last Volume	" "
"Annals of Natural History"	" Purchase.
Photograph of Dr. Sharpey	from Mr. Ingpen.
1 Slide, section of *Hydra vulgaris* ...	" Mr. E. T. Newton.
3 Slides (Vegetable Sections) ...	" Mr. J. W. Reed.
2 " (Injections by Professor Quekett)	" Mr. Crowther.
Improved "Botterill Life Slide" ...	" Mr. F. Crisp.

The thanks of the meeting were unanimously voted to the Donors.

Mr. F. Crisp exhibited and described a new form of the Botterill Life Slide, which was made of ebonite, and could be taken to pieces for the purpose of cleaning, and could also be readily adjusted to any required thickness.

A letter from the Secretary of the Greenwich Microscopical Society, announcing their Soirée for December 8th, and inviting the assistance of the members of the Q.M.C., was read by the President.

A communication from Mr. Romyn Hitchcock was read, announcing the intended publication of Dr. Habishaw's "Catalogue of the Diatomaceæ,"

provided a sufficient number of subscribers could be obtained—35 more being wanted.

Dr. M. C. Cooke read a paper "On New Freshwater *Algæ* discovered during the Year," the subject being illustrated by numerous coloured diagrams.

The President expressed the pleasure with which he had listened to Dr. Cooke's very interesting paper. He could quite confirm all that had been said as to mounting in water, having specimens in his possession which had been so preserved for 12 years, and the endochrome of which was only slightly faded.

The Secretary expressed his regret to Dr. Cooke that from want of previous intimation more adequate means for the exhibition of his diagrams had not been made; and reminded the members that there were difficulties in the way of making permanent arrangements, in consequence of the use to which that room was applied by the College.

A cordial vote of thanks to Dr. Cooke for his paper, and also for the trouble which he had taken in the preparation of the diagrams, was moved by the President, and carried unanimously.

Dr. Cooke presented two gatherings of Desmids for distribution amongst the members.

The President announced the engagements for the ensuing month, and the proceedings terminated with the usual Conversazione, at which the following objects were exhibited:—

Alcyonella	Mr. L. Bennett.
Melophagus ovinus, Sheep Tick ...	Mr. F. Coles.
Mermelion formicarium, Ant Lion ...	" "
Brilliant eyes of Jumping Spider, *Salticus scenicus*, retaining natural form and colour	Mr. F. Enock.
Moss Copper, &c.	Mr. A. Fieldwick, jun.
Section of Jaw of Kitten, double stained, showing growth of Incisor ...	Mr. W. I. Curties.
Petal of *Trichinium Manglesii*, showing jointed Hairs	Mr. C. G. Dunning.
Thistle brand...	Mr. H. R. Gregory.
Plumularia setacea, a delicate variety, showing extended tentacles ...	Mr. A. D. Michael.
Wing of Lace-wing fly	Mr. T. S. Morten.
Leaf of Oleander, showing the hair-lined cavities in the lower cuticle ...	Mr. J. W. Reed.
Leaf of Camphor Tree, showing the Camphor-storing cavities ...	" "
Œdogonium, and an unnamed Rotifer ...	Mr. F. A. Stoessiger.
Psocus—sp ?	Mr. J. Woollett.

Mr. S. H. Needham exhibited a method of mounting Sections of Fossils and Minerals, Lepidoptera, &c., so as to exhibit the upper and under sides at one view. The specimens were mounted on a glass plate forming the lid of a shallow box, at the bottom of which was placed a flat mirror. The

object could thus be seen both directly and reflected in the mirror, by which it was also illuminated. Both the opaque and transparent portions of the specimens were thus seen remarkably well.

Attendance—Members, 75; Visitors, 3.

November 12th, 1880.—Conversational Meeting.

The following objects were exhibited:—

Section of Skin of Porpoise, Polarized ...	Mr. F. W. Andrew.
Spiracles of Larva of Blow-fly ...	Mr. W. R. Browne.
Eggs of House-fly	Mr. J. W. Cafe.
Blossom of a Rock-plant from Iceland, with beaded petals	Mr. E. Carr.
Section of Tooth of *Myliobatis aquila*, Eagle Ray, &c.	Mr. F. Coles.
Hamatomyrus elephantis, Parasite of Elephant, showing ova *in situ*	Mr. C. L. Curties.
Crystals of Platino-cyanide of Strontian ...	Mr. T. Curties.
Eggs of *Pediculus corporis*, in very great numbers, completely covering a piece of cloth	Mr. C. G. Dunning.
Young *Planorbis* (?) with *Vorticellæ* attached	Mr. H. Epps.
Pollen of Hollyhock	Mr. A. Fieldwick, jun.
Hair of Brown Otter	,, ,,
Living Diatoms, showing their movements...	Mr. J. D. Hardy.
Shell of Prawn	Mr. F. H. P. Hind.
Oak Galls, mounted in balsam	Dr. Matthews.
Cellularia ciliata, showing the long spines unbroken, and the birds-head processes	Mr. A. D. Michael.
Head and tongue of *Stomoxys calcitrans* ...	Mr. H. Morland.
Parasite of Stork	Mr. T. S. Morten.
Agates and Mocha Stones, mounted to show the under side by reflection	Mr. S. H. Needham.
Amphipleura pellucida, × 2,200 diameters; shown with Powell and Lealand's 1-16th water immersion objective - transverse striæ 96,000 to the inch; longitudinal striæ 80,000...	Mr. E. M. Nelson.
Stephanoceros Eichornii	Mr. J. M. Offord.
Hymeniacidon (Cliona) celata, in an Oyster-shell, decalcified, showing the channels filled with the spongæ... ...	Mr. B. W. Priest.
Section of Oak-spangle	Mr. J. W. Reed.
,, leaf and cuticle of *Rochea falcata*	,, ,,
Quinine Quinate	Mr. H. J. Waddington.

Ova of *Musca vomitoria*, showing the Micropyle, &c.	The President.
Viscera of *Musca vomitoria*, stained in an alcoholic solution of Judson's blue dye	" "
Plates and ambulacra of *Holothuria in situ*	Dr. H. T. Whittell.
Leaf of *Drosera rotundifolia*	Mr. F. Wood.

Attendance—Members, 75; Visitors, 9.

November 26th, 1880.—Ordinary Meeting.

T. Charters White, Esq., M.R.C.S., &c., President, in the Chair.

The minutes of the preceding meeting were read and confirmed.

The following gentlemen were balloted for and duly elected members of the Club:—Mr. Robert Hopkins, Mr. Charles T. Kingsett, F.C S, Mr. Richard Larkins, jun, and Mr. J. H. Wright, Jun.

The following additions to the library and cabinet were announced:—

"Memoirs and Proceedings of the Literary and Philosophical Society of Manchester"	from the Society.
"Report of the Brighton and Sussex Natural History Society" ...	" "
"Science Gossip"	" the Publisher.
"The American Naturalist"	in Exchange.
"The American Journal of Microscopy" ...	" "
"Report of the Epping Forest Field Club"	from the Club.
"The Quarterly Journal of Microscopical Science"	by Purchase.
"Annals of Natural History"	" "
No. I of "The Scientific Roll"	from Mr. T. Simpson.
Manuscript Index to the 4 Volumes of "Phycologica Britannica" ...	" Mr. Alpheus Smith.

The thanks of the meeting were voted to the Donors, and upon the motion of the President a special vote of thanks was accorded to Mr. Smith for the valuable index which he had prepared and presented, greatly enhancing the value of the work, which was neither paged nor indexed.

Mr. J. D. Hardy exhibited and described a new live trough or Vivarium, and explained its special use and the method of filling it.

The President thought the trough was simplicity itself, but doubted whether glass thin enough for use with high powers would be sufficiently strong to bear the pressure required to keep the cell water-tight.

Mr. Hardy did not know if this would be so as at present arranged, but thought some plan might easily be devised if his present method of holding the glass proved inefficient. He had tried tallow, and found it to answer very well; but did not like it on account of the greasiness.

Mr Ingpen suggested that if two semicircular clips were used so as to be

exactly over the indiarubber band, there would be no difficulty in using thin glass for the cover.

Dr. T. Spencer Cobbold, who had been announced to read a paper "On *Filariæ* in relation to the Febrile State," by Dr. Manson, explained that he had been obliged to withdraw it for the present, and would therefore offer some few observations upon a nicely mounted specimen of *Strongylus filaria* from the lung of a sheep This had been given to him by Mr. Curties, who had received it from Mr. Beaulah, by whom it had been prepared. The slide, when placed under the microscope, showed very clearly many thousands of larvæ in the oviducts of the worm. The presence of these parasites gave rise to what was known as the "husk" in sheep, and *Str. micrurus* caused the same disease in cattle. Another species (*Strongylus paradoxus*) was also found in the lungs of the pig. The specific differences between the various species of the genus were readily determined by the shape of the tail of the male, and in this matter we were much indebted to the labours of Dr. Schneider. [Diagrams in illustration were exhibited]. Being very desirous some time ago of tracing the development of these worms so as to be able to find out some means of destroying them, or of preventing their ravages, he made a series of experiments upon *Strongylus micrurus* from the lung of a calf. Knowing that many of this class of worms were developed in mud, he placed a quantity of the ova in some mud in a watch-glass, which was again placed in a fern case. On one occasion, whilst examining the contents of this glass, he was surprised to observe a sudden upheaval of the surface of the mud, and found that it was due to a small earth worm having crept into the watch-glass. It occurred to him at once to examine the worm, and after carefully washing it, he dissected it, and found the intestines to contain a very large number of embryos from the watch-glass. He thought, therefore, that it was quite likely that the earth worm might prove to be the "intermediate host," and all his subseqnent experiments had tended to confirm this idea. Endeavouring as far as possible to imitate the natural conditions under which the further development of these worms would be likely to be carried on, he placed some of the embryos from the earth worm in some of the dew drops on a particular fern in the case, and in two days he had the satisfaction of finding in these dew drops two or three embryos of gigantic proportions. A few days after this he obtained some more specimens from the same place, including some young males, one of which was changing its skin. One remarkable difference between those in the mud and those in the dew drops was the very greatly increased activity in the last named, so active in fact that it was necessary to compress them almost to danger of crushing them, in order to keep them within the field of view. From these observations he came to the further conclusion that in nature the larvæ were to be found in the dew upon the grass, with which they were taken up by grazing cattle. He did not think, however, that they passed down into the stomach with the fodder, but that their activity was such that they wriggled out of the contents of the mouth, and got into the trachea in a direct manner. Here he had little doubt their development would be completed in two or three days. He was further confirmed in this opinion by placing some of the embryos from the

dew drops in saliva kept at an even and warm temperature. Under such conditions the increase in their activity was still more surprising, for if it had been great before it was now quite tumultuous. When the husk-affected cattle gave their short husky coughs they undoubtedly scattered the young embryos in immense numbers upon the earth. The embryos were then taken up by the earth worms, and in due course were thrown up by these intermediate hosts in the worm casts, whence they migrated to the blades of grass, and in this way he believed a solution of the question of their life history was arrived at. He thought the animals might be protected by putting salt upon the land, or by keeping them out of the infected pastures. All observations in biology should be verified, and he thought that if this brief summary were placed before those whose time enabled them to follow up the subject, it might lead to some good practical result. He hoped that some one would take the matter up, and complete the observations in the direction which he had thus briefly indicated.

The President hoped that those who had heard of the systematic way in which Dr. Cobbold had worked at this subject, would be encouraged to go on in the way he had suggested. The matter was one which deserved to be worked out on account of its importance, both from a scientific and an economic point of view.

Mr. E. T Newton thought it rather singular that whilst the development of the embryo took place only to a limited extent in the earth worm, it should go on so rapidly in a medium in which there seemed to be no nutriment. Was there any explanation to be given of this?

Dr. Cobbold, in reply to Mr. Newton, said that the same question had occurred to him during his investigations. Some Nematode larvæ underwent these changes in mud without passing into the body of any intermediate host at all. As to the question of nutriment, he believed they were simply nourished by the water. His only doubt was whether they needed to have gone into the earth worm in order to develop afterwards. This was a point he should be glad to see confirmed. He felt persuaded that the larvæ of all the lung worms required to pass through the bodies of earth worms or some other intermediate host. Mr. Beaulah had said that he found the certain parasites encysted; did he make any estimate of the length of those so found? He asked the question because there was a large Nematode worm which attacked cattle, and which was from four to six inches in length. This was the *Strongylus enfescens*, whose larvæ were occasionally found encysted in the lungs of sheep.

Mr. Beaulah said he had never seen any so long as that. He had found that they would live a long time in water; he had kept them in water for observation, and it did not seem to drown them.

In reply to a question by Dr. Cobbold, Mr. Beulah further said that the land most subject to the *Filariæ* was low, damp, rich pasture. In some parts of a field very numerous worm casts occurred. He had noticed that the more worm casts, the more eggs and larvæ of *Filariæ* along with Infusoria, all of which appeared to be fine food for the worms. This larva, if such, was a minute white worm, without structure or eggs in it.

It was about three-eighths to half-an-inch long, and was abundant during the warm wet weather of July and August (perhaps earlier). Afterwards, that is by September, the disease appeared amongst the sheep grazed on such land, but only lambs were affected, old sheep had strength of constitution to withstand it. Was it not very probable these small worms got up the sheep's nostrils, and quickly grew into *Strongylus filaria?* For it was certain that if sheep were fed on such pastures for a day only, they were afterwards affected by the disease, and many very soon died. Mr. Beulah said that though he felt unable to say much upon the subject from a scientific point of view, he was very well acquainted with the practical side of it, and knew that the disease caused by these worms increased in his neighbourhood to a fearful extent. He got a large family of them from the lung of a sheep, where they had become encysted, and he made out that there were over 300,000 eggs in this single group. The males he found to be very few in number as compared with the females. It was his opinion that the embryos were upon the grass where the sheep were fed, and this was how the disease got spread. It was not, however, found everywhere, but only partially distributed. He remembered a case in which 72 sheep had been purchased and sent home all healthy—two of their number falling lame by the way were put in a pigstye and left behind—the others went on, and were turned into a meadow for the night. The whole of the 70 began to show the disease eight days after being in the field, but the two who did not go there were alive and well at the present time. On examination the dew from this meadow was found to be full of eggs. On his own farm sheep had been grazed in eight different parts, and those from three out of the eight were attacked by the disease, whilst the number of sheep which had suffered from it within a radius of five miles was upwards of a thousand. How the larvæ got into the lungs was a question that often arose, and he had thought they were snuffed up by the sheep. Some people called this disease the liver rot; but he could only say that, so far as his sheep were concerned, they had perfectly healthy livers, but their lungs were all full of the worms. He had seen some of the saliva coughed up by the sheep, and knew that it contained thousands of the eggs. He would only say further that if anyone present wanted specimens for the purpose of study, he should be very glad to send what was required, as he was sure there was a very wide field open for their investigations.

Votes of thanks were then unanimously passed to Dr. Cobbold and Mr. Hardy for their communications.

The President said that, owing to the lateness of the hour, it would not be doing justice to Mr. Priest to take his paper then, for if any one had taken the trouble to write a paper and to draw diagrams in illustration, it was hardly fair to have them hurried through during the last part of the evening. With Mr. Priest's concurrence, therefore, the paper would be postponed until their next ordinary meeting, which would take place on January 28th, 1881.

The proceedings then terminated with the usual Conversazione, at which the following objects were exhibited :—

Jute, showing the brittleness of the fibre ...	Mr. F. W. Andrew.
Aulacodiscus Sollitianus	Mr. W. J. Brown.
Hairs of *Echinus micranthus*	Mr. C. G. Dunning.
Fern, *Niphobolus costatus*	Mr. A. Fieldwick, jun.
Seeds of *Mesembryanthemum crystallinum*	,, ,,
Théine from Black Sea, polarized ...	Mr. H. R. Gregory.
Hydatina senta	Mr. A. Martinelli.
Sticttodiscus Buryanus; rare	Mr. W. Moginie
Larva of *Limnobia replicata*, a Crane fly showing the Tracheal system ...	Mr. F. A. Parsons.
Thea assamica, transverse section of leaf, showing large branched cells ...	Mr. J. W. Reed.
Pseudomorphus Copper, Copper Formate reduced by heat	Mr. H. J. Waddington.

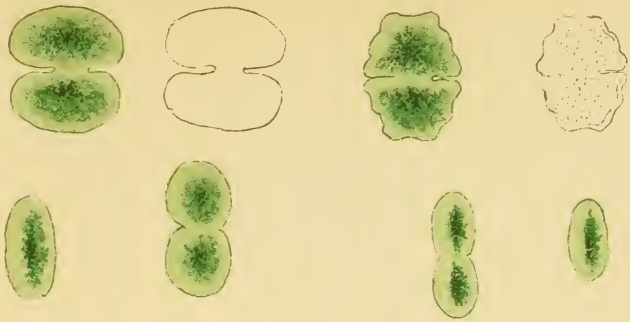
Attendance—Members, 77; Visitors, 12.

December 10th, 1880.—Conversational Meeting.

The following objects were exhibited:—

Parasite of the Fox	Mr. F. W. Andrew.
Cuticle of Rye, polarized	Mr. W. R. Browne
Campanularia volubilis	Mr. C. G. Dunning.
Trichinium Manglesii	Mr. A. Fieldwick, jun.
Aregina bulbosum, Bramble brand ...	,, ,,
Spiracles of Larva of *Gasterophilus equi*, Bot fly	Mr. H. E. Freeman.
Ptilota sellcea	Mr. A. D. Michael.
Submerged Stipule of *Potamogeton nataus*	Mr. H. Morland.
Head of *Chrysopa perla*, &c.	Mr. T. S. Morten.
Amphipleura pellucida, shown with Powell and Lealand's water immersion 1-16th objective and oil immersion condenser	Mr. E. M. Nelson.
Euchlanis Hornemani	Mr. J. M. Offord.
Head of *Cysticercus fasciolaris*, from liver of Mouse	Mr. J. W. Reed.
Leaf of *Coffea arabica*	,, ,,
Amygdalin, a derivative of Bitter almonds	Mr. H. J. Waddington.
Section of gustatory organ of Rabbit's tongue, showing the "taste goblets"	The President.
Echinococci and germinal membrane of Hydatid	Dr. H. T. Whittell.

Attendance—Members, 71; Visitors, 1.



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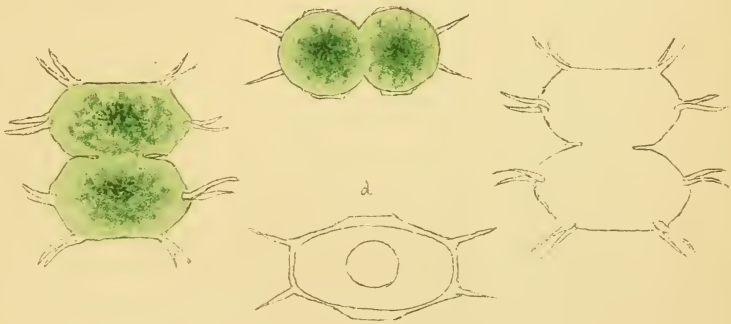

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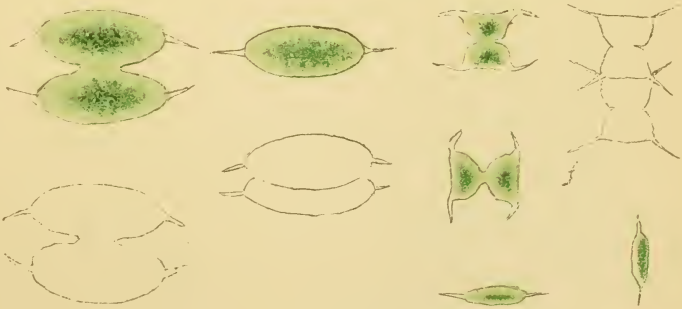

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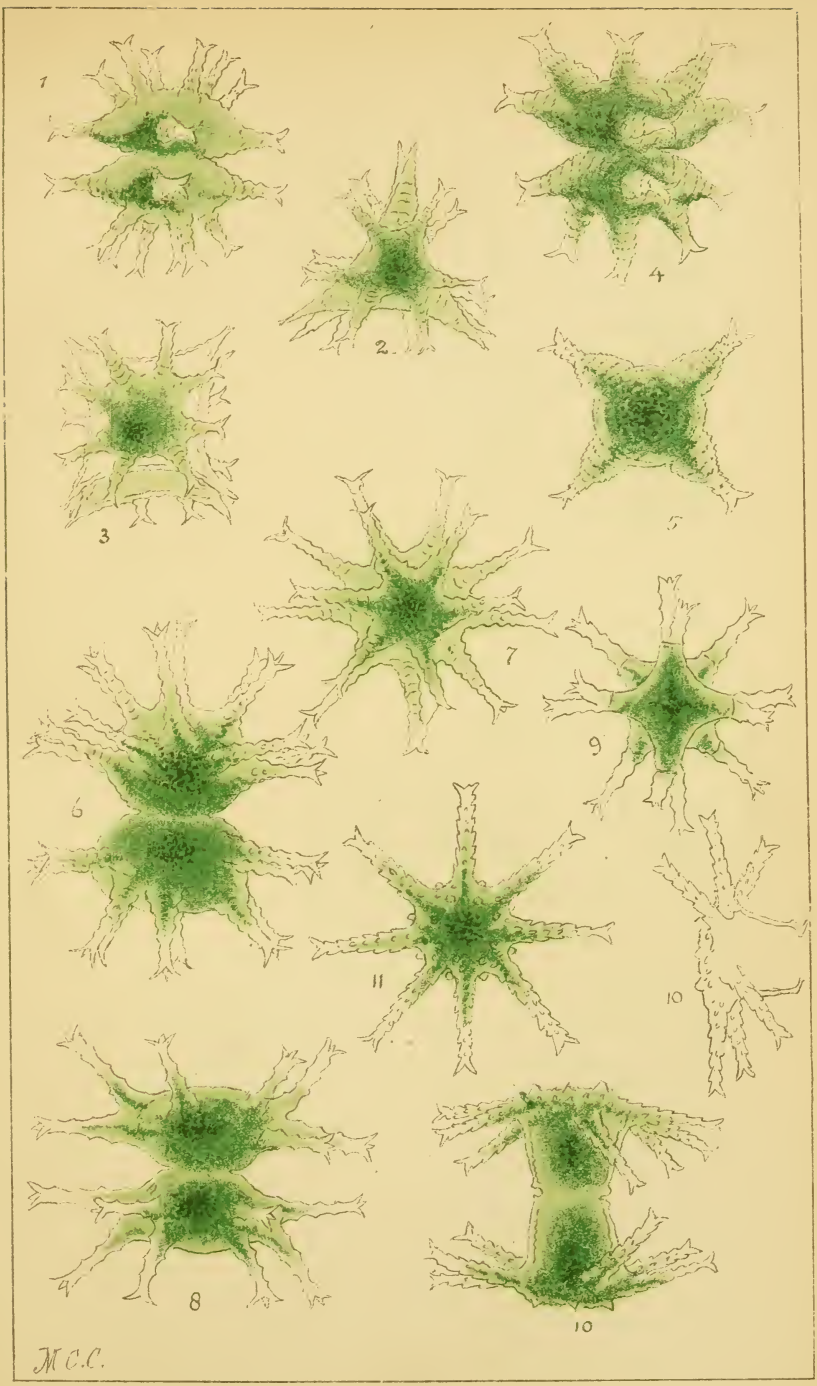
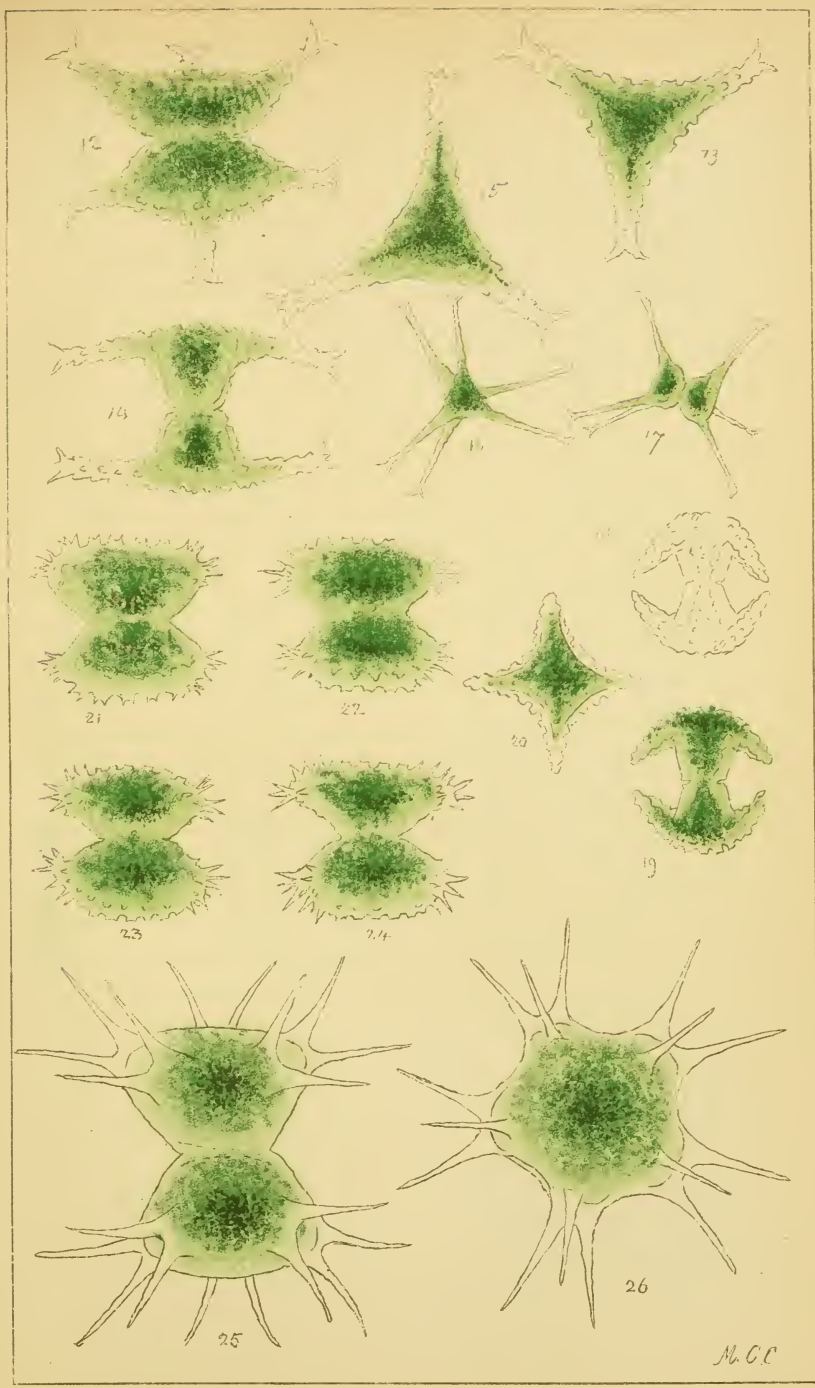


1-3. St. pseudofurcigerum 4-5. St. furcigerum 6-7. St. artiscon.
8-9. St. sexangulare 10-11. St. ophiura.



12-13. *St. anatinum.*

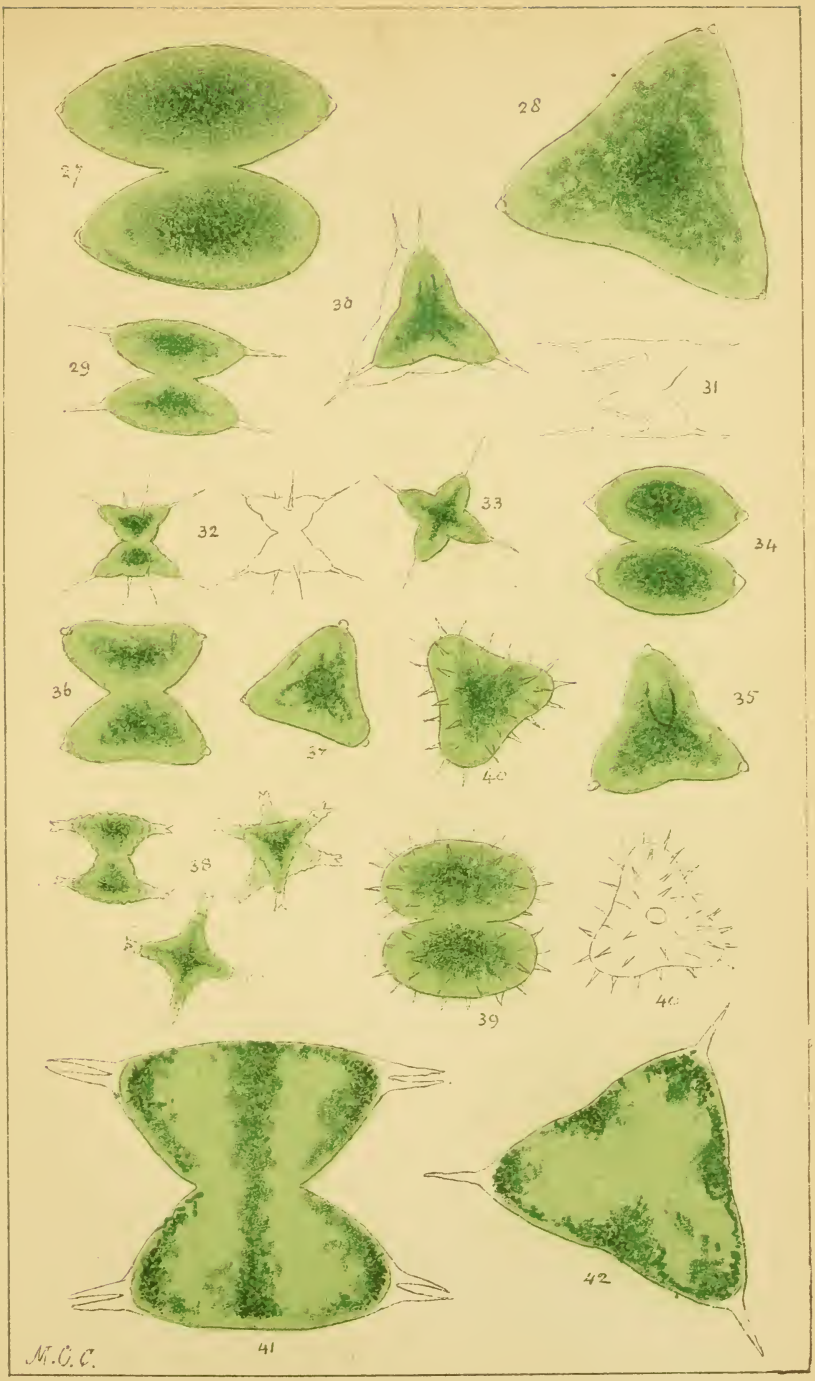
14-15. *St. Sebaldi. var*

16-17. *St. paradoxum. var. longipes.*

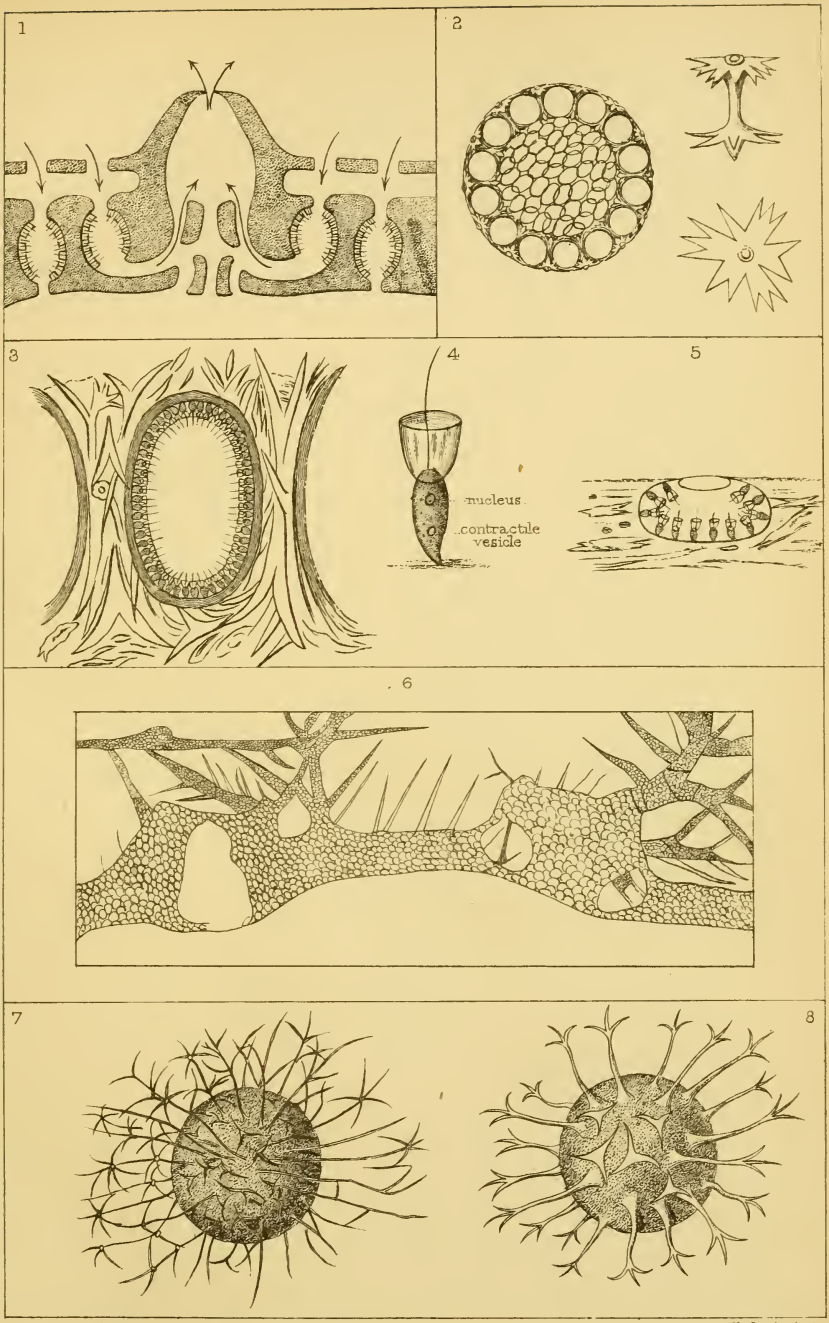
18-19-20. *St. cerastes.*

21 to 24. *St. saxonicum?*

25-26. *St. Brasiliense.*

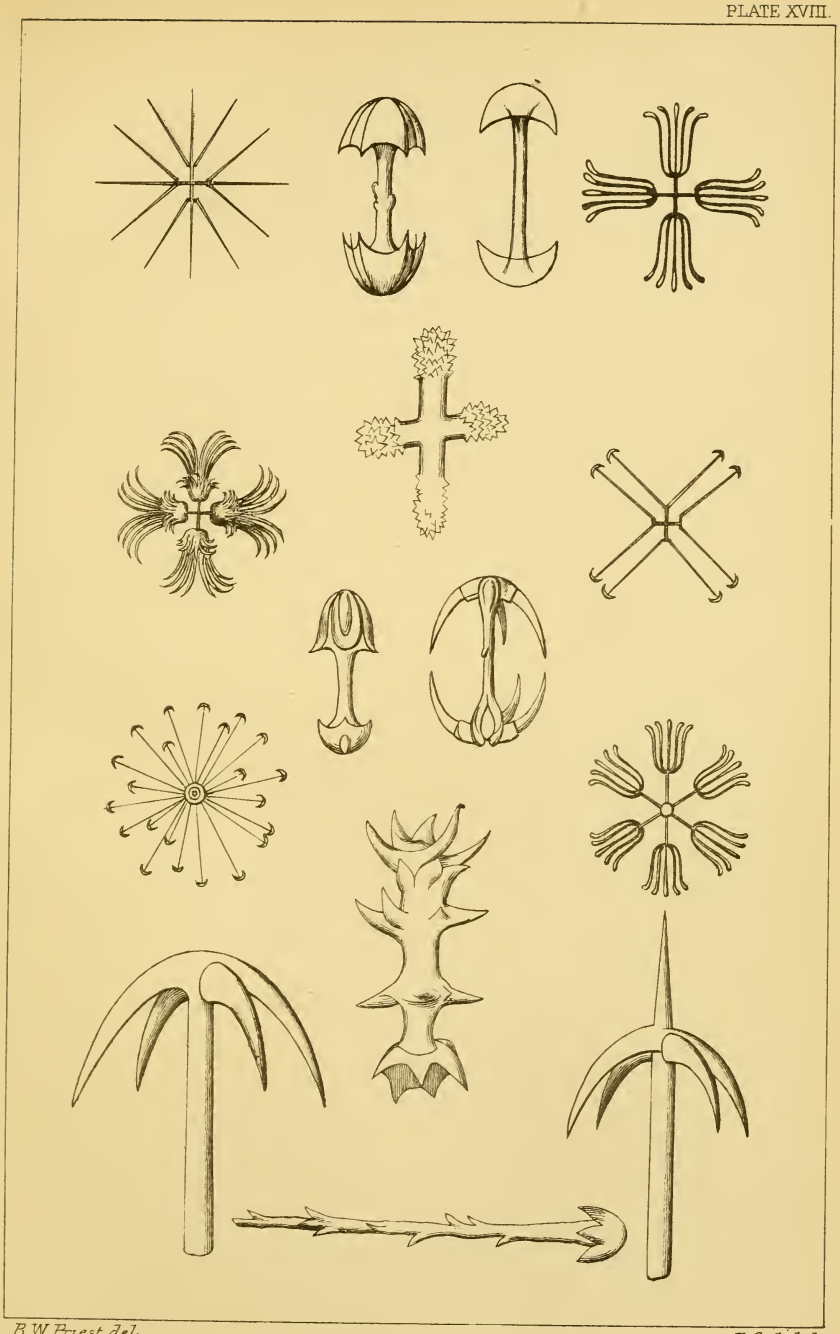


27-28. St. grande. 29-30-31. St. megacanthum. 32-33 St. aristiferum
34-35. St. brevispina. 36-37. St. aversum. 38. St. inflexum.
39-40. St. Pringsheimii. 41-42. St. longispinum



B W Priest, del.

E. Cooke, lith.



B W Priest, del.

E. Cooke, lith.

On the Natural History and Histology of Sponges.

By B. W. Priest.

(*Read January 28th*, 1881.)

PLATES XVII, XVIII.

It is only within the last few years that the Sponges or Porifera have been classed in the animal kingdom, thanks to the modern improvements of our microscopical appliances, which have enabled us to work out their minute histological structure. They were long thought to be of a vegetable nature, on account of some species, as in our freshwater *Spongilla* for instance ; the green colouring matter being due to the formation of chlorophyll, which, of course, is influenced in the same manner by the action of light as it is in plants, and also by their being fixed to one place.

With the exception of those that belong to the genus *Spongilla* all known Sponges are marine, but they vary much in their habit of growth, some being obtained only from great depths, others between the tide marks, on weeds, stones, and the piers and piles of our shores, some of which are mere films incrusting the substances on which they grow.

It appears, by reference to Dr. Johnston's work on the Spongiadæ, that the first British Sponge recorded was in 1616 ; since that time the species have been multiplied greatly, and would bear a deal of cutting down, young specimens being in many cases taken for different species ; but some excuse may be made, in that only a few have studied this branch of Natural History.

For our present purpose, perhaps, the late Dr. Bowerbank's classification will be the best to adhere to, although every year, I may say every month, brings something fresh to our knowledge that will make it necessary to alter their arrangement at some future time.

The Sponges are divided into three orders :

The Calcareous, Siliceous, and Keratose.

The Calcareous Sponges are few in comparison to the other two, and include the well-known *Grantias*, whose histology perhaps is one of the easiest to make out of the marine ones.

The Siliceous Sponges are very numerous, as every dredging expedition which has been organised fully testifies, always discovering some new form or forms. It includes the *Halichondria* and others of our shores, as also that beautiful Hexradiate group, comprising the *Euplectella* or Venus' Flower Basket, *Rossella*, *Holtenia* and others, specimens of which may be seen in our National Museum.

The Keratose Sponges include the *Chalina*, *Dysidea*, and the Sponges of commerce.

Very few species can be made out by their external appearance; even Dr. Bowerbank himself could not, experienced as he was, always determine the species without a microscopical examination.

Most of the Calcareous Sponges, comprising the four British Genera, viz., *Grantia*, *Leucosolenia*, *Leuconia* and *Leucogypsia*, take a more or less definite form, and with little experience it can almost always be told at once to what genus they belong. For instance in *Grantia compressa* and *G. ciliata* we find the Sponge to be constructed of a series of cells, each having separate parietes, and extending from the dermal surface to near the inner surface of the Sponge, where they discharge the fœcal streams into the cloacal cavity.

In *Leucosolenia* the system of cells is entirely wanting; the Sponge is composed of a single thin stratum of membranous structure and spicula, surrounding a large cylindrical cloacal cavity, from the terminations of which the streams are discharged.

Leuconia nivea, a sessile growing Sponge which occurs massive and irregular in form, contains numerous cloacal cavities, each terminating in a single large mouth, the interstitial structures between the sides of these cavities and the dermal surface of the Sponge consisting of irregularly disposed membranes and spicula, terminating in orifices or oscula in the sides of the fœcal cavity into which the excurrent streams are discharged.

In *Leucogypsia* the Sponge is massive without cloaca, and with oscula at the external surface, thus simulating the mode of structure of the Siliceous Sponges, whose pores and oscula are mostly on the surface of the Sponge, the pores being the incurrent and the oscula the excurrent terminations of the canals, conveying the streams of water through the Sponge.

There is a curious phenomena connected with these pores, and that is that they can, when closed entirely, coalesce, so that no trace of them can be found, and fresh orifices are formed at a different part of the surface of the Sponge, afterwards.

In the Hexradiate group before-mentioned, so named on account of all its spicules being formed more or less on that type, we have spicules in some cases of great length, extending from the base of the Sponge, the ends of many terminating in hooklets, often reminding one of anchors or grapnels, by which the Sponge attaches itself to the bottom of the ocean in the mud, and is thus swayed to and fro by the currents without injury to the main body.

When the *Hyalonema*, or Glass Rope Sponge, was first brought over from Japan, some few years back, it was believed for a long time that the Sponge grew with the long-twisted coil of spicules upwards; but from subsequent dredgings and further examination and inquiry, it was found to be the contrary, and that it was the Japanese themselves who had imposed on our credulity, by imbedding the Sponge in the cavities formed in stones, &c., by some mollusc, with the glass rope looking like so many long brushes of spun glass bristling upwards. A specimen of these may be seen in the British Museum.

We have over two dozen recorded genera of British Siliceous Sponges, so that it would be impossible for me to go through them in one evening. Many of the spicules of some of them are familiar objects in our cabinets, such as the stellate forms of *Tethya*, the so-called gemmules of *Geodia* and *Spongilla;* but I must leave that part for a future time.

The spicules which go to form the non-histological part of a Sponge build up more or less the skeleton, excepting in the purely Keratose ones. The forms they take in the Calcareous Sponges are mostly of a tri-radiate type; but in the Siliceous ones they take forms, which for beauty and symmetry are often hardly to be equalled, more particularly the minute spicules dispersed through the sarcode.

The Keratose Sponges have in some cases their fibres strengthened by the presence of spicules, generally of the acerate type. One species of the latter, named *Dysidea fragilis*, which may be found very plentifully at Brighton, seems to have a selective power of taking up grains of sand, often about the same size, and depositing them in its structure. In a specimen I have seen, evidently allied to *Dysidea*, from Australia, in the possession of Mr Waller, the finest hair-like fibres had grains of silex regularly arranged in their interior.

The true essential part of a Sponge is composed of structureless sarcode and nucleated cells, placed side by side, with a flagellum, some

cells having a hyaline collar protecting the flagellum. These latter cells line all the passages leading from the pores, in most cases to the cloacal cavity or cavities to the oscula, regulating the currents of water and causing them to flow through the channels, and convey the nutriment necessary to the existence of the Sponge. (Fig. 1, Plate XVII.)

Some naturalists, I believe, look upon the collared cells as playing the part of respiratory organs only, and not as means for assimilating nutriment, at any rate I have no doubt, along with others, with regard to their regulating the currents of water.

In some species of Sponges these ciliated cells occur only in well-determined circular chambers, with their ciliated ends pointing towards the centre, each chamber having a small aperture which perforates the investing membrane. (Fig. 5, Plate XVII.)

The late Professor James Clarke, of Kentucky, was the first to notice the analogy of these ciliated cells with the free flagellate collared Infusoria, followed up at the present time by the elaborate researches of Mr. Saville Kent. It has been found by this gentleman that some of the free collared monads are identical with the ciliated collared monads discovered in the Spongiadæ, each separate collar-bearing cell possessing a separate existence, and securing its nutriment in the same manner. Furthermore, Mr. Kent tells us that Sponge structure may be and *is* built up from one of these constituent monads, by a repeated process of cleavage, by which means it quickly multiplies itself, though still more rapidly by the subsequent encystment and breaking up of the monads into spores.

Through the kindness of Mr. Charles Stewart I have been enabled to see for myself these truly wonderful collared cells, in sections of *Grantia compressa* and *G. ciliata*, properly prepared. Fig. 3, Plate XVII., is a sketch of a section through one of the passages leading to the cloacal cavity of the first-named species, showing them *in situ*. You will often see an embryo Sponge in a greater or less state of development, and dispersed through the sarcode the amæboid particles or cytoblasts; also the supposed stinging threads, analogous to those found in the freshwater *Hydra*.

Professors Haeckel and Huxley, I believe, still hold that the proper place of the Sponges is among the Cœlenterata, including the Sea Anemones and Hydroid Zoophytes, from the theory of their being composed of separate multicellular membranes or tissues The recent investigations with regard to their place amongst the Protozoa may

be said to be as yet in its infancy, although things look very much in its favour.

Much has been written on the reproduction of the Sponges, but in a paper like this it would take too long to go into the subject minutely.

They are, up to the present time, known to propagate by three modes—

1st. By ova with and without ovaria.

2nd. By internal and external gemmation; and

3rd. By spontaneous division of the sarcode.

Dr. Bowerbank tells us that little is known regarding the reproduction by ova without ovaria, as that mode is confined to the genus *Spongia* (the Sponges of commerce) alone, and we seldom obtain them in a fit condition for the examination of that subject; they may be seen occasionally in specimens that have not been cleaned by the dealers, dispersed evenly over the surface of the fibres, and also imbedded in the sarcode that coats them, but even then in a very unsatisfactory manner. The ova generated in ovaria are, perhaps, best studied in the freshwater species of the Upper Thames. I name that place more particularly, on account of the luxuriance of the growth of both the species, *Spongilla fluviatilis* and *S. lacustris*, which may be met with growing together at Henley, Goring, Marlow, &c.

Spongilla fluviatilis grows in a more massive and compact form than *S. lacustris*, but both are of a bright green colour, and anyone not knowing what they were would certainly take them at first sight as a vegetable growth. The ovaria are found at the base of the Sponge, having the appearance of small brown seeds. When examined under the microscope, after soaking them in spirits of turpentine for some hours, the walls of these ovaria are found to be strengthened and supported by bi-rotulate spicula in lines from the centre to the circumference. Fig. 2, Plate XVII. These ovaria contain the ova, which, as the spring comes on, creep out of the vents, which may be seen situated at one or other part of the ovaria, swimming about by means of cilia, until they at length settle down in some suitable place, and develope into *Spongilla*.

In some species of Sponges, as in *Grantia compressa* for instance, the ova are often developed in the interior of the Sponge, and in that case may frequently be watched, passing through the process of cleavage, similar to the segmentation which takes place in the yolk

of the hen's egg. It is this last process that may be considered as internal gemmation, and, according to Dr. Grant, if two or more ova are placed on a watch glass or slide, they spread themselves out as a thin transparent convex circular film, which, if they come in contact with one another, coalesce, thicken, and produce spicula, which in a few days grow up as from one ovum.

In *Tethya leyncurium* true gemmules, according to that term, are produced externally. At the base of most specimens a small globular mass of sarcode may often be noticed, in which, if mounted in a cell in Canada balsam, the skeleton spicules, like those of the parent sponge will be plainly made out.

There is an interesting paper, with plate, in the December number of the "Journal of the R.M.S. for 1880," treating on this subject of the external gemmation of *Tethya*, dredged up in the White Sea by a German naturalist. It appears that this budding process does not confine itself to the base only, but occurs at any part of the Sponge, giving it the appearance of being covered with some parisitical growth.

The third process of reproduction is by division of the sarcode, viz., if a portion of the sarcode, naturally or even by artificial means, be separated from the parent sponge, it will ultimately develope into perfect form.

This process that Sponges have of growing from detached portions has been recently taken advantage of by two German naturalists, on account of the supposed likely falling off of the supply of the Sponges of commerce. They found that by carefully cutting small pieces from living specimens, and attaching them to boards or stones, and sinking them in suitable localities and depths, they will grow into large Sponges as if nothing had happened.

The genus *Spongilla* has been long known to develope by both ovaria and division of sarcode, but generally in the latter case, very few, if any, ovaria could be found present.

If two pieces of living *Spongilla* be placed under suitable circumstances so as to touch, they will, after a certain time, coalesce in the same manner as described with regard to the ova.

There is still much to be found out regarding the growth and reproduction of Sponges, as also the process which enables certain species to burrow into shells and substances of a hard and compact nature. One often picks up oyster shells completely riddled by one species named *Cliona* (now changed to *Hymeniacidon*) *celata*, and up

to within the last few months I had always regarded the chambers or burrows occupied by the Sponge as having been made by some Annelid, and that the Sponge itself had nothing to do with the formation of them, being only parisitical in them. Dr. Bowerbank had, I believe, come to the same conclusion. From specimens that I have prepared of portions of an oyster shell, which was full of the Sponge, and also from the examination of a section of a shell of *Haliotis* kindly lent to me by Mr. Kitton, of Norwich, chambered out in a similar manner by another species, I have come to the conclusion that no known Annelid could bore in the manner indicated in this diagram (Fig. 6, Plate XVII.), where you will see that the ramifications are very numerous and in some cases very fine, and most of them are more or less filled up with the Sponge or remains of the same.

Whether it is accomplished by a mechanical or chemical process, *or both*, by the Sponge still has to be found out; that it is the action of the Sponge there can be, I think, little doubt, and I myself am rather inclined to think that both processes are brought into action.

As I intend to go more into this subject I shall reserve my reasons for a future paper.

Sponges seem to have existed in more abundance in earlier times than they do now—more especially at the Cretaceous period—to witness, the Ventriculites and formation of Flints, which in the latter either form the nucleus or the chief of those interesting and curious substances.

If a thin section of Flint be taken and examined you will generally find, besides other forms, such as Foraminifera, spicules, and in some cases entire reticulated Sponge structure, small spined bodies, which have been termed *Xanthidia*, because they were at one time supposed to be the sporangia of certain forms of Desmidiæ, named *Xanthidium*.

From more extended observations they have been found to differ much from their supposed homologues, answering more to the descriptions we have of Sponge gemmules, or the statoblasts of some of the marine Polyzoa. At any rate I think that they may now be expunged from the vegetable kingdom. From what I have read and seen I am not inclined to think that they are gemmules, but either the statoblasts of some of the Polyzoa *or* analagous to the peculiar bodies which have been found in some Sponges, and a description

of which may be met with in the "Annals of Natural History," vol. vi., p. 220, in a paper by Mr. Saville Kent, where he explains their occurrence in a Sponge dredged up in the Norna expedition. (Figs. 7 and 8. Plate XVII.)

I have drawn roughly here, a copy of the figures given in the Annals just mentioned, of one of these bodies, along with one of *Xanthidium ramosum*, and I think you will agree that there is a resemblance and some analogy between the two, although the fibres of the former are somewhat finer than the tentacula of the *Xanthidium*. Of course we have to find these bodies occurring in other specimens of Sponges to corroborate the idea, and it would be a great boon if the captains of vessels and others who go long sea voyages would try and obtain specimens of Sponges, and distribute them to different Societies, who have members interested in that branch of natural history. In the first volume of the "Transactions of the Royal Microscopical Society" there is an account of some living *Xanthidia* having been sent over from America, found in some pool or pond, but I think that went to negative the idea entirely of their being Sporangia, as Desmids have never been found, that I am aware, in salt or even brackish water, and therefore could not be found in Flint.

It has long been a disputed point what these bodies are, and perhaps some of the members present could enlighten us a little more on the subject.

Perhaps a word or two on the examination of Sponges may prove of interest to those who wish to follow up the study of this interesting subject.

Unfortunately the marine Sponges cannot be kept long alive in an aquarium, therefore we have to content ourselves with examining them the next best way.

Those who would work out their minute histology, should, if possible, obtain living specimens in as many stages of development and growth, and whenever they chance to come across them, follow out the ciliary action in the chambers and passages.

A good and interesting way to see the currents in *Grantia compressa* is to slit up the side of the Sponge with a fine pair of scissors, laying it open in a cell with sea water, with the inner surface upwards, and so arranged that a high power can be brought to bear on it—a few grains of indigo or carmine being placed in the water.

For further examination, specimens should be plunged for some minutes, whilst living, into a one or two per cent. solution of osmic acid, and then transferred to weak spirit, about 25 per cent. Thin sections should be made from the surface inwards by a section cutter, a freezing microtome being preferred, and then examined with high powers.

Those who would only study Sponges for the beauty of the spicules should cut a tolerably thick piece of the Sponge, taking care to include a portion of the dermal membrane, when present, from the surface to the centre, placing it in a test tube and boiling for a few minutes in strong nitric acid in the case of siliceous Sponges, but liquid potash when they are calcareous, washing carefully several times the spicules which fall to the bottom of the tube with distilled water, and finally mounting in Canada balsam. Thin sections taken in the same way, as also portions of the dermis, and mounted in cells, brass ones being avoided, with Canada balsam, show the relative position of the spicules. In the case of the Sponges of the Hexradiate group, it is better to mount portions of the dermis and interior part of the Sponge without attempting to cut them, as the process would mutilate the structure, which is in most cases so delicate.

This group contains, I think, a greater variety of beautiful forms than any other. We have a few of the spicules drawn here (Plate XVIII.) to give some idea of the forms they take; and you will be struck by them, as in many things, that man's inventions and ideas of form and symmetry have been forestalled by Nature long before, perhaps, he himself appeared upon the surface of the earth.

One question forces itself upon us when we look at these minute forms—Why is so much beauty hidden from our view, and for what purpose are they so placed, that they can only be seen in many cases by the higher powers of the microscope? We can only wonder, and find it is as much beyond our grasp, as the definition of an atom, or the realization of boundless space.

DESCRIPTION OF PLATES XVII., XVIII.

PLATE XVII.

Fig. 1.—Hypothetical diagram of *Spongilla*, showing currents (Carter).

Fig. 2.—Section of ovary of *Spongilla fluviatilis*, showing position of birotulate spicules and separate spicules of same.

FIG. 3.—Section of *Grantia compressa*, showing ciliated collared cells *in situ*.

FIG. 4.—Single collared cell (Kent).

FIG. 5.—Ampullacious sac showing position of cells in some species.

FIG. 6.—Section of *Haliotis* shell, with burrows of sponge.

FIG. 7.—Spherical body from Sponge (Kent).

FIG. 8.—*Xanthidium ramosum.*

PLATE XVIII.

Spicules from various Sponges of the Hexradiate type.

On the Periodicity of Filarial Migrations to and from the Circulation.

By Patrick Manson, M.D., Amoy. [Communicated by Dr. Cobbold.]

(*Read January 28th*, 1881.)

PLATE XIX.

Amoy, 25th August, 1880.

T. Spencer Cobbold, Esq., F.R.S.

Dear Sir,—I read with much pleasure the notice in the "Lancet," 3rd July, of your communication to the Quekett Club respecting the specimens I sent you. I note that the bird parasites are new species, and I am much gratified to learn that the *Distoma* of Dr. Ringer is new also, and is to bear that gentleman's name. As I did not make any examination of the *Distoma Ringeri*, fearing to mutilate too much the solitary specimen, I would like to see any description of it you may publish.

The reprint from Vol. VI. of the "Quekett Club Journal" I duly received, and I thank you for the trouble you have taken in thus bringing forward my work. In reading it I was especially interested in the short note by Dr. Mortimer Granville. Though his speculations are founded on an error, yet I like the scientific style in which he treats the subject. Perhaps you will show him the chart I send you herewith. He would see from it—1st. That the periodicity observed by the filaria embryos is by no means an exceptional or capricious phenomenon; and, 2nd, that it is associated with the advent of night, and not depending in any way on the sleeping state.

Although in the paper I sent you some time ago I refrained from speculating on the cause of filarial periodicity (because I had nothing but guesses to offer), yet I have thought a good deal about what might be the reason of this most remarkable phenomenon, which, as you say, "savours of the marvellous." As Dr. Mortimer Granville remarks, it is well deserving the attention of physiologists, for could

we ascertain what the subtle influence is that sets these creatures circulating in the blood stream and arrests them with such "military punctuality," we probably would let new light in on many an obscure problem both in physiology and pathology. It was with the intention of providing myself with a standard with which to compare the results of observation and experiment that I prepared the chart I send you. If it is published it may help others, who are willing to work on this subject, but who may not have the opportunities of the continuous observation it records.

Dr. Mortimer Granville's ingenious speculations are based on the assumption that the phenomenon of periodicity depends in some way on sleep, either on the mechanical changes in the circulation when the body is in the recumbent position, or in the different proportions of oxygen in the blood, or in relative alterations of blood and tissue temperatures during the walking and sleeping states. Now, as the embryos begin to appear hours before the usual time for repose, and are in no way sensibly affected by changes in the hours of sleeping and waking, it is evident that the power which fixes them and lets them loose operates independently of the sleeping state. It is associated with the advent of night, but not of sleep.

Part of Dr. Mortimer Granville's note is so much to the point that I will quote it—"The change of place may be fairly ascribed to change of state. Looking at the habits of life in the lowest organisms, it can scarcely be supposed that the periodicity can depend on the state or requirements of the filariæ. It is not likely that the parasite needs repose, or that it resorts to special localities to feed. It seems more probable that the state of the circulating fluid determines the presence or absence of the filariæ in the main current by night and day respectively." . . . The first part of this I quite agree with, but the latter part I am not quite so sure about. What is the difference between the state of the circulating fluid at 4 p.m. and 6 p.m. respectively? It is evident that something happens between these hours which liberates the embryos. I do not know that physiologists have demonstrated or even supposed some sudden change beginning in the blood between these hours. Again, the conditions permitting the free circulation of the parasites continue with increasing effect up to midnight, and the restraining influences which fix them are gradually reapplied from that time till they effect also complete fixation by nine or ten o'clock next forenoon. What alteration in the physiological state of the blood or

body generally corresponds to these hours? If you refer to my chart you will find no explanation in the rapidity of the circulation, nor in the temperature of the body. For sometimes the pulse is quick when the embryos are numerous, and sometimes it is slow; sometimes the temperature fluctuates a degree without apparent effect on the numbers circulating.

Whatever the cause may be it certainly operates *through* the body, the medium in which the parasites are, but I very much incline to think that though operating through the body it is placed *outside* of it

Of one thing we may be quite certain—that from the fact of the periodicity being one of 24 hours its remote cause is the rising and setting of the sun, or rather the altered relation of the earth's surface to the sun recurring every 24 hours. Of another thing we may also be certain, that the immediate cause is applied between the hours of five and seven p.m. What, then, is the phenomenon in nature which, depending on the position of the earth's surface to the sun, begins to operate on the human body with the utmost regularity between the hours of five and seven p.m., increases in power up to midnight, wanes towards morning, and finally ceases to act between nine and ten a.m.? A correct answer to this would be a step towards the solution of this strange problem; only a step however, for the method of its operating would still remain to be explained.

We may dismiss at once the diurnal variations of atmospheric temperature and pressure, for, although, especially in these latitudes, these daily ranges are pretty constant, yet when completely inverted as sometimes happens, and as you may see from a comparison of the chart and meteorological register, there is no corresponding disturbance in filarial periodicity.

In casting about for the answer two things occur to me. 1st. The rays emanating from the sun undergo about these hours marked alteration in their proportions and power. 2nd. The magnetic condition of the earth suffers a change about the same time.

I am inclined to dismiss the former as the *direct* cause, for were the sun's rays the *direct regulating influence* we might expect to find the rhythm answered by the embryos affected by the presence and absence of clouds and so forth. This is far from being the case, as you can see by comparing the chart with the meteorological register. The periodicity bears no relation whatever to the hours of sunshine,

cloud, or rain, or other condition influencing the quantity or kinds of rays infringing directly on the human body, at least so far as I can see; but with terrestrial magnetism the case is quite otherwise. Its variations are rhythmical. If you consult authorities on the diurnal variations of the declination and inclination of the compass, and intensity of terrestrial magnetism you will find a marvellous correspondence between the rhythm of these phenomena and that of filarial periodicity. For example, the needle of the compass crosses the magnetic meridian, or mean daily position, between the hours of nine and ten a.m. and six and seven p.m.; during the night and early morning the north end of the needle is to the east of the meridian, during the day to the west, and the hours when the meridian is crossed correspond pretty closely to the times of change from rest to activity, and *vice versâ* of the filaria embryos.

Again the minimum of daily change of terrestrial magnetic intensity is between the hours of ten and eleven a.m., and the maximum between four and seven p.m., varying slightly with the season of the year. These hours correspond very closely with those of commencing rest and activity of the filaria in the normal state of the body. There is no proof whatever that there is any cause and effect relation between these two phenomena, but the coincidence is most striking, and suggests further investigation. If experiment should show such relation it would be interesting to know if the cause operated directly, or if the effect on the embryos depended on physiological changes on the body the result of terrestrial magnetism.

These may seem wild and unjustifiable speculations, but I only offer them for what they are worth, and desire to separate them by a clear and well-defined line from my facts. But the imagination has its place in science, I believe, as well as rigid observation and induction. At any rate, actuated by these speculations, I have made one or two crude and unsuccessful experiments. I wish very much some expert in physiology and electricity would take the matter up. My knowledge is so limited, and the apparatus I can command so rude, that I despair of being able to give the answer myself. I believe a systematic examination of the compound force called light, or of terrestrial magnetism in their influence on these worms, would give most valuable results, not only in solving this most interesting problem, but in opening new and fertile fields in physiology and pathology.

I do not anticipate much from observations on the disturbing effects of drugs and the febrile state. These undoubtedly in the future will be found to have an influence on filarial periodicity, and it is possible this study may lead to just conclusions as to the cause of the phenomenon. It is not likely, however. The conditions of experiment become in such cases almost too complicated to unravel. We must be careful to bear in mind that substances or forces which interfere with the periodicity may have nothing in common with its normal cause. Assuming that quinine has this power, it would be absurd to infer that the presence or absence in the blood of this drug had anything to do with normal periodicity. It is only by the exclusion or inversion of the cause that we may hope to arrive at correct conclusions.

I have written more than I intended about my speculations on this subject. The great interest you take in these matters is my excuse, and I hope you admit it.

I will leave speculation alone now, and pass to the facts in explanation of the chart I have sent you.

The chart records a series of observations on the blood, temperature, and pulse of two Chinese lads ascertained to be filarious, and were in the main made by themselves. After enlisting them in the cause, and before commencing systematic observations, I trained them to recognise and count the embryos with the microscope, to read accurately the clinical thermometer, and to record correctly this and observations on the pulse, barometer, and ordinary thermometer. I took care from time to time to satisfy myself that their observations were carefully made and recorded, and I believe if there are any errors in the chart they are few and unimportant. Observations were made every three hours, day and night, during one month. At first the hours selected were—12, 3, 6, 9, 12, 3, 6, 9 ; but after two days it was found convenient to change them to—1, 4, 7, 10, 1, 4, 7, 10. The quantity of blood was as nearly as possible the same in each examination, just sufficient to form a thin workable film fully occupying a covering glass 1½in. by 1in. The inevitable differences in the quantities examined probably accounts in part, at least, for discrepancies, in the number of embryos found at corresponding hours on different days. Notwithstanding this unavoidable imperfection, the microscopical observations serve their purpose, and in the main may be relied on. The same clinical thermometer was used throughout, and by both lads. The instrument I found on

comparing with two others is too high set ; this circumstance explains the range of normal temperature being in the 100th instead of the 99th degree as is usual.

Food of the kind usually consumed by middle-class Chinese, viz., rice, a little pork or beef, salted and fresh fish and vegetables, was taken at seven a.m , one p.m. and seven p.m., or thereabouts.

Sleep during the night was constantly interrupted to take observations, and consequently was frequently indulged in during the day.

The meteorological observations recorded in the chart were made with an ordinary large aneroid barometer, with thermometer attached. The instruments, though good enough for the purpose in hand, are probably not perfectly reliable. I have accordingly procured from the customs a copy of their meteorological register corresponding to the period of these observations. This is very accurately kept, and may be trusted with the exception of the afternoon readings of the thermometer. In consequence of the faulty position of the instruments they stand 3° too high during the afternoon.

Both lads come from Hooie-Oah, a filarious district, some three days' journey to the north of Amoy. They have resided in Amoy but a very few months. Li-Kha (I. in the chart) is 21 years of age, of average size, and in good health. He has no history of fever or any serious disease. Tiong-Seng (II. in the chart) is 21 years of age, and is fairly well nourished. When about 14 he had what he called ague (what I call lymphatic fever), and from that time till now has on an average an attack about once a month. The attacks begin with giddiness, weariness of the body and limbs. This gradually merges into a cold stage, with moderate rigors of two or three hours' duration ; then succeeds a hot stage of very high fever of 24 hours' duration, terminating in moderate diaphoresis, lasting for an hour or two. The fever is accompanied by complete anorexia, and during its continuance the inguinal and femoral glands invariably swell up and pain him excessively, those on the right side being affected more than those on the left. Unless the attack of orchitis or inflammation of the tunica vaginalis, to be hereafter alluded to, he has never had any trouble about the genitals or limbs, nor any signs of elephantoid disease. There is manifestly nothing of an ague type about these fever attacks. Though recurring about once a month (he had another attack without orchitis, however, on

the 18th and 19th August) they are single, not quotidian, tertian, or quartan.

The first three compartments on the chart refer to Li-Kha (I.); the second three to Tiong-Seng (II.); and the two lowest are occupied by readings of thermometer and barometer. At the margin are numbers referring to number of filaria found, temperature of body, beats of pulse per minute, &c., &c. Along the top the figures refer to the date and the hour of the day.

One or two things require a little explanation. The effect of the *febrile state* is well known in the case of Tiong-Seng (II.). From the 12th July, when systematic observation commenced, till the afternoon of the 16th he was in his usual health, though his temperature ranged rather high, and the filarial rhythm was perfect. At one p.m. on the 16th, after being out of sorts all the morning, he had a rigor, followed by rapid rise of temperature and smart fever; at four p.m. he took five grains of quinine; by ten p.m. inflammation of the right tunica vaginalis, with effusion and perhaps orchitis, declared itself, and the groin glands had become painful and swollen. Next day he was quite confined to his bed, inflammation continuing. He took three doses of quinine of five grains each during the day. On the 18th fever and inflammation had subsided, and he took only two doses of quinine. On the 19th the fever and inflammation relapsed, and he had an attack of a sort of convulsive hysteria; that day he had three doses of quinine. On the 20th he was better, and on the morning of the 21st was entirely free from pain and fever. The swelling of the testicle and glands gradually subsided. Contrast the behaviour of the thermometer and of the embryos during and immediately after the attacks. The disturbance in periodicity did not begin for some time after the thermometer had risen, and it continued for days after the temperature had fallen to the normal standard. My inference is that the mere elevation of temperature has not *per se* any effect on the periodicity, it would show at once were this the case; chemical or other pathological changes, consequent on the febrile state, have an effect, and, until these changes are eliminated or subside, filarial rhythm is interfered with. The effect of the fever seems to be to prolong the periods of remission, to diminish the number circulating at the time of maximum, and prevent complete fuscation at any time.

As the *quinine* taken during the attack might have had some disturbing influence, I tried the effect of a large dose on Li-Kha

(I.) on July 26. Thirty grains were taken in three doses of ten grains each at intervals of one hour, beginning at ten a.m. On the following day you see the pulse rose, the temperature fell, and comparatively few embryos could be found circulating, and their ingress that evening appeared to be delayed; but by one a.m. on the 28th they were as numerous as ever, and thenceforward periodicity and numbers continued as before the experiment. I cannot say, however, that this slight perturbation was the result of the quinine, for Tiong-Seng (II.) was treated exactly in the same way on the 29th, but periodicity and numbers were in no way affected.

Nitrite of Amyl (15 drops) was inhaled by Li-Kha (I.) at ten a.m. on the 25th. There were no embryos in the blood when inhalation commenced; shortly afterwards 2 were found in one slide—3 at one p m., 2 at four p.m., 0 at seven p.m., 18 at ten p.m.

Sontonin (four grains) was given to Li-Kha (I.) at ten a.m. on the 29th, and the same dose at seven p.m. No effect apparent.

Turpentine Spray inhaled by Li-Kha (I.) at ten a.m. August 1st. No result.

Quassia Tincture Spray inhaled for eleven minutes at mid-day August 1st by Tiong-Seng (II.). No result.

Besides these I have tried one or two experiments with electricity, but they proved barren and need not be detailed.

Referring again to your Quekett Club communication of 27th February, I would ask you if Dr. Bancroft has published his observations on the dog louse as intermediary host of *Filaria immitis*? Unless he has observed metamorphosis of the embryo in the louse's stomach it is premature to conclude that this is the intermediary host. Did the louse play the *rôle* he assigns to it? then we might expect to find *Filaria immitis* in the dog in all countries where the louse is found. The intermediary host is, I fancy, the principal element in determining the geographical spread of such parasites. A little reflection soon convinces one of this.

Before concluding this letter I would suggest that Dr. Somerville's statements about the habits of the Chinese, with regard to the use of drinking water, should not be received until he, or someone else, has given us the details of the investigations that have led him to the conclusion that the Chinese do not drink uncooked water. I have been many years in China and mix a good deal with the people, and the outcome of my experience is that, like other people,

the Chinese drink water when they are thirsty and can get nothing better. It is quite true that with a certain class of Chinese there is prejudice against drinking cold water, but it is only the richer classes who can afford to act on such prejudices. I asked a Chinese friend, "Do your countrymen often drink cold water—the farm servants and coolies?" "Certainly," he said, "all drink water if thirsty on the hill side or in the fields; what else can they get to drink?" Only a day or two after reading Dr. Somerville's letter I asked ten consecutive patients as they passed through the hospital consulting room about their drinking habits, and these are the answers to my question, "Do you drink cold water?"—

I. Case of elephant leg, a paperhanger—Before my disease began I drank cold water daily, especially during the hot weather.

II. Case of bruise, a boatman—When thirsty I always drink cold water.

III. Case of leprosy, a boatman—When younger, and before falling ill, *i.e.*, till I was 12 or 13 years old, drank cold water in hot weather. Since my leprosy commenced never drink cold water, always tea.

IV. Case of fibro-sarcoma, farm labourer—I generally drink cold water, sometimes tea.

V. Case of bruised and lacerated lip, idol paper maker—I generally drink tea, once in ten times drink water; when young I always drank water.

VI. Case of scabies, a comb maker—Seldom drink; when very thirsty generally drink water, sometimes tea.

VII. Case of flat feet, a blacksmith—Generally drink tea, very rarely water.

VIII. Case of leprosy, pedlar—When young I drank water daily, now generally drink tea; water seldom.

IX. Case of dyspepsia, pedlar—When young drank water; since becoming dyspeptic never take fluids.

X. Case of bruise, shopkeeper—I generally drink tea or rice water; sometimes drink water.

There happened to be nine lads, assistants and dressers, in the room when I interrogated these patients. Turning to them I asked them individually if they drank water—one and all confessed to being guilty of the habit, and seemed very much astonished that anyone should doubt it.

Foreigners are not so partial to water drinking as are the natives; at least when water is drunk it is usually qualified with wine or spirits, and ærated waters of different kinds are in general use. The most careless foreigner and the total abstainers seldom drink unfiltered water; and if filtration cannot exclude an animal at least the thirtieth of an inch in length, the passing of water through a filtering apparatus must be regarded as a meaningless ceremony.

It is to be regretted that Dr. Somerville has not been more explicit as to the number of natives whose blood he has examined for filaria. Dr. Rennie, of Foochow, writes me he frequently sees the parasite in his hospital cases. Readers of Lewis' earlier papers will remember the warning he gave, foreseeing such criticisms as Dr. Somerville's. He says, referring to accounts of chyluria cases, such remarks as this will be frequently recorded, "Filaria searched for but not found"—or words to that effect.

If the examination of filarious blood is made during the night it is almost as easy to find the parasite as it is to find a white blood corpuscle. Seeing this, and the frequency with which the presence of the parasite is associated with lymphatic fever, elephantoid and other disabling affections, I have sometimes thought it would be worth the trouble for the Government in India to institute the systematic examination of the blood of native recruits by their medical officers. I am satisfied that by the rejection of filarious subjects much invaliding and expense might be avoided, and that, too, at very little trouble. At any rate much useful information might be got together, and such an idea might be profitably ventilated by Sir Joseph Fayrer, or some other Indian authority.

You may use this letter as you think best.

Yours faithfully,

PATRICK MANSON.

Description of a Zoophyte Trough, Live Box or Growing Slide.

By the Rev. H. J. Fase.

(*Communicated Feb. 25th*, 1881.)

This arrangement is shown in plan view with the cover removed at Fig. 1, and in transverse vertical section at Fig. 2. In these figures A is a glass plate, 3 inches in length by $2\frac{1}{4}$ inches in width, to which is cemented a stout bone or ivory ring B, $\frac{5}{8}$ths of an inch in height, having a thin lining of cork C, cemented to it. D is a shorter tube of ivory or bone, furnished at the top with a broad flange, and closed at the bottom by a disc of thin cover-glass E. This tube D slides freely in the cork-lined tube B. A narrow slot F, is cut in the inside of the tube B, from the top outside, sloping to the bottom inside, for the purpose to be presently explained.

To use this apparatus as a Zoophyte trough, a ring of indiarubber G, cut through as shown at H, in Fig. 1, and of a thickness suitable to the object to be examined, is placed as shown at the bottom of the tube B. The object is placed in this ring with a little water, and the cover is then pressed down gently, any excess of water flowing out of the cut in the indiarubber ring into the box. For use as a growing slide a ring of indiarubber or of gutta-percha tissue is placed as before in the bottom of the box (but in this case the cut in the ring is to be placed as indicated by the dotted lines in Fig. 1), the object to be examined is placed within the ring, and water added through the slot F, which passes into the box outside the indiarubber ring.

Water may also be added to supply the loss from evaporation from time to time, through the slot F in the ring B, which slot may be closed by a plug of cotton wool, to exclude dust and prevent evaporation.

When it is desired to use the apparatus as a live box, the indiarubber ring may be dispensed with. The object is placed in the

ring B, the cover D pushed in as far as found desirable, and water added if required, by the opening or slot F, which may be closed by a plug of cotton wool as before.

The advantages of the above-described apparatus are, that it admits of the easy arrangement of the object to be examined. That it is readily cleaned. That as no metal is used in its construction, it allows of prolonged observations being carried on without disturbance of the object. That water, either fresh or salt, may be added from time to time, and that the thin cover-glass permits of high powers being used, and is readily replaced when broken.

FIG. 1.

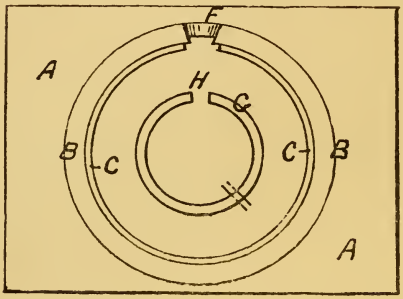
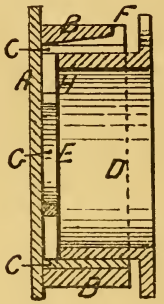
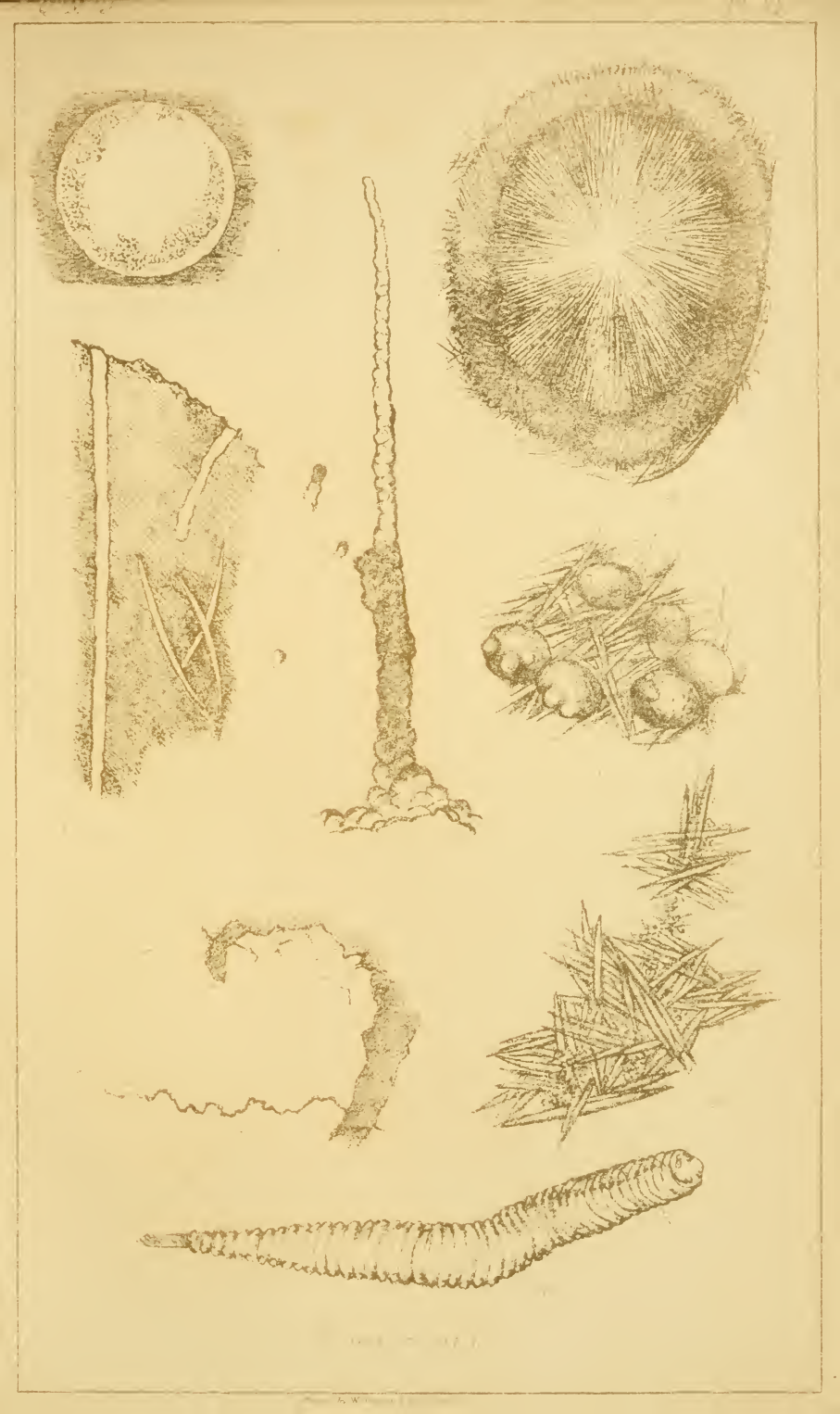


FIG. 1.





On Cliona celata *(Grant)*, Hymeniacidon celata *(Bowerbank)*. Does the Sponge make the Burrow?

By J. G. Waller.

PLATES XX, XXI.

(*Read March* 25*th*, 1881.)

It may perhaps be thought that, in renewing this subject, I am somewhat of a pertinacious disposition, nor am I disposed to deny such imputation. But I can assure you, nevertheless, it is not a pertinacity to hold to error, but an endeavour to seek the truth.

To dogmatize by asserting, this cannot be done by a Sponge or that by an Annelid, is to no purpose whatever. You may go on thus until the day of doom, and then be no nearer to a solution. It is to base a calculation upon nothing, and to expect a result. Facts alone, carefully studied, with a mind free from foregone conclusions, are our only safe guide, and to bring the subject, as far as possible, under the dominion of an *a priori* reasoning, is my object in again addressing you.

The problem before us ought to be capable of solution. Whether it will be when we indulge in theories, in place of demonstration, is a matter open to doubt. A theory may be plausible, it may be possible, but it advances little to an end without it be submitted to the stern conclusion of experiment. Whether the *Cliona* bores the cavities it inhabits, or whether the cavities are made by another creature, are both hypotheses. We must endeavour to interpret by analogies. It matters little whether Sponges are to be relegated to the Protozoa or to the Metozoa, it is clear enough we are dealing with a condition of life imperfectly understood, or its classification would not be the subject of contest. Even in its most active state, it has at best but a vegetative or quiescent existence. You may see it forming spicules before your eyes, from day to day; a mysterious operation, just as a plant may open its bud by an expanding leaf, and you go from the contemplation as wise as before.

One thing is made manifest, that the living elements before you do not belong to a creature with much motive power.

Perhaps I may here be called in question, and be reminded of the monad-form Sponge animal, the more perfect knowledge of which is one of the latest developments of science in this department. But this helps but little; the ciliated monad which may leave the parent stock, and set up for itself, is but a feeble creature, and soon settles down to a state of rest. To give this being, or a collection of these beings, the power of excavating a limestone rock, or the shell of a mollusc, is one of the difficulties before us. To assume that it does this, and then to bend the mind to find out some expedient by which it may be accomplished, does not commend itself to my mind as a true and philosophical mode of enquiry: yet, nevertheless, this is as the case at present stands.

When one reads what has been written on the subject, we find all sorts of surmises, as to *the how* it is performed. Mr. Hancock, to whom we owe the theory of a "boring sponge," thought he had found the instruments by which the operation was accomplished, which was easily disproved. One suggests acid, others deny its presence. The course followed by some would be amusing, if it did not painfully suggest a royal road to error. For instance, one tells us of the Sponge attacking the oyster, which, on its defence, bars him out by the formation of new shell, and thus escapes the burglarious intent. The same writer then philosophizes on the possibility of this creature, in the economy of nature, being for the purpose of assisting in the breaking up of such portions of organic structure.* Once, in this room, it was accused of attacking the oyster spat, and of even assailing an infant oyster, only a fortnight old. A ferocious oyster-loving Sponge is a novelty in Natural History, and its propensities somewhat alarming. The story is almost pathetic, but, is it true? When science condescends to such dreams as these, it is necessary to give it a reminder, and to awaken it to common sense.

To an opponent of the theory, it is certainly satisfactory, as well as remarkable, to notice the vacillation in those who support it.

* The progress of assumption when once the ball is set rolling is seen in the following passage:—"The greatest enemy of oyster-banks is a Sponge (*Cliona*), which eats into the valves, both of dead and living shells; at first only small round holes, at irregular intervals, and often disposed in regular patterns are visible; but ultimately the shell is completely mined and falls to pieces." ("Manual of the Mollusca," by S. P. Woodward, F.G.S., 1856, p. 254.) It really seems as if on this subject proofs for a statement were never held to be necessary. The falling to pieces is purely gratuitous.

Their views are always changing, and never agree one with another. This is inevitable, when the mind convinces itself first, and afterwards seeks for proof for its conviction. When such is the case, to begin by evidence is distasteful, for it is apt to disturb the preconception and the bond of faith. So it is, that they refuse to look at opposing evidence, but cling to whatever aids their own views, however remote it may be. It is hardly possible to find any subject in which the opinions have been more varied, and least consistent one with another. Not that any want of good faith exists; all may be credited by desiring a true solution; but a large number of those who mention the facts of *Cliona* burrows, and ascribe them to the work of a Sponge, have never studied the question at all, but taken upon trust the views of others.

We want evidence—which way it leads is unimportant, so that it be not to follow an *ignis fatuus*. Bring facts before us, and on those build. The only facts which appear to me to take the form of evidence are those given by Dr. Bowerbank, and, strangely enough, never alluded to, though every one should see how important is the bearing upon this question. He says, Vol. ii., p. 218, "Brit. Spongiadæ," "Some naturalists have promulgated the idea that this species of Sponge has the power of excavating the canals and other spaces which it usually occupies. My own intimate knowledge of the species has led me to a contrary conclusion. When located in oyster or other shells, it usually fills entirely the cavities between the two surfaces, but when the canals excavated in the limestone extend to the depth of two or more inches, it frequently occurs that the Sponge terminates at the depth of less than an inch, and the remaining part of the canal is quite empty and clean, without the slightest indication of ever having been occupied by Sponge.* And in one of these perforated stones from Tenby, which I broke through its centre, although it abounded with the sinuous canals, none of them presented the slightest traces of having ever contained Sponge; and occasionally oyster shells full of perforations may be found in the same condition—one such I have in my possession. These facts militate strongly against the idea that the excavations are produced by the Sponge." Again—"In an oyster shell from which I have thin sections, the perforations in its substance consist of nearly straight tubes, of about the same diameter throughout, and each

* Precisely the same facts occur in the burrows in the limestone at Babbicombe.

single one terminates in a round or oval cavity, varying in its diameter from three to eight or nine times the diameter of the tube ; up some of these tubes the Sponge may be seen lowly winding its way, with one or two spicula disposed in a longitudinal direction, while the upper portion of the tube and the large terminal cavity is completely empty.* In another part of the same specimen there is one of these large elongo-oval cavities, from which there are four cœcoid canals, radiating from it, of different lengths, two long and two short ; the cavity is entirely filled with the Sponge, apparently from a fifth canal connected with the exterior of the shell. Now the condition of the Sponge in the four cœcoid canals is relatively the same, that is to say, all the parts in immediate proximity to the large cell are filled with the Sponge ; the two small ones entirely so, the two long ones partially so ; the shortest of the two long ones, for rather exceeding one-third of its length, and the longest for not more than one-fourth of its length. This condition of the Sponge in relation to the shell, unmistakably indicates that the cavities and canals were prepared previously, and that the Sponge, at the time that life was arrested, was slowly winning its way into them."

Now let me arrest you here for a moment, whilst we consider the bearing of these passages on the question before us. Dr. Bowerbank, though, like everyone else, he made his mistakes, yet is acknowledged, even by his most inveterate antagonists, to have been a most excellent observer. And the question before us is one of observation. He tells us what he *saw*, not what he imagined. He tells us these borings are sometimes empty, sometimes only partly occupied by the Sponge, which is still growing and progressing in the excavation. Nor can his testimony be easily set aside. A long life spent in the pursuit of natural history, and notably in this department, carries with it special claims. To say he could not see, nor describe what he saw, would be boldness indeed. But you must dispose of what he says or accept all it involves. His high character forbids us to say he does not tell the truth, and to leave what he says unanswered is impossible. It is a dilemma ; but the case does not rest on this, nor have I yet done with all the evidence he gives. If the facts are admitted, a new theory will be required for the "boring Sponge" not being in the channel excavated, the more especially will this be necessary when the Sponge is found in one part of the

* There is the same evidence given in Pl. XXI, Fig. 1, also at Fig. 5, and abundantly in the section whence this was taken.

channel and not in the other. The theory of washing out has been suggested, where the Sponge is not found at all, and is most convenient, but this will not answer where it has not filled the burrow. We may, perhaps, be told it has retracted. I know what power Sponge has of retraction, and have watched it in the living state, not only of *Spongilla*, but of marine specimens on the rocks at Paignton, but no retraction, such as is observable in the Sponge, can possibly account for empty burrows.

In presenting before you the result of the literature of the subject, I must now notice the theory of Mr. Charles Stewart And there is no one whose opinion, as such, is deserving of more respect and attention, and, if this were a question of physiology, I should have no place before him; fortunately, it is of a very different character. This, as far as I understand it, is, however, in some respects, only the resuscitation of an old one, viz., that acid plays a part; with this important difference, that he goes to some analogy to support his views, which is the action of lactic acid upon bone. And he seems to infer, from this operation, a similar action in the Sponge. Of course, given certain premisses, this theory has a plausible possibility. Yet, it is open to doubt whether a theory, founded on what is seen in special conditions of the human body, can be in analogy to the living action of a lower creature. For the gap is immense between the top of the Metazoa and an organism which, at best, must be placed at the bottom. But herein lies the difficulty. To concede a premiss is to concede a conclusion. It is the old story, a theoretic and not a practical solution. It is a suggestion to account for a conclusion already arrived at. There is, as far as I see, no direct induction; it is simply an idea, extremely ingenious, of the application of which no proof whatever is given. I oppose such a process of reasoning as unsound, even if the result should establish that the "idea" is correct.

If the acid theory be maintained, we must infer some secretive powers in the animal's tissues. Then, it may be necessary to maintain, that these powers belong only to the species *Cliona*, one of the simplest in organization, in many particulars, of the genus to which it belongs, and not to Sponges in general. Surely this would be an assumption, which could not be received without, at least, something like proof. There are re-agents by which the presence of acid may be detected. There is the spectrum analysis, by which some aid might be given; but with

out this close enquiry and investigation, it would be impossible to accept any theory, which involves an acid secreted in the Sponge, for any purpose whatsoever. Nor would an enquiry of this kind be complete if it stopped at the *Cliona*. It must be pursued throughout the several orders of the Sponges to ascertain the positive or negative proofs.*

On a former occasion, I pointed out three different operations, that have been suggested in the making of these burrows, viz., by acid, soft living substance, or hard substance. These may be represented by secretive powers, living sarcode, horny teeth, or the like. The use of acid on all substances, as far as my experience goes, is irregular in operation, unless carefully prepared against as in the process of etching. Defined edges are otherwise impossible, and, as to any rhythmical reproduction of the same form, it is absolutely out of the question. In engraving, the etched line and that done by the graver has a very different aspect under the microscope, and shows what are the separate conditions between that executed by an erosive material and that by a hard tool, even in working a fine line, The one is irregular, the other is not. The exercise of a soft substance in boring would and must produce rounded edges. A hard substance, but not exactly sharp, which grinds rather than cuts, may show a result somewhat irregular under the microscope, but it will nevertheless be able to define and preserve sharp outlines and boundaries of the tool's operation. And it will also show whether the tool worked in a right line or in segments of circles. These are the conditions I propose, in part, to consider with the object we are discussing.

But before I proceed to do this, it is well to cast a glance at such analogies, which seem at least to justify a certain suspicion, if nothing more, of the nature of the "borings" seen in shells of molluscs, &c. What common operation is most familiar to us which simulates the burrows in these shells? Is it not that of a *Scolytus*, a borer in wood? I have an early printed book, dated 1484, the beechen covers of which are perforated throughout by what has been called "the book-worm." So completely is it burrowed, that, but for its leathern envelope it would scarcely hold together. This is done by the minute larva of a beetle, which infests beech and other woods with which books were originally

* Of course I set aside the action of carbonic acid, which belongs to the process of respiration, &c.

bound. It belongs to the cover not the book. Now, not only does this simulate those of the excavators in shells externally, but also the burrows, to a great extent. (Pl. XX, Figs. 1, 3, 4, 6.) There is, indeed, nothing wanting to show both cause and effect. Being perfectly familiar with the operations of this creature, as well as itself, both as beetle and larva derived from the volume in question, my conclusions are formed by its study.

This leads me, then, now to consider the aspect of the commencement of the work on the shell. It is, of course, from the outside, as one might suppose, and begins by a small circular speck which enlarges as it proceeds, sharp and well defined, sometimes throwing up a furrow like ridge, before a complete perforation is made, but cutting always with the utmost precision. There are also to be found signs of the nature of the tool's operation moving in the segment of a circle, but it is not easy to describe them.*

Having now considered the external orifices, let us enter the cavities and examine the mechanical action therein declared. And we must bear in mind the characteristics of the substance, whether of limestone or of shell, because the operation will not be exactly the same in each. Nevertheless, there will be general principles found in both, which are unmistakable and point to the same operator.

That which at once strikes us is, that the excavation is made by a series of consecutive circular cuttings, intersecting each other irregularly by segments, with sharp ridges between them, and sharp points at the boundaries. The whole surface is thus tesselated with so many depressions, assuming geometric forms, all produced by tangental sections of circles. It is remarkable for the precision of the work. No softening, no blurring, no indefinite outline; but one that is distinct, hard, and well marked. Continue our search, the same law is ever present, as shown in my drawings and diagram. (Pl. XX, Figs. 7, 8, 9, 10.) As regards the Sponge a thin membrane overlies the work described, having upon it its spicules lying athwart in the usual orderless arrangement, which distinguishes the genus *Hymeniacidon* (Bowerbank) to which this is referred. Look where you will, there is not a

* I have a mounted specimen of the periostracum which shows every stage of the perforation, and the remarkable sharpness of the cutting, and its strictly mathematical precision defines with accuracy the mode of operation, as it simulates exactly that done by a punch or any other sharp instrument, and this is especially shown when the work is not quite accomplished, having the same appearances as when a cut through any object is incomplete. (Pl. XXI, Fig. 2.) In no instance is any Sponge present.

sign, not even a fascial bundle, which in the remotest manner points to an offensive operation, or can by any possible reasoning be assumed to have had, or to have the power of "boring" or even of assisting in such excavation. In some parts, the Sponge is only represented by the merest film looking like a varnish, and having but here and there a spicule to convince you of the organic structure under your observation.* Let me call your attention to this example. (Pl. XXI, Fig. 3.) Here you have a portion of the lamina of a shell covered with a membrane and a net-work of spicules. But the membrane is the thinnest of films, which is bounded by the sinuous line at base. It has scarcely a spicule upon it, until it forms the net-work seen above, and the whole of this surface is entirely destitute of any of the known excavating indications, until you reach that part represented by shading. The channel on one side, however, does so, yet the membrane passes over this, in no way more developed, colourless, and with scarcely a spicule upon it. So here we have Sponge with no excavation, and excavation with an almost invisible Sponge.† I have noted, in my previous paper, that the greatest development of the Sponge is seen at the extreme edges of the shell, closing up the spaces between the laminæ, and at the circular orifices. In fact, it is at these orifices, that you see the most active functions of the Sponge during life, most interesting to observe, when the opportunity occurs, which may sometimes happen in an oyster tub. Here may be found, not only the oscula, but the porous system, the former often a distinct canal leading into the body of the Sponge, or rather the commonwealth lining the burrows. When in an active state the Sponge is protruded considerably, and withdrawn again when at rest, and then the osculum is closed by an array of spicules, which have their sharp points radiating towards the centre. (Pl. XXI, Fig. 4.) I am indebted to Mr. Priest for a specimen of this Sponge dissolved out of the shell, and it is very instructive. It demonstrates completely its thin membranous character with spicules sparsely scattered upon it, without order, conformably to the genus *Hymeniacidon*. Not a sign of any arrangement by which the spicules could effect any erosive purpose, for

* I am here, of course, describing the Sponge in the dried condition. But as I made observations on the example whilst in the fresh and living state, I am enabled to mention that the quantity of sarcode follows the membranous development.

† This phenomenon is of common occurrence.

they lie parallel on the membranes, and exhibit no massiveness, except at the oscula. Remarkable as these organs are in their construction, their characteristics are not confined to this Sponge, but are found so represented in others, without, however, the same comparative importance, due to the fact, that in this Sponge these orifices, for the most part, concentrate the necessary functions of inhalation and exhalation. I should not have thought it necessary to discuss the question of spicules taking any part in the "boring" if there had not been still those who maintain the same.

But I will now leave this part of my subject and proceed to discuss the non-appearance of the Sponge in certain burrows or parts of burrows. It was one of Mr. Hancock's arguments, in favour of the Sponge being the excavator of its habitat, that it always filled the excavations. That this is very important to that argument needs scarcely to be noted. But I have already quoted Dr. Bowerbank's testimony against the fact, and I shall again quote him in another passage, and then take up the question of my own experience. At page 221 of the former named volume he says, "I have in my collection several specimens of large *Balani* which I took from the sides of the rocks forming the Guliot Caves in Sark, which are perforated, in the usual manner, with numerous sinuous canals, which I found filled with the living Annelids, the dried remains of which still remain in them, and without the slightest indication of the presence of *H. celata*, and I have also found living Annelids in the deeply seated portions of the perforations in the limestone boulders of Tenby, beyond the range of the Sponge, so that I think it may be reasonably concluded that the Sponge occupies the canals and cavities in shells and stones that have been excavated by other animals, and that they have no power to make such residences themselves."

Such testimony as this cannot be passed over in silence, even if it came from a less-known observer. But my own observations have abundantly shown me analogous facts. Numerous instances have presented themselves to me of small, clean excavations, which have never had the Sponge within them, although it was showing all around them. And the theory of "washing out" will not here answer, as I formed my observations on an oyster shell as it came from the dredge with all its dirt, encrusting Zoophytes, Annelids, &c., upon it. Besides, to provide a *Deus ex machinâ* for removing a difficulty is, at best, but a poor and doubtful argument.

I now return to the mode of operation, and the forms resulting in these excavations, because, as such forms are never absent, they constitute a test, the determination of which must settle all controversy on this subject. I refer you to a drawing from a section of oyster-shell in my possession. (Pl. XXI, Fig. 1.) Here you get the sub-circular contiguous hollows, to which I have before alluded, and also an elongated channel diminishing as it proceeds. All these are excavated precisely upon the same principle of sub-circular excavations, whether they be large or small. I must specially direct your attention to the manner in which these are made, and to the certainty, that they are each excavated separately. Let us suppose one circle made first, another added, encroaching upon its boundary, in a more or less degree, and we find the problem of the work determined. The sharp clear outlines of this operation point inevitably to a hard tool as the factor. The smaller ones differ only as such, and can be accounted for only in the same manner.* (See Pl. XX, Figs. 7, 8, 9, 10.)

In all microscopic work measurements are of great value. These sub-circular depressions, in the larger normal size, average the 500th of an inch in diameter, and the smallest diameter of an elongated channel is the 2,000th of an inch; I have met with no excavation smaller than this. I may again refer to these measurements.

I now call your attention to this pebble of limestone. Some years ago, during a stay of two months at Torquay, closely engaged all day during the week, I, one morning on the day of rest, walked to Babbicombe bay. The morning was lovely—it was at summer's close—the sea was as calm as a mill dam, its blue-green colour emulated that of the Mediterranean, whilst the soft air of Devonshire might almost carry you to the sunny south. Add to this, the rich colour of the New Red Sandstone cliffs, as tilted by upheaval, they lay on the flanks of the limestone with masses of luxuriant vegetation around, and there was a noble picture for the eye to rest on, and to give the jaded mind repose. Thus I descended to the shore, the tide running out, to listen to "sermons in stones."

The limestone boulders here, as in other parts of this coast, exhibit the excavations of an Annelid, which, I believe, is well-known. But, at dead low water, I made my observations rather on

* Since writing this, I find this character of the work did not escape the vigilance of Dr. Bowerbank, who alludes to it in Vol. ii., p. 220.

the excavations of another "borer," of which this pebble gives an example. As here, so in huge boulders of all sizes, which lay strewn around, there was what, in the geologist's term, we may call "denudation." The outer crust, which covers the burrow in the perfect state, was broken away in large patches, and thus made conspicuous, what might otherwise have easily eluded vigilance, from the very small size of the orifices. But when I had informed myself of this character, I at once instituted a rigid search and examination, breaking away perfect portions to find, what I really expected to do, the "borer Sponge." But not a single instance, on this or another occasion, ever greeted my eye, and I do not believe it is ever seen in these excavations at all.*

A close examination, however, will convince us, that the work must be made by a similar, if not the same creature, and this is the more inevitable when we proceed to a microscopic examination. I again call your attention to my diagrams. First, to the drawings of these contiguous cups, which do not seem to be continuous, or generally at least to anastomose the one with the other; but to be separate dwellings, each with its own aperture. (Pl. XX, Fig. 2.) A still closer examination shows us that the creature, wishing to enlarge its burrow, or to seek its food, whichever it may be, proceeds to make a new excavation at the base centre, sometimes at the sides, but not often, apparently, interfering with his neighbour (Figs. 11, 12.) And this invariably begins by a new orifice of the same small diameter as that, which is external, and by which it entered. But in the example before you, I never find any deeper workings than about a quarter of an inch. All these are perfectly clean, and without any extraneous matter, except in the instance referred to, which was completely superficial, and in an uncovered burrow caused by the "denudation."

Let us now bring the microscope to bear upon these workings, and, at a glance, we find the same sub-circular depressions as in the burrows of shells. (Fig 8.) There is the same character, the same interference or section of the circular boundary, and the diameter is the same, viz., the 500th of an inch.† In fact, the precision of the cuttings all declare them to be by a similar,

* I thought I had found a minute dried piece of it. But on mounting it I discovered it was a mixture of extraneous matter, particles of sand and a few acerate and pin-shaped spicules, which appeared to me to belong to *Hymeniacidon suberea*.

† Owing to a slight error in the drawing, they appear larger.

or even by the same factor. However different, in some respects, in arrangement between the limestone burrow and those of the oyster-shell, the *modus operandi* is identical, and there is no escape from whatever conclusion this forces upon us. The creature who makes the one makes the other, be it Sponge or Annelid.

I must now return to the borings of the *Scolytus*, and present you with the analogy of the operations. For it is surely a natural mode of reasoning to proceed from the known to the unknown, for, as no one can doubt the evidence of his eyes as to the analogy presented in external appearance with those in oyster-shells, &c., or indeed with the burrows themselves, the comparison is a fit one to lead us on to the solution of the interesting question in debate. (*Vide* Pl. XX, Figs. 1, 3, 4, 6.) Now to the microscope, and let us see how far this assists in the enquiry.

Here is a drawing, made under the microscope, showing the mode of excavating by the larvæ of the *Scolytus* (Fig. 9). And what does it teach us? Why exactly the same principle, the difference is only in the material. There is the same concentric cutting as in the shell and the pebble; the same *law* of operation. The mode of excavation is sub-circular in its process, such as is familiar to us in the work of mandibles moving laterally. The conclusion is therefore irresistible, that creatures of similar faculties made all the borings in question; creatures armed with teeth or jaws, call them by what names you please—larva or annelid. Can it possibly be asserted that a Sponge does precisely the same thing?

And now what are the difficulties in the way of such a solution? Do they exist at all? The voracious larvæ of many of the Articulata are borers, as we know. Many of the Annelidæ, at least, are acknowledged to be so too. Not only so now, but have been so in far back geological epochs. The *Spiroglyphus* and other excavators in shell belong to the Tertiary period, and ages still more remote, and furnish some indications of their presence.* And an analogy drawn from the operations of a larva of one of the Insecta in a class but little elevated above the Annelid, closely allied in form and habit, and all belonging to the same great group of Articulata, is surely more natural than one drawn from an operation in a mammal, especially as the latter has got to be proved in detail.

Then where is the difficulty in assigning to the Sponge, which

* Mr. Etheridge, the President of the Geological Society, very kindly sent me a list of Annelidæ referred to.

dwells in these cavities, the character of a parasite? Parasitic Sponges abound. Clefts of rocks, deserted polypidoms, shells, &c., all present examples; in fact, I here show you a drawing from an instance of this very Sponge, the *Cliona*, taken from the same oyster-shell, which has afforded me material for my observations, where it appears, not in the burrows, but on the *outside* upon the deserted home of a *Lepralia*, which was partially covered by the tubes of *Sabellæ*. This, of itself, suggests the habit to be parasitic, which is confirmed in a still stronger manner by Dr. Bowerbank, ("Brit. Spongiadæ," Vol. ii., p. 217). And I have many examples of it inhabiting the deserted tubes of *Serpulæ*. The difficulties indeed are with those who have committed themselves to the opposite view. We know of no Sponge excavator except in theory.* Sponges afford no sort of analogy with themselves of any such aggressive power, even in those which might seem to present more external signs of such a capability.

I have endeavoured to show you, that the solution of the question is, and must be, in the mode of working the burrows. The markings, I have attempted to describe, can be demonstrated to be made by a hard tool working in the segment of a circle, to which I have drawn your attention, as shown by the *Scolytus*. And that such should be mimicked by a Sponge, a creature so far down in the scale, would be, if proved, one of the most extraordinary marvels in natural history. It would be altogether without parallel, and it therefore requires the most absolute proofs before it should be accepted. No imaginative dream, no assumption, no jumping to conclusions, because minor points are not understood, can support such a theory in the face of hard and tangible facts, in full agreement with well-known precedents.

My friend, Mr. Priest, kindly brought me for inspection the specimen from New Zealand, of the excavated shell of *Haliotis*, in the possession of Mr. Kitton, which formed the subject of a diagram illustrating his paper on Sponges. On giving it an attentive examination, I found the main facts differed in no way from those familiar to me. The same mode of working was indicated, and I saw nothing in this example, which either raised or removed a difficulty.†

* I here distinctly assert that there is no record of any observation which *proves* the Sponge to be an excavator.

† Since writing the above, I have, through the kindness of Mr. Priest, been enabled to quietly examine the slide in question. It has some curious

My argument is thus complete. I rest upon it, well knowing that, as yet, it has never been so taken up. The analogy which exists with the borings of the larvæ of the *Scolytus* is shown throughout. The orifices are identical (Pl. XX., Figs. 1, 2), so are the burrows, as seen in sections (Figs. 4, 6), and again in the minute workings (as in Figs. 7, 8, 9).

As I have been alluding to Annelids, I may observe that several forms, apparently of such, I have recently observed upon one of my mounted portions of shell. The diameter of these is the 2,000th of an inch, which I find to be the same as the smallest excavated channels. Assuming therefore an Annelid to be the factor, these forms, if of such, present no difficulty on the score of dimensions. Moreover, we may fitly compare the size of the larva of *Scolytus* as quoted, which has a diameter of about the 500th of an inch, and its sub-circular excavations about the 250th in diameter; full double that seen in those of shell or limestone, and thence infer a still more minute creature to be the factor, in the view that an Annelid makes the burrow.

In my previous paper on this subject ("Q.C.J.," Vol. ii., 1871) I believe, I was the first to figure the so-called gemmule of this Sponge, as Dr. Bowerbank makes no mention of it. Besides this I also figured other forms, apparently connected with reproduction. In examining with higher power amongst these gemmules, I discovered above them groups of spicular bundles, which mark the early growth of siliceous Sponges. Many similar ones are given by Dr.

features, and is so far extremely interesting; but it is anything but an example which gives evidence in favour of the Sponge being the excavator. The most patent fact exhibited is the *entire* absence of Sponge from minute channels, where, had it ever been, it must, at least have left some spicules. In Pl. XXI., Fig. 5, I give a drawing of one of the long channels of the smallest kind, and have brought from another part, where remains of Sponge are seen, a group of spicules to contrast the size together. The channel has a diameter of 2,000th of an inch, the section of the arc of the spicules' curve is the same, so had they ever been developed within this channel, no ordinary means could remove them. As the same fact is seen throughout, it has a great significance. But it exhibits a still more important piece of evidence, for the large excavated channel, out of which the small tubular channels proceed, itself has no remains of Sponge, or even a spicule, although the greater part has escaped being uncovered by grinding the section. In fact, the spicules are very few in any part of the section, and are the sole representatives of the Sponge: where they do appear is in the most open parts, and where most exposed to washing away; they are entirely wanting in all the ramifications. The form of the spicules are shown in the drawing, and are all of the same kind—acerate—totally unlike those of *Cliona celata*, and probably belonging to an entirely different species. The evidence of excavation differs in no way from the familiar forms.

Bowerbank ("Brit. Spongiadæ," Vol. i.), and I have also many other examples. These developments therefore of the young Sponge may assist in determining the possibility of such a creature commencing life as an excavator. One example is figured in Plate XXI., Fig. 6 (500 diam.). At Fig. 7, same plate, is a group of the gemmules (?) with buds developing, which are possibly the same, as previously noted, but are here given from the dried state, the others being from a specimen mounted in balsam. In all cases, where these (Fig. 6) occur, the gemmule seems to be exhausted, and its vesicles to have disappeared.

Thus I have endeavoured to bring the subject from the dominion of conjecture, and to place before you an issue, whence it may be determined. In summing up I state these propositions. If it can be shown, that the Sponge is not always in the burrows, even as a whole or a part, there is an end of the theory of a "boring" Sponge. If the limestone burrows at Babbicombe never exhibit traces of the Sponge, the theory is also at an end, for no one can doubt but, that a similar creature made these. If it can be demonstrated, that the burrows are made by a hard and not a soft instrument, nor by a solvent, the theory is also at an end, and its further prosecution useless. These propositions, I have endeavoured to prove, in the paper before you.

It is my hope that the subject may now be definitely settled, for, in this friendly warfare, both victor and vanquished are gainers equally in the contest, when the struggle is not for victory but for truth.

Having through the courtesy of our President, Mr. Charters White, and that of Mr. Charles Stewart, had an opportunity of examining the slides on which each illustrated their respective theory and analogy on this subject, viz., Dentine absorption and the operation of Lactic Acid upon bone, I feel it necessary to give some supplementary remarks. And I cannot but express myself thankful to those gentlemen for their kindness in explaining their several views. Especially is this due to Mr. Stewart, who took much pains to explain an operation, with which I was unfamiliar, in that lucid manner for which he is so distinguished.

Now, at starting, there is a formidable objection to both theories. Here are operations going on within a living creature, part of the incidents of its life, destruction of material, waste, co-existent as it is

with renewal of its structure. How this can, by any possible reasoning, be said to be analogous to what might take place by a living thing acting upon a substance foreign to itself, *i.e.*, the shell of a mollusc or limestone rock, is to me inconceivable. It would be very different, if we were discussing an action within the mass of the Sponge ; it then might appear much more plausible.

But the analogies, extremely interesting as they are, still are not close, even in the forms of operation. There is a general resemblance, but it is irregular and incomplete, just as it is also in iridescence of ancient glass, which Mr. Stewart also brought forward as an analogy, though how it bears on the question it is difficult to see, any more than in other similar forms of decomposition. Then only a small part of the phenomenon is accounted for at best.

It was advanced by Mr. Priest, on the authority of a passage written by Mr. Carter, that the Sponge had been found to have worked its oscula through the overlapping frond of a *Nullipore*. The passage runs thus : " *Cliona corallinoides* not only excavates shells, but the sandstone rock too of this locality, where it shelters itself under the florid expansion of *Melobesia lichenoides* which goes on growing (that is spreading in all directions), while the *Cliona*, every here and there, makes holes through this crust or thalloid frond for its pore areas or vent as required."* If the writer of the above has not watched and seen the whole of this operation, it is nothing more than a deduction from appearances, of which there are so many in the scientific history of this Sponge. Oscula projecting through a crust of polypidoms are common enough, but give no proof whatever of the Sponge being the factor ; the difficulties in the way of such interpretation I have already stated.

That the Sponge is parasitic can be shown by many examples in my possession. It seeks seclusion in orifices or fissures between incrustations, deserted tubes of *Serpulæ*, and can often be found to be spreading over surfaces without excavation. (Pl. XXI., Fig. 3).

The limestone pebble from Babbicombe is a test object, as the total absence of any Sponge in its deep-seated burrows is surely fatal to the theory. Its curiously minute orifices are paralleled in excavations in the shells of some oysters, as in example given (Pl. XX., Fig. 12), and it suggests the probability of more than one species of factor.

* " Annals and Magazine of Natural History," 4th Series, Vol. viii., p. 15.

The recent discovery of an Annelid, on one of my slides, taken from a shell with burrows, comes in aptly for my conclusion. It is similar in size to the dried form alluded to, and in its figure (Pl. XXI., Fig. 8) I have marked near its head where the diameter is the 2,000th of an inch. The remains of two others coiled up within circular burrows, in diameter the 333rd of an inch, I have also found and preserved with the small fragment of shell itself.

DESCRIPTION OF PLATES XX, XXI.

Plate XX.

Fig. 1.—Drawing of a portion of oyster shell full size, showing the orifices.

Fig. 2.—Ditto, ditto, of the limestone pebble from Babbicombe, showing its minute orifices, and the excavated cups denuded of the outer crust Actual size.

Fig. 3.—Orifices of the *Scolytus* borings from an example in the beechen cover of a book, dated 1484. Actual size.

Fig. 4.—Drawing of a vertical section of oyster shell, showing burrows. Magnified about three diameters.

Fig. 5.—Burrows in Babbicombe pebble. Three diameters.

Fig. 6.—Burrows of *Scolytus*. Section taken from the covers of the volume referred to. Three diameters.

Fig. 7.—Drawing of sub-circular depressions, as seen in excavations in oyster shells 95 diameters.

Fig. 8.—The same as in Babbicombe pebble. 95 diameters.

Fig. 9.—Same as in the beechen covers of the book. 45 diameters.

Fig. 10.—Geometric plan of the mode of excavation. The dotted lines exhibit portions of the circular boundary effaced by the adjoining subsequent excavation.

Fig. 11.—Plan of excavation in Babbicombe pebble. *a*. Shows cups in section, with orifices and extension of burrows. *b*. Cups denuded, showing small orifices at bottom for extension of burrow.

Fig. 12.—Portion of oyster-shell, showing similar minute orifices, as in the pebble referred to. Actual size.

Plate XXI.

Fig. 1.—Excavated channel in section of oyster shell, 100 diameters. The diameter of extreme point measures 2,000th of an inch. The smaller excavations, cut through at right angles, have the same measure. The shaded part is debris caused in making section.

Fig. 2.—Orifice cut through periostracum of shell. 75 diameters.

Fig. 3.—Portion of lamina of oyster shell, with early development of the sponge. About 15 diameters.

Fig. 4.—Osculum of sponge closed; the porous system in the thick ring of net-work around it. 25 diameters.

Fig. 5.—Excavated channels in section of *Haliotis*, in possession of Mr. Kitton, with a group of spicules brought close to them for comparison of size. 125 diameters.

Fig. 6.—Development of sponge from gemmule (?). 500 diameters.

Fig. 7.—Gemmnles (?) of the sponge, with budding development About 85 diameters.

Fig. 8.—Annelid found on fragment of a perforated shell. 500 diameters.

Further Remarks on the Histology of Sponges.

By B. W. Priest.

(*Read March 25th,* 1881.)

Since bringing my paper on Sponges before you, I have sought all the information I could in the time on the matter of the Burrowing Sponges, and still hold to the same opinion that I had then, that a certain class of Sponges are capable of burrowing or boring cavities in hard and soft substances.

I certainly cannot see why, because the *Cliona* and others of that class occupy the cavities made by Annelids or Molluscs, that they should not be capable of burrowing for themselves. No doubt in perforating the shells in which they are found they avail themselves of ready-made spaces and cavities, and spread out and line them, and so in that case take a more or less massive form which they are known to do, Carter and others describing *Cliona celata* in a form, where it does not burrow, but occurs massive.

Carter, in describing *Cliona corallinoides* in the Annals of Natural History for 1871, states that not only does it excavate shells, but the sandstone rock too of the same locality, where it shelters itself under the florid expansions of *Melobesia lichenoides*, which goes on growing (that is, spreading in all directions), while *Cliona*, every here and there, makes holes through this crust or thalloid frond for its pore-area or vents as required. Still quoting Carter, he goes on to say, "Of course, therefore, these 'holes' are occupied by a longer or shorter cylindrical prolongation of the Sponge in proportion to the thickness of the crust, which thus presents as many heads, so that when the shell is dissolved off by acid the heads project here and there above the general surface of the Sponge."

Again, my friend Mr. Hillier, of Ramsgate, in a letter to me on the subject, states that *Cliona celata* burrows in the hard limestone of which the pier is partly built, and that it sends up its oscula right through any other Sponge which may be growing over the stone; —in fact liking to get freely at the water, and that it is on that account it is never found inside, but outside, the harbour.

Mr. Hillier has also sent me up a foreign shell, where the perforations and cavities, though small, are completely filled with the Sponge, and says, in the letter accompanying it, "Can you doubt that the burrows are made by the Sponge?"

Even Dr. Bowerbank himself tells us that very few oyster, or other shells in which the perforations exist, are free from this Sponge, and yet he is trying hard to prove that it is only as a parasite that it exists in them. It seems strange to me that, if such is the case, the same species or class of Sponge should almost always be found to occupy those cavities.

That Carter, Hancock, and other naturalists should have made a separate family of these Sponges under the name of *Eccœlonida*—from the Greek, to hollow—is, I think, sufficient proof of their belief in their excavating powers. The family is divided into three genera—*Cliona* of Grant, *Thoosa* of Hancock, and *Alectona* of Carter.

Speaking of the last, which comprises the *Alectona Millari*, which excavates Corals in a most devastating way, Carter says that, like *Cliona celata*, it leaves its burrows and grows up externally into a massive form.

Now the process by which this burrowing, boring, or excavating is produced is another question. I think that I have said enough to prove that the Sponge is capable of doing it. Certainly the nearest approach of analogy is in what Mr. Stewart said at the last short discussion on the subject, when he brought forward the markings which appear in bones, where necrosis has, or is, taking place; and also similar markings which may be seen in the process of the formation of bone in the femur of a fœtus, where, as the development of the bone proceeds, the calcified cartilage is absorbed, and larger cancelli and canals formed. I have had the opportunity of examining very carefully sections with the process going on, and I have there actually seen the protoplasm acting on the surrounding parts, and to all appearances eating its way into them.

One can hardly call that a mechanical process, but I feel certain in my own mind that it is a similar sort of thing that takes place with the burrowing Sponges.

I hold with my friend Mr. Hillier that there are processes beyond the mechanical, or even the chemical processes of the laboratory, which we do not as yet thoroughly understand, but which may be called vital for want of a better term. Because we do not know how

a thing is accomplished it is no reason that we should ignore the fact. How is it that *Lucerne* can penetrate its roots two or three feet into the chalk, or the adventitious roots of the ivy penetrate frequently through substances, even limestone, round which the plant is growing; one can hardly grasp the idea of the process being mechanical or even chemical, when we consider the delicacy of the soft vegetable cells composing their framework, particularly those at the ends of the rootlets which are working their way in.

I am not rash enough to say that it will never be found out how *Cliona* accomplishes its excavations, but I do think that this family of Sponges will continue to burrow into shells and rocks, and bore naturalists for some long time to come, without the *modus operandi* being thoroughly understood.

As I have said before, I certainly agreed with Dr. Bowerbank until I came across shells where the cavities ramified right and left into such fine processes, and those cavities being filled with the Sponge I could not at all make the burrowing of Annelids agree with them.

In conclusion, I may mention that we hear of a great many of the borings being made by lithodomous Annelids and Molluscs, but I cannot find any account of the said Annelids and Molluscs being found in them, or by what species they are formed. Dr. Bowerbank's analogy of the process pursued by the Annelids being analogous to that of the garden worm swallowing the earth and the marine Annelids swallowing the calcareous substances from the borings they make in the limestone rocks, hardly holds good, after what Mr. Gosse tells us, that all marine Annelids are carniverous. It must be rather hard fare for them if it is so.

If time and weather had permitted, I had intended to have gone to the coast, and treated the shells with osmic acid, and taken sections; this I still hope to do at some future time.

PROCEEDINGS.

JANUARY 14TH, 1881.—CONVERSATIONAL MEETING.

The following objects were exhibited :—

Taste-goblets of Rabbit's tongue ...	The President.
Canella alba, wild cinnamon, section of bark, polarized	Mr. F. W. Andrew.
Skin of Tench	Mr. W. R. Browne.
Winged Parasite of Swallow, *Stenopteryx hirundinis*, showing peculiar scythe-shaped wing	Mr. F. Enock.
Transverse section of stem of *Sarsaparilla*...	Mr. W. Goodwin.
Sting and poison-bag of Honey Bee ...	Mr. H. R. Gregory.
Strongylus filaria	Mr. G. Hind.
Diaptomus castor	Mr. A. Martinelli.
Nothrus sylvestris	Mr. A. D. Michael.
Transverse section of petiole of *Pontederia cærulea*, showing diaphragm with crystals	Mr. H. Morland.
Navicula rhomboides, ¼ inch objective ...	Mr. E. M. Nelson.
Pedicellina echinata	Mr. E. T. Newton.
Radiolarian entangled in *Euplectella* ...	Mr. B. W. Priest.
Sieve-tubes in *Cucumis sativus* ... Tylosis in ditto	Mr. J. W. Reed.
Transverse section of Turkey's claw ...	Mr J. G. Tasker.
Arsenious Acid prepared by sublimation ...	Mr. H. J. Waddington.

Attendance—Members, 57; Visitors, 5.

JANUARY 28TH, 1881.—ORDINARY MEETING.

T. C. WHITE, ESQ., M.R.C.S. &c., President, in the Chair.

The minutes of the preceding meeting were read and confirmed.

The following donations to the Library and Cabinet were announced, and the thanks of the meeting were voted to the donors.

"Proceedings of the Royal Society" ...	from the Society.
"Journal of the Linnean Society" ...	The President.
"Proceedings of the Belgian Microscopical Society"	the Society.

"Annual Report of the Postal Microscopical Society"	the Society.
"Science Gossip"	the Publisher.
"The Analyst"	" "
"The Northern Microscopist"	the Editor.
"The American Naturalist"	in Exchange.
"The American Microscopical Journal" ...	" "
"Dr. Braithwaite's British Moss Flora," Part 3	the Author.
"Harris and Power's Manual of the Physiological Laboratory" ...	Mr. J. W. Groves.
"Calendar of the Incorporated Law Society"	the Society.
"Report upon the Wild Silks of India" ...	H.M. India Office.
"Annals of Natural History"	Purchased.
"Grevillea"	"
Three Slides	from the President.
Two Slides of Microscopical Writing, by Peters' Machine	Mr. E. M. Nelson.

The following gentlemen were balloted for and duly elected members of the Club—Mr. C. W. Burt, Mr. Herbert Lankester, and Mr. John A. McKenzie.

The President announced a donation of particular interest from the Royal Microscopical Society, being a bronze copy of the Quekett Medal, and read a letter from the Secretary, which accompanied the donation.

A special vote of thanks was unanimously accorded to the Royal Microscopical Society for their donation.

The President announced that the first Soireé of the Hackney Microscopical Society would take place on February 24th, at which members of the Club were invited to assist.

The President read a letter from the Secretary of the Epping Forest Naturalist's Field Club inviting co-operation in a protest against the proposed encroachment upon Epping Forest by the Great-Eastern Railway. A motion to that effect was put to the meeting and unanimously carried.

Mr. B. W. Priest read a paper "On the Natural History and Histology of Sponges," the subject being well illustrated by a number of excellent diagrams.

Mr. J. G. Waller differed from Mr. Priest with regard to the so-called boring sponges. His opinion upon that matter was well known, but he would give it up as soon as any evidence was produced that the excavations alluded to were the work of sponges. He had never met with any such evidence, though he had met with assumption, and it was upon this that the idea appeared to him to be based. Mr. Priest had said that, "no annelid could do this boring," but it was not a question of an annelid at all, and he would ask the question, could a sponge do it? When they examined a piece of hard rock, bored and excavated in the manner shown by Mr. Priest's diagram, and asked that question, he was quite ready to answer

that no sponge *could* do it. It had not been mentioned that there were three theories as to this matter—one referred the action to that of some solvent—another thought it due to the action of a soft living substance, whilst a third ascribed it to the action of a hard substance. He had some experience of the action of acids, and also of a graver, and it was quite certain that a line, however light, made by a solvent, was never like that by a graver, and could not be confounded with it, and it was quite certain that a soft substance produced its special characteristics upon the substance on which it acted by rendering every sharp angle and detail perfectly smooth and obliterating distinctive form altogether. The well known example of the toe of the statue of St. Peter at Rome being completely worn down to a mere knob by the repeated osculations of the faithful for centuries, was an instance of the last-named kind of wearing away. Give the requisite time, and the wearing away could be done by a soft body, but the nature of the resulting effect ought to be such as to make it quite easy to say whether it was done by a hard or by a soft substance.

Mr. Chas. Stewart, whilst disclaiming to be an authority upon the subject, said he must certainly join issue with Mr. Waller on the question of the boring sponges. In looking for the most probable explanation, what did they find in the facts themselves to guide them in their opinion? They found that rocks and calcareous substances were channelled out in the manner described and figured, and that sponges were inserted in these exceedingly fine orifices, and the question was whether these minute perforations were made by marine annelids? He thought that they were much more likely to have been done by the sponges themselves, and it had been suggested that it was accomplished in one of three ways. Firstly, the action might be of a cutting nature like that of a graver, but this he thought to be highly improbable; the second idea was that the spaces were eaten out by some acid excretion which decalcified the structures with which it came into contact; and the third mode was by what might be called a colloidal action. When they examined the surface of the materials which had been acted upon, they found it was not a smooth one by any means, but it was eaten out into various concave depressions. Now when they looked in other directions they found that there were other substances which were eaten away in an almost precisely similar manner. If a dead bone were left surrounded by living tissues it would be actually thus eaten away by the soft granulated tissue around. The same process was going on in the case of ordinary bone, for they found numbers of holes regularly excavated in the bone tissue which were known as Haversian spaces, and which were due to the action of the so-called bone destroying cells. Here, then, was an instance in which depressions were produced with comparative rapidity by the action of soft substances, and it seemed to him on looking into a section of rock supposed to be perforated by a sponge that they had there an appearance identical with that of an Haversian space; and he thought that the process by which these soft osteoblasts excavated the bone might be applied in the case of rocks and shells. Certainly no annelid could do it. With regard to the position of the

sponges—they were, he thought, rather to be considered as allies to the corals, than as Mr. Kent seemed to regard them as allies to the infusoria.

Dr. Cobbold said he was himself inclined rather to take Mr. Kent's view. As regarded the animality of sponges, it had been stated that this was a question of rather recent date, but as a matter of fact the discovery dated just 33 years ago, the real discoverer being Dr. Dobery, of Chester, who first found the cilia in *Grantia*. As the manuals in general which dealt with the sponges were in error as to the discoverer, and as Dr. Bowerbank himself admitted it, he thought that in the interest of an honest worker the facts of the matter should be mentioned.

The thanks of the meeting were voted to Mr. Priest for his paper.

A paper by Dr. Manson, of Amoy, "On the Periodicity of Filarial migrations to and from the System," was read by Dr. Cobbold. The paper was illustrated by a large diagram, on which were tabulated the results of a series of observations made every three hours during an entire month upon a given quantity of blood from two Chinese youths afflicted by these parasites—the observations recording the number of *Filariæ* found, the temperature of the blood, height of barometer, &c.

Dr. Stephen Mackenzie referred to the case of a patient under his care who was suffering from the disease. In that case he had been unable to find any of the *Filariæ* in the blood, although when his attention was directed to it he examined it by night as well as by day, and Dr. Cobbold had given him specimens so that he might better recognise them if he found any. He thought that the facts mentioned in the paper were exceedingly important, and that it was highly desirable that the periodicity should be made known. The chart exhibited in illustration of the paper was a most striking confirmation of previous observations, and the regularity was in itself marvellous. Indeed it seemed little short of fabulous how the *Filariæ* should swarm into the blood just at the time when the mosquitos fed. An important point was whether the *Filariæ* had the same periodicity in temperate climates as in the Tropics. As to the way in which the observations were made, they must, of course, rely upon the testimony of Dr. Manson in the matter, but it occurred to him that the Chinese were very clever, and if *Filariæ* were wanted at particular times they might perhaps have little trouble in finding them, and perhaps it was a little natural to suppose that anyone who was particularly interested should see exactly what he was looking for. He was glad to have the opportunity of expressing his sense of the value of what Dr. Cobbold had done in this direction. If anyone found a new form of parasite in any part of the world, it was sure to be sent to Dr. Cobbold, who examined it and gave the benefit of his knowledge upon the subject. In the instance before them he was quite sure that had the diagram been Dr. Cobbold's own he could not have done it greater justice. He should, however, like to know what sort of control was exercised over these two young men. It also occurred to him that the Chinese did not as a rule drink *cold* water; it was certainly not their custom in some parts.

Mr. J. W. Groves asked if the statement that the *Filariæ* passed from

the lymphatics into the blood vessels was merely inference, or the result of observation ?

Mr. Chas. Stewart enquired whether when a person was kept in perfect rest during the day as well as by night the periodicity continued ? Was the altered condition of habit the cause in any way of the phenomena ?

Dr. Cobbold regretted that the lateness of the hour prevented him from fully answering these questions, but as to the water drinking this had been gone into by Dr. Manson with very great care, and particulars of the cases of 10 Filarious patients were given who answered "Yes" in every case to the question, "Do you drink cold water ?" As regarded the education of these two Chinese, the evidence showed that Dr. Manson took infinite trouble with them, and watched them, and confirmed their observations for many days. As regarded the position of rest, he hardly saw what that could have to do with it, and the subject of the Migration from the Lymphatics had already formed the material of a paper recently laid before the club.

The thanks of the club were unanimously voted to Dr. Manson and Dr. Cobbold.

The proceedings then terminated with the usual Conversazione, at which the following objects were exhibited :—

Glandular hairs of Sweetbriar leaf ...	Mr. F. W. Andrew.
Phthirius inguinalis, Ovum, Young and Adult	Rev. H. J. Fase.
Microscopical writing by the Peters' Machine	Quekett Club Microscope
Annular vessels in *Zea mais* ...	Mr. J. W. Reed.
Lacticiferous vessels in *Scorsonera hispanica*	Mr. J. W. Reed.
Flint in Sponge remains ...	Mr. G. J. Smith.
Spores of *Lepidostrobus*... ...	Mr. G. J. Smith.

Attendance—Members, 62 ; Visitors, 10.

February 11th, 1881.—Conversational Meeting.

The following objects were exhibited :—

Trombidium autumnalis, Harvest bug ...	Mr. F. W. Andrew.
Egg cases of *Cimex lectularia*	Mr. W. R. Browne.
Diatoms from Forest Gate	Mr. F. Coles.
Leaf of *Lepicystus sepulta* ...	Mr. C. G. Dunning.
,, *Alyssum hirsutum* ...	Mr. C. G. Dunning.
South African Fly	Rev. H. J. Fase.
Salicylic Acid, polarized	Mr. H. R. Gregory.
Limnia with parasitic *Vaginicola grandis*...	Mr. J. D. Hardy.
Hairs of *Dermestes* shown under dark ground, with 4-10th inch objective and Abbe's Illuminator... ...	Dr. Matthews.
Neroid Annelid (Marine)	Mr. A. D. Michael

Section of stem of *Modecca tamifolia*, showing raphides and sphœraphides in pith	Mr. H. Morland.
Podura scale shown by polarized light with 1-25th inch objective (1200 diam.)	Mr. E. M. Nelson.
Section of leaf of *Viscum album* ... ,, ,, *Sarsaparilla* ...	Mr. J. W. Reed.

Attendance—Members, 72 ; Visitors, 7.

February 25th, 1881.—Ordinary Meeting.

T. C. White, Esq., M.R.C.S., &c., President, in the Chair.

The minutes of the preceding meeting were read and confirmed.

Mr. C. G. F. Essell, Mr. James Glaisher, Mr. William Haigh, Mr. Alfred Leicester, Dr. John Millar, Mr. Clifford Probyn, Mr. Thos. Taylor, Mr. Chas. Tyler, Mr. W. J. Vereker-Bindon, and Mr. J. D. Ward were balloted for and duly elected members of the Club.

The following donations were announced:—

"Proceedings of the Royal Society" ...	from	the Society.
"Proceedings of the Linnean Society" ...	,,	the President.
"Journal of the Royal Microscopical Society"	,,	the Society.
"Proceedings of the Botanical Society of Edinburgh"	,,	,,
"Proceedings of the Geologists' Association"	,,	the Association.
"Science Gossip"	,,	the Publisher.
"Popular Science Review"	,,	,,
"The Analyst"	,,	the Editor.
"The Northern Microscopist"	,,	,,
"The American Naturalist"	,,	in Exchange.
"The American Monthly Microscopical Journal"	,,	,,
"The Microscopist's Annual	,,	Mr. Turnbull.
"Annals of Natural History"	,,	Purchased.
"A Letter in the Handwriting of Professor Quekett"	,,	Mr. Moginie.

A vote of thanks was unanimously accorded to the donors.

The President said it would be remembered that at their last meeting a letter was read inviting their co-operation in opposing the proposed encroachment on Epping Forest by the Great Eastern Railway Company, who wanted to carry a line through it to High Beech. Since that meeting he had been invited to join a deputation as their representative, and in that capacity he, with a number of other gentlemen, waited upon the Board of

Works, to whom they stated their case, and the matter was, from their point of view, fully discussed. They were cordially received, and he judged from what he saw and heard that the wishes of the majority of the Board were in harmony with those of the deputation, but it was argued that the Board had no *locus standi* in the matter, and could only refer it to the Works Committee, which they promised to do. There the question was left, and it seemed to depend upon the action of the Parliamentary Committee, which would shortly be sitting in connection with the proposal of the Railway Company.

The President announced that the Soireé of the Ealing Microscopical Society was arranged to take place on the 30th of April. Members of the Club who were willing to assist were cordially invited to do so.

Mr. A. D. Michael said he had received a communication from Mr. Beaulah relative to *Myobia musculi*, one of the *Acarina*, the peculiar position of the generative organs of which was described in a paper "On the Reproductive System of the Acarina," published in the Journal for November, 1879 (No. 41, p. 223). The peculiarities of this species were first called attention to in 1834 by Claparède, and all writers upon the subject had treated it as a parasite of the mouse—it did not appear to be confined to any particular species of mouse, but had always been found on a mouse of some kind. Mr. Beaulah had read this paper, and whilst searching for some parasites upon a mole found also "*Myobia musculi*." Whether it was naturally parasitic there or not he could not say, but it was certain that it was found there, and he thought the circumstance worthy of note, particularly as pointing to the practice which had prevailed of naming species according to the creatures on which they happened to be found, and according to which if a parasite were caught on a new species of bird or animal, it was thought, of course, it must be a new species also. The mode of naming specimens after the creature they were caught upon, instead of according to their own characteristics, was one which led to great confusion, and was certainly to be condemned. So that he felt glad to be able to bring forward this instance, seeing that it went some way towards knocking a nail in the coffin of this fallacy.

Dr. T. S. Cobbold said that though external parasites hardly came within his range, yet he should like to observe that nothing could be more absurd than to suppose that any parasite was limited to one particular host. As regarded internal parasites, some of them might be limited to certain creatures; but there were others which might be found almost anywhere. Every animal no doubt had its own parasite, but it also entertained a great many others which it had in common with its neighbours; so that it was difficult to say how they were to limit them. He should be very glad if Mr. Michael could tell him whether the genus *Pecobia* had any limitations; if not, on how many creatures had it been found? He should like to add, by way of showing what extraordinary errors were sometimes committed in the manner referred to, that some time ago a foreign observer, named Sherrimatuski, found a parasite on a heron, and of course, regarding it as a new species, gave it the name of "*Desmatofatoiges Sherrimatuskii*." It after-

wards turned out to be only a parasite of one of the common domestic animals which had transferred itself, and thus got this splendid name given to it.

Mr. E. T. Newton said that regarding this subject as a matter of nomenclature generally, every one must be struck with the difficulty which surrounded it. It was no doubt an evil to have species unnecessarily multiplied, but yet when any one began to work upon a class of creatures, like the *Acarina*, for instance, no doubt it was found a matter of convenience to know what animal it was found upon. What they had to do now was to cut down the numbers, so that the same form was not described under several different names. The difficulty was one which reigned throughout the Animal Kingdom; but whilst they sought to remedy it, they should remember that in the beginnings of research it was a plan which had its advantages at the time, and he thought they should also remember that in other quarters there was an equally inconvenient tendency the other way. The matter was certainly one worthy the attention of a Society such as theirs.

Mr. Michael said his observations on *Pecobia* were so limited that he was not in a position to say what were its limitations.

The Rev. H. J. Fase exhibited and described a growing slide and live box which he had used for about a year and a-half, so that it had been well tried. In construction it was very simple, and resembled a live box in its action; the cell was a ring of bone, cemented upon a glass plate, and the slide was made of cork; at the bottom of the cell there was an indiarubber ring, and the piece of thin glass used as the cover was kept down upon the ring by the pressure of the cork slide, the depth of the interior space being regulated by the thickness of the indiarubber ring. The difficulty with most of the forms in use was that if they were too thick the object inside could not be focussed upon with anything but a low power; whilst if they were very thin, they contained too little water. This one had certainly acted very well, and he could recommend it for practical service.

Mr. Curties enquired in what way provision was made for a fresh supply of fluid?

Mr. Fase said there was a little groove in the cork ring, into which water could be put with a pipette, but there was not much evaporation.

The thanks of the meeting were voted to Mr. Fase for his communication.

The President announced the meetings, &c., for the ensuing month, and the business of the ordinary meeting terminated.

The President having vacated the chair, Dr. Matthews addressed the members of the Club in the following terms:—Gentlemen,—I pray your attention and patience for a few minutes whilst I introduce to your notice a subject which has not only occupied much of my thoughts as well as those of many friends whom I see before me, but has enlisted all our sympathies. By way of preface, I will begin by saying that there are amongst the ethical canons by which I have ever tried to shape my conduct, two which I shall quote for the present occasion—the first of good morals, the second of good taste, though I must admit that I by no means consider

them as of equal obligation. The first is paramount—"not to speak ill of a man behind his back." This I have never consciously broken. The second is—"not to praise a man to his face." This canon of good taste I have rarely—indeed I may say hardly ever infringed, though it is very difficult to avoid it sometimes. But there are times and occasions when a rule of conduct which may very properly influence an individual, may, indeed ought to be relaxed, when an association of gentlemen concur in the same opinion of one of their number, and, as a tribute of justice to him, desire to give it open and hearty expression by the mouth of one of them. In the position of that one I now find myself; if therefore I err in what I am about to say on the score of warmth of expression, I trust that I may, in consideration of the special circumstances, have your sympathy and approval. And when, indeed, I call to mind all these circumstances, they seem to me to resemble so much the act of an University in conferring a degree *honoris causâ* as to suggest almost irresistibly the parallel, and to impel me to consider myself in the light of a public orator, whose duty it is to set forth, with due insistence, the titles and claims to distinction of one whom his fellow men have delighted to honour. Let me assure you, then, that I value more highly than I can express the privilege of being your spokesman on this interesting occasion. We have met this evening to perform a ceremony which may be briefly described as a hearty and spontaneous recognition of the valuable services of our worthy Secretary, John Edmund Ingpen, after eight years of voluntary service of our Club. During all this long period the affairs of the Club have gone on so smoothly and well, the work committed to him has been so unobtrusively, silently, and, I must add, so heartily performed, that it never, until now, seems to have occurred to any one of us to ask himself at what cost of time and of brain work—with what sacrifice of needful rest and leisure, nay even of family communion and comfort, these services must have been rendered. Gentlemen, it has been one of my highest privileges, by your favour, to have occupied such a position in relation to this Club as to enable me to speak with some confidence, with some authority, on this subject; and I can therefore assure you, and that without seeking in the least to undervalue the services of any of the other officer-bearers of the Club, that the effort—the strain involved has been very great—far greater, indeed, than those who are not, in a sense, "behind the scenes" can imagine. Do not, I pray you, for a moment suppose that I have gathered this from anything that our friend has said to me or to anyone else—I speak but from a silent and prolonged observation. It would be as entirely superfluous as it is fortunately unnecessary for me to enter into any disquisition upon Mr. Ingpen's title to the thanks of the Club. To enumerate his special services would be almost to give or to write its history during his time, and you must be all as well acquainted with that as I am. In most other Societies which have aims in any sense akin to ours, it has been found necessary to divide the duties of the Secretariat between two or even more persons, and yet I will venture to affirm that their duties are, as far as relates to the actual business of this Society, scarcely more

onerous than those which are so efficiently discharged by our one worthy officer. And I will again take this opportunity of assuring you that, seeing only the happy results as you do, you can scarcely estimate the whole amount of work and responsibility involved in such an office. But some one may say, "It was voluntarily assumed." True, most true. But does not such willing service all the more deserve—nay, even demand recognition? Besides, I may remind you that when Mr. Ingpen assumed office, the condition and status of the Club were not quite what they are now, and that its business and influence have silently, yet onerously increased. And I will assert, with no fear of contradiction, that if this Society have increased in importance and estimation, if its usefulness have been developed, if, in fine, it have prospered, as it most assuredly has, much, very much, of this advancement is greatly due to the untiring energy, the acuteness, and, I will add, the technical as well as general knowledge of our Secretary. When we come to consider, too, that all these qualities have been exerted on our behalf under the grievous physical difficulty of failing sight, it certainly raises wonder in my mind at the great amount of self-sacrifice displayed under such serious and ever increasing discouragement. But that is a subject which, if we touch on at all, must be with light and tender hands. We may, however, be permitted to hope that the cheering wish may be realised to the uttermost with him, "Post terebras lux." It has never been the way of a body of Englishmen to accept services such as those I have been speaking of in, I fear, very feeble terms, after all that I have said, without, sooner or later, expressing their thanks for them; and I think I may say, without violating any confidence, that if the thanks of the Club have not hitherto been openly accorded by its members to Mr. Ingpen, such an expression has been prevented, or at least delayed, by circumstances which many present will readily understand. To those who may not, I will only hint that they have arisen chiefly, if not wholly, from the honourable and delicate scruples of our friend, which have at length yielded only to the wishes and representations of those of his sincere well-wishers, whose sense of justice would no longer be denied nor postponed to other considerations. I will not delay you much longer, except to remind you that an efficient Secretary has been said to be the mainspring of a society—just as the President may be called its regulator. The latter, like a Sovereign, reigns, but he does not govern, for it is the Secretary who is largely, though not entirely, the motive power. Like a mainspring, he may, being out of sight, be also out of mind, yet his influence, for good or for evil, must needs be felt in every throb of the machine. And if that influence be so subtle, so refined as not to appear, so much the more is it to the credit of him who uses it so discreetly. Do not mistake me, I pray you, gentlemen; the influence I speak of is that of an amiable character, upright conduct, and unusual scientific talents, as well as acquirements, influenced and regulated by a tact as rare as it is enviable. In conclusion, I will only observe that if Mr. Ingpen have not done so, he might well have adopted the famous speech of the French

Monarch, "*L'état, c'est moi!*" We all know in what spirit it was uttered by the King, as well as the miserable outcome of that supreme selfishness of which it was the embodiment. But if our Secretary had adopted it, what a whole heaven of difference its meaning would have borne with him? Instead of merging the common weal in himself he has done exactly the reverse, and that is why we have met here now to testify our esteem and respect for him, not only by our verbal assurance, collectively as well as individually, but also by that tangible kind of proof which scarcely ever fails to lend emphasis and force to even the kindest and most considerate words. Mr. White, to you I now more particularly address myself. You, Sir, have but now, for the time, abdicated the chair which you so worthily occupy in this Club. I therefore appeal to you as one who, in the past having quite as worthily filled the same office, having manfully borne the heat and burden of your day, and having retired from it with dignity and applause, as some "brilliant" memories testify, are, therefore, well able to estimate the difficulties which beset and surround the office, as well as the ability which Mr. Ingpen has displayed in dealing with them—to you, Sir, I now appeal to assure him on your own behalf, as well as on that of his other friends and well-wishers here assembled, how high are our respect for his character and our esteem for his person, by delivering to him the tokens which are mentioned in this memorial, which, as well as the signatures attached, I ask you first to read to this assembly, and then to deliver to him.

The testimonial, which consisted of a silver tea service and a Zeiss microscope, was then placed upon the table.

Dr. Matthews then handed the memorial to the President, who read it to the Members. It is worded as follows:—

"To John Edmund Ingpen, F.R.M.S., Honorary Secretary of the Quekett Microscopical Club.

"The accompanying microscope is presented by his friends and well-wishers, Members of the Club, as a memorial of their pleasurable association with him for the eight years during which he has so genially and efficiently fulfilled his Secretarial duties; at the same time, knowing that the assiduity with which he has worked for the Club must often have led him to give up for its advantage hours which would otherwise have been devoted to his family, and being assured of the kindly sympathy which Mrs. Ingpen has ever shown with his exertions in this direction, the Members beg her acceptance of a silver tea service, as an expression of their esteem.

"While deeply lamenting the cause which it is feared will compel Mr. Ingpen to retire from office at no very distant period, it is the earnest hope and prayer of his many sympathising friends that his retirement may not be permanent, but that they may still have the advantage of his ready help and kindly advice for many years to come.

"Signed on behalf of the Members of the Q.M.C.,

"PRESIDENT—T. Charters White, M.R.C.S., F.R.M.S.

"Past Presidents—

"Thomas H. Huxley. T. Spencer Cobbold, M.D.
"John Matthews, M.D. Henry Lee, F.L.S., &c.

F. Coles.	W. H. Gilburt.	B. W. Priest.
M. C. Cooke.	J. W. Goodinge.	Jno. W. Reed.
Arthur Cottam.	J. W. Groves.	Walter W. Reeves.
Frank Crisp.	Henry F. Hailes.	Jno. C. Sigsworth.
Thomas Curties.	Richd. T. Lewis.	J Slade.
Edward Dadswell.	Albert D. Michael.	Alpheus Smith.
Chas. G. Dunning.	E. T. Newton.	C. Stewart.
F. W. Gay	Fredk. Oxley.	J. G. Waller."

The President said that he desired to express his sense of the pleasure he felt in taking part in these proceedings. Knowing from experience what the work was in which Mr. Ingpen had been engaged, he could deeply sympathise with everything which had been said by Dr. Matthews. He felt as much as anyone how greatly the Club's present prosperity was due to the labour and judgment of their Secretary, and was quite sure that in thus acting as spokesman he only expressed what was felt by them all. He then, amidst great applause, presented the memorial to Mr. Ingpen, with a further expression of the hope that the necessity for his permanent retirement might not after all really arise, but that after a time his services might be again restored to them.

Dr. T. S. Cobbold said—Mr. President, I rise with very great pleasure to offer a few remarks on this auspicious occasion; and what few observations I have to offer I have for various reasons preferred to commit to paper. There are those, Sir, who have known Mr. Ingpen longer than myself, and who can speak of the services he has rendered to the Club at a period when this scientific institution was in a less flourishing condition than it now is. I can only say that during the brief time that I occupied your chair I not only admired but envied the skill, the tact, the discrimination, and the quiet enthusiasm which Mr. Ingpen displayed in conducting the duties of his office. His whole heart seemed bound up in the interests of the Quekett Club. Sir, I am free to confess that there are some methods of getting up testimonials with which I have no sympathy. Mr. Ingpen's claims are of a very different order. He has given us time that could be ill-spared; energies that might have been more profitably employed elsewhere; talents of no mean order, and perhaps not a little of his health and strength. We have been benefited by these self-denying labours, and we should be wanting in common gratitude if we had not adopted some simple and readily accessible means of expressing our grateful acknowledgments. Speaking, finally, as one of the rank and file of the Club, I would add an expression of indebtedness to the Memorial Committee. From the hearty manner in which their appeal has been responded to, it is quite evident that they have in their own gracious example succeeded in kindling into a flame the sparks of gratitude which lay smouldering in the breast of every member of the Club.

Mr. Crisp said that he rose as a "brother snip," not to bear testimony to the well-known excellence of all Microscopical Secretaries in general, but to the special qualities of Mr. Ingpen in particular. No Club had ever had a Secretary who was more devoted to its interests; and whilst repeating and cordially endorsing all that had been said that evening in recognition of Mr. Ingpen's services to the Club, he might specially refer to the unobtrusive manner in which he had always performed his duties.

Mr. A. D. Michael thought that after what had been said, and said so well by those who had spoken, little remained for him to add, but he should hardly feel comfortable if he were not to express his own concurrence in what had been expressed. There was a proverb that "One did not know the value of a blessing until there was a danger of losing it;" but on looking round at the different Scientific Societies, one could not but be struck with the wonderful way in which the honorary secretaries performed their arduous and important duties; and during the few years that he had been connected with the Club he had found, what he had no hesitation in saying was the case, that no Society was better served or more indebted for the service than was the case with their own Society in regard to Mr. Ingpen.

Mr. Ingpen, who on rising was received with prolonged applause, said he felt in the greatest state of embarrassment he had ever been in since he had held office amongst them. He hardly knew what to say, or how to express his feelings at the reception which they had just given him. His embarrassment was increased by the glowing terms used in his praise, and it would be complete but for the known fact that their worthy Vice-President, Dr. Matthews, always put on a pair of rose-coloured spectacles when he reviewed the conduct of his friends. The more sober view of the case would be something as follows: He took up the secretaryship as a labour of love nearly eight years ago, and had all along been happy in his work; he had the pleasure of serving under a series of eminent and able Presidents, with a Committee always ready to give help, and with colleagues with whom he had always worked in the most perfect harmony. He took the opportunity of thanking one and all of them for their great assistance, and for their uniform kindness and forbearance towards him throughout that period. The part which it had fallen to his lot to perform had not been so difficult as it might have been. He had not, like their first Secretary, to assist in the construction and organization of the Club, nor like the second to extend its range and influence in new directions, but he had merely to do his best to keep it from retrograding, and to see that it proceeded in the course which had been already marked out for it. The only difficulty would have been to have retarded its progress. Perhaps they would allow him to say a word or two as to the nature and character of this testimonial. That glittering portion of it upon the table seemed to him emblematic of the influence of the Quekett Club upon the home circle. They had probably sometimes heard a slight expression of discontent from Materfamilias at the absence of Paterfamilias at the meetings of the Club; but it was worthy of remark that the same microscopical pursuits often kept him at home, when he might possibly have been—elsewhere. There was an

advantage in microscopical study in which it somewhat resembled lady's "work," for if a man were absorbed in his books he was apt to be grumpy and unsocially disposed; but if he were at work with the microscope he could not only join in the conversation, but might occasionally add to the general enjoyment by calling attention to some interesting and beautiful object. Then again many members had from time to time been added to the Club by being invited to tea, and an evening with the microscope afterwards, and he ventured to say that in the addition of useful members, the tea table had vied successfully both with the Quekett dinner and the Quekett Arms. With regard to the scientific portion of the testimonial, it might seem to require some explanation that a microscope should, under the circumstances, have been chosen; but this was at his express wish, for should his sight be spared or eventually restored, he hoped to do good work with the instrument; if not, it would still be valued by himself and by his family. The selection of a German instead of an English microscope was not in the slightest degree in disparagement of English work, but it was well-known that he had always taken a great interest in the work and teachings of Professor Abbé, and had taken every opportunity of imparting his theories to others;—regarding them, indeed, as forming the true "Grammar of Microscopy;" and he had a desire to do this with the instrument which Professor Abbé himself preferred, and with the appliances he had invented or adapted. Nothing else remained but for him to thank them for their beautiful and valuable presents. These he should always prize highly, but still more did he value the kindly feelings which had prompted the gift, still more the kindness which he had all along received from every one with whom he had come in contact, and most of all the true and lasting friendships which he had had the happiness to form with so many of the members of the Quekett Microscopical Club.

The President said it had been with very much pleasure that he had listened to the manner in which the testimonial had been given and received. He asked that Mr. Ingpen would allow the articles to remain upon the table for inspection by those members present who had not previously had an opportunity of examining them.

The following objects were exhibited:—

Indian Gad-fly *(Tabanus)* showing barbed edges of the lancets	Mr. F. Enock.
Selected Diatoms from the Richmond deposit	Mr. W. Moginie.

Present—Members, 103; Visitors. 6.

March 11th, 1881.—Conversational Meeting.

The following objects were exhibited:—

Membranipora ptilosa, living ... *Pulex irritans*, cleared in Carbolic acid	The President.
Section of Bitter Almond	Mr. F. W. Andrew.
Feather from head of Drake ... Sheep Tick, mounted without pressure	Mr. A. Fieldwick, jun.

Larva of *Tiresias serra*, showing halbert-shaped hairs	Mr. H. E. Freeman.
Micro-fungus *Polyactis* sp.? mounted in Salicylic Acid	Mr. W. H. Gilburt.
Section of lip of Cat ... ... " " Skin of tail of ditto ... " " Testis, Epididymis and vas deferens of Guinea Pig	Mr. J. W. Groves.
Cirri of *Balanus* ... ... Larva of *Corethra*, living ...	Mr. J. D. Hardy.
Carchesium polypinum ... ... *Euglena viridis*	Mr. A. Martinelli.
Very young *Doris aspera* (Nudibranch Mollusc), showing the various spicules in the skin, characteristic of genus and species	Mr. A. D. Michael.
Grammatophera marina in situ on Marine alga	Mr. H. Morland.
Sponge—*Askonema setabulense*	Mr. B. W. Priest.
Section through seed of *Viscum album*, showing the embryo ... ... Section of anther of Tulip, showing spiral cells and early formation of pollen	Mr. J. W. Reed.
Bermuda Arrowroot, showing corrosion from partial digestion ...	Mr. W. H. Symons.
Octopus, from the egg, showing rudimentary suckers	Dr. H. T. Whittell.

Attendance—Members, 56; Visitors, 10.

March 25th, 1881.—Ordinary Meeting.

T. Charters White, Esq., M.R.C.S., &c., President, in the Chair.

The minutes of the preceding Meeting were read and confirmed.

Mr. Edwin Norman and Mr. Arthur Wildy were balloted for and duly elected Members of the Club.

The following additions to the Library and Cabinet were announced, and the thanks of the Meeting accorded to the respective donors;—

"Proceedings of the Royal Society" ...	from the Society.
"Proceedings of the Epping Forest Nat. Field Club	"

"Proceedings of the Belgian Microscopical Society"	from the Society.
"Proceedings of the Royal Society of New South Wales"	,,
"Report of the Department of Mines, New South Wales"	,,
"American Naturalist"	in Exchange.
"American Microscopical Journal" ...	,,
"Northern Microscopist"	,,
"The Analyst"	from the Publisher.
"Science Gossip"	,,
"Grevillea"	Purchased.
Nine Slides	The Rev. H. J. Fase.
Two Slides	Mr. W. H. Symons.

Mr. J. G. Waller read a paper "On *Clionia celata*—Does the Sponge make the Burrow?"

Mr. Priest read a short paper on the same subject.

At the conclusion of his paper, Mr. Priest remarked that he considered that Mr. Waller had been depending too much upon *dried* specimens. In the specimen Mr. Waller had spoken of, prepared by him, and showing the round oscula, the membrane had become perfectly dry, and nothing but the spicula were left. He illustrated the manner in which the *Scolytus* made its burrow, showing the ramifications with lateral openings for the purpose of depositing its eggs.

The President then read the following remarks on the subject:—

It has been asserted that *Cliona* has a power by which it bores its habitation in rocks and shells, but what this power is, or wherein it lies, is at present not clearly made known to us. Some maintain that the spicula are used as implements by which a burrow is made, while others, ignoring the mechanical theory, believe the boring to be the result of chemical action; but, from the point of view from which I regard the question, I believe that both theories are untenable. In the first place, an examination of the spicules of *Cliona* will convince the observer that no abrasion has blunted their fine points; points that terminate sharper than any needle would show at once the effect of wear—but supposing the spicules, being so much harder than the shell or stone in which the boring is made, resist the consequent wear, and maintain their sharpness, by what means can they be so efficiently worked by the small amount of contractility inherent in the sponge's protoplastic body? If it is argued, that the continually dropping will in time wear away the stone, and so the continual contraction and expansion of the sponge will in time make its bore into the rock or shell, I would ask *how long* will it take for a *Cliona* to form the dendritic growth filling the interlaminar space of a Pecten-shell, even acknowledging that this growth is the combined product of several *Clionæ* amalgamated? But the chemical theory is, to my mind, far from conclusive, because it pre-supposes the possession on the part of *Cliona* of some powerful acid capable of decalcifying shells and limestone, or of dissolving out the silica from flint, such an acid in this

latter case being of the most corrosive and energetic description. If any such chemical was contained in the body of a sponge, I do not think we should expect to find siliceous spicules in it. It has been urged that probably the carbonic acid evolved in the respiration of the sponge would be sufficient to dissolve the lime of the rock or the shell, but to this I would ask, supposing this to be the case, that would not account for the removal of the silica in a flint-boring ; and has it been proved that sponges exhale carbonic acid as other animals do, and would carbonic acid be evolved only at the point of excavation, which is not at the osculum, but at the tail, if we may suppose it to have one. The theory I would advance, and which would be one embracing modifications of both these preceding theories is, that boring-sponges have a limiting membrane endowed with the power of absorption, and I have been led to this view by an examination of the characters of the *Cliona* borings, and a comparison of them with the well-known absorptive action which occurs in the human subject, and which leads to the shedding of the milk teeth in children ; and, to illustrate this theory, I have placed near my microscope for comparison, specimens of the absorption of the dentine of the temporary teeth, and side by side with that the inner surface of a Pecten-shell, which was the seat of a Clional growth, and I hope the examination of the specimens will prove by their character that the tube of a *Cliona* is produced by a similar absorption to that which gradually causes the shedding of a child's first tooth, where we know that a soft cellular papilla grows up in close contact with the root of the temporary tooth, and absorbs the dentine into circular depressions similar in character with those shown as the interior of the borings of *Cliona*; and the analogy is further strengthened by the fact that it is by no means an uncommon thing to meet with cases in the temporary teeth where an arm of these papilla, having a more energetic action than the rest of the surface, has pushed ahead and bored its way into a chamber for itself. My conviction that *Cliona* borings are not due to mechanical action, has been much confirmed by the perusal of a paper by Prof. Martin Duncan, published in the "Transactions of the Royal Society," for 1876, in which he shows that a Thallophytic growth had permeated the septa and outer walls of certain *Madreporaria*, and I had an opportunity afforded me for inspecting the specimens from which he had drawn his observations, and the soft mycelium threads of this fungus, unprovided though they were with any mechanical means of boring, had yet perforated the hard structures of these corals, and were even fructifying within the pent-up walls of their prison-house. Now here were no diamond-edged spicula to bore their way with, and no Annelid of the diameter of 1-10,000th or 1-20,000th of an inch could have prepared the way for them which they so accurately filled up, but it may be probable that the carbonic acid, evolved by the extremity of the growing plant, may have acted on the hard arragonite of the coral. It is not for me to measure swords with such doughty warriors as Mr. Waller and Mr. Stewart, but I confess my inability to accept the mechanical and chemical theories advocated by these gentlemen, and simply suggest a method by which this boring, or rather excavation, may be accomplished,

after a process which offers so many illustrations in the physiology of higher animal life.

The President then invited discussion.

Mr. Charles Stewart said he did not understand that the President offered any explanation of the way in which absorption took place. The dentine of the tooth was removed under the influence of the membrane in contact with it, but he did not say *how*, and he left the question, strictly speaking, without an answer. The facts of the case had been quite truly given by Mr. Waller. We had, in the case of the limestone, and also of the calcareous shells, certain cavities which were more or less occupied by the sponge, and when examined under the microscope, they were found very constant in the character of their surface. From the main cavities there were, however, certain minute processes which tapered off into what were practically sharp points, these were occupied by the soft substance of the sponge. His contention was that no Annelid was likely to make so fine a passage as this, going off practically to a point. Of course Annelids did bore with facility into limestone and shells, and even into harder substances. Very much stress was laid on the depressions being segments of spheres; that was a very important point which we should recognise, but he did not think it was quite worked out to a natural conclusion by Mr. Waller. It was perfectly certain that a homogeneous body might be worked to that form. Either mechanical or chemical action commencing erosion from a point would make a regular concave depression. Or, if the erosion be equal over the surface attacked, but the resistance less at certain points, a similar pitted surface would be produced. If we examined a piece of iridescent glass under the microscope, the surface would present a number of regular depressions exactly like those said to be made by the Annelids. Mr. Waller would not allege these were excavated by Annelids. In the glass there were certain points and streaks where oxide of iron was more abundant, and around these points as centres decomposition spread into layers and laminæ, which shelled off from the surface of the glass, leaving curvilinear cavities as seen in the rocks and shells. Mr. Waller seemed to think that the analogy was very strained between erosion of bone which occurred in a natural process, and that which occurred in the case of the sponge. He failed to see that the analogy was strained. What we had to deal with in the case of bone or teeth was a mixture of organic matter with certain lime salts, and we had, in the case of the shell, a mixture of inorganic matter and lime salts. Now, the actual surface of the bone was covered with certain cells which presented no great difference from the cells in contact with the shell bored by the sponge. Those cells would eat out the bone, forming a surface so closely resembling the chambers containing the sponge that he did not think they could be distinguished from one another. He thought the cells and the substances were very similar, and the effects produced identical in character.

Mr. M. Hawkins Johnson said he had no theory of his own to advance on the subject, but he did not place implicit confidence in those he had heard. He once saturated an oyster-shell, which was full of these holes, with melted

wax, and then dissolved away the shell with acid, and thus got a complete cast of all the excavations which had been made in it. There was one very striking feature present which had not been noticed that evening. There were circular cavities, which in the cast were solid wax. These were irregularly placed, and from one to the other there were connecting tubes, and these knobs in the cast, representing cavities, varying from 1-12th to 1-8th of an inch in diameter, were very striking, with fine threads of wax from one to the other.

Dr. Cobbold, referring to the absorption of dentine, stated that there were at the Hunterian Museum two tusks from female Indian elephants, and therefore of small size, which, at the part immediately above the gum, were eroded to the depth of ¼ inch. The question naturally occurred: How were these excavations formed? From their size and other indications, as if chiselled out like the sculptured appearance shown that evening, he had no doubt whatever that they were the result of parasitic erosion. On these tusks were immense numbers of the ova of a *Dipteron*—on one tusk, he had counted over 2,000 eggs. A very large proportion of the eggs were broken up and were without the lid. They resembled those of the gadfly's when attached to the hairs of animals. He believed that the maggots had escaped from these egg-shells, and that their presence had caused this erosion. It was quite another question to say by what power the larva produced those excavations.

The President enquired if the erosions were below the gum If so, the irritation caused by disease would set up this appearance.

Dr. Cobbold replied in the negative. The erosions were on the exposed surface.

Mr. E. T. Newton said it appeared to him that each of the gentlemen who had spoken, with the exception of Mr. Stewart, had regarded these borings as being the work of only one kind of animal. He thought they might be made by several kinds. Annelids might possibly make such borings, and the vacated burrows might be occupied by sponges, or *vice versâ*. As he was anxious to test the question from his own point of view, he had looked over the cases at Jermyn Street Museum, to see what kind of holes were present in the fossil shells, and how far they might be explained by one or other of the theories which had been put forward. He found in the very thick shells, such as *Inoceramus*, almost globular cavities, always with one aperture in the middle, which apparently opened upon the surface. These cavities were connected together by numerous stolons which much resembled the processes, or pseudopodia, of Foraminifera. If much denuded, as was common in Museum specimens, the casts of these cavities were reduced to a mere knob. In other cases one finds simple isolated cavities, as shown by Mr. Stewart. In one instance a Belemnite was so completely occupied with the casts of fine tubes which had been bored into it that they might have been taken for a group of Serpulæ. Some of these borings might have been made by either Sponge or Annelid; but he could not conceive how an annelid could make the first mentioned cells with the stolons running off from them in every direction, so as to give, in some instances, the

appearance of branches and twigs; or, having made them, how it could possibly live in them.

Mr. Waller, in reply, said he laid stress in his paper on the method shown in the borings. He thought the question must be tested by that. It was asserted that the effects produced by dentine absorption were similar. He believed that his profession had made his eye more critical, and he asserted that the results were not quite alike; there were not the same geometrical forms that he contended the other had. In his diagram he had given the form, and had shown how one depression might be made interfering with another, and a third interfering with both. He was prepared with the piece of alabaster he had in his hand to demonstrate the fact, and make the peculiar markings of the burrows as seen under the microscope. Mr. Stewart had mentioned, that some of the processes tapered off to a point. He (Mr. Waller) had said, that he had never found that point smaller than the 2,000th of an inch. In the borings which he considered to be made by annelids, he said it was above that diameter, so that what he supposed were annelids, as shown in his drawings, were quite capable of forming the tubes. Mr. Priest referred to the analogy of the *Scolytus*, remarking that it was *very* far removed from the annelids, being one of the Articulata, but the latter are grouped by naturalists in the same class. We know that the larva of the *Scolytus* makes circular depressions, and continues to excavate in that manner. His specimen of perforated wood showed very clearly how the borer in wood did its work. He had a specimen of shell, which he had mounted, for the express purpose of showing the process of the working—that just beginning and that partly carried through. What had been said did not account for the uniform operation, which he had pointed out as being so precise. It did not account for it, because of the irregularity which is observable in the dentine absorption, which is distinct and separate from what is seen in his diagram. His argument rested entirely on the character of the subcircular depressions.

The thanks of the meeting were unanimously voted to Mr. Waller and Mr. Priest for their communications.

The President announced the engagements for the ensuing month, and the proceedings terminated with the usual Conversazione, at which the following objects were exhibited:—

Specimens to illustrate the similarity in character existing in the absorption of Dentine and the excavations of *Cliona*	The President.
Fungus on wing of House-fly—*Empusa muscæ*	Mr. F. W. Andrew.
Head of *Cysticercus cellulosæ* or Hog Measle, an unique specimen, the head being furnished with six suckers—Specimens removed from the human brain	Dr. T. S. Cobbold.
Section of human stomach and duodenum at their junction—showing Peyer's patches	Mr. W. I. Curties.

Tongue of Honey Bee, polarized, prepared to show the internal muscular structure	Mr. F. Enock.
Section of stem of *Sarsaparilla*, stained ...	Mr. H. R. Gregory.
Boring sponge, in Shell of *Haliotis*, showing the cavities	Mr. B. W. Priest.
Growing point of *Camellia japonica* Section of *Welwitschia*, showing thickened spicular cells containing numerous crystals in the walls	Mr. J. W. Reed.

Attendance—Members, 71 ; Visitors, 7.

April 8th, 1881.—Conversational Meeting.

The following objects were exhibited :—

Medusa (sp ?)	The President.
Section of hymenium and gills of *Agaricus edulis*	Mr. F. W. Andrew.
Section of bark of *Cinchona succirubra* with crystals *in situ*	Mr. W. R. Browne.
Beaded elytron of Egyptian Bean Fly ...	Mr. A. Button.
Silicified wood with insect borings ...	Mr. H. E. Freeman.
Limnias, &c., on weed from the Serpentine	Mr. H. R. Gregory
Early stage of *Volvox* (?)	Mr. J. D. Hardy.
Isthmia nervosa, shown with Powell and Lealand's Oil-immersion 1-12th (1.42 Num. Ap.) ... ... *Coscinodiscus asteromphalus*, ditto, ditto (magnified 1,200 diam.) ...	Mr. E. M. Nelson.

Mr. A. D. Michael distributed a large number of duplicate slides among the Members.

Attendance—Members, 53 ; Visitors, 5.

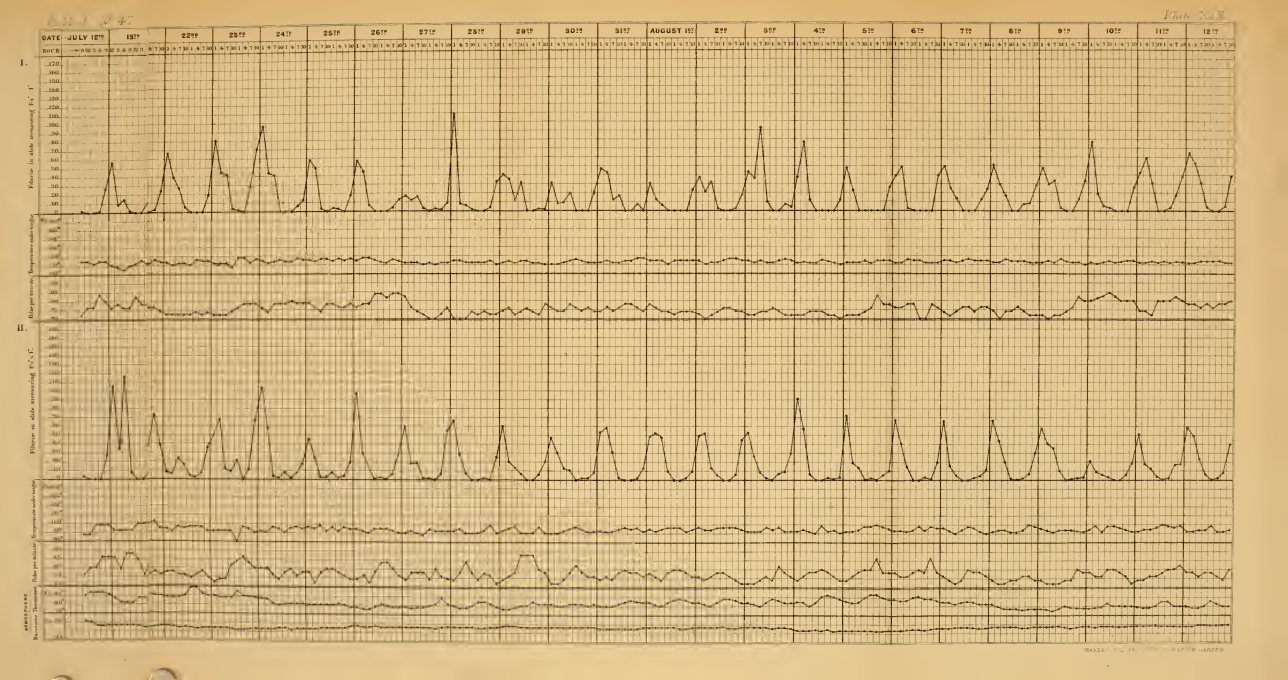
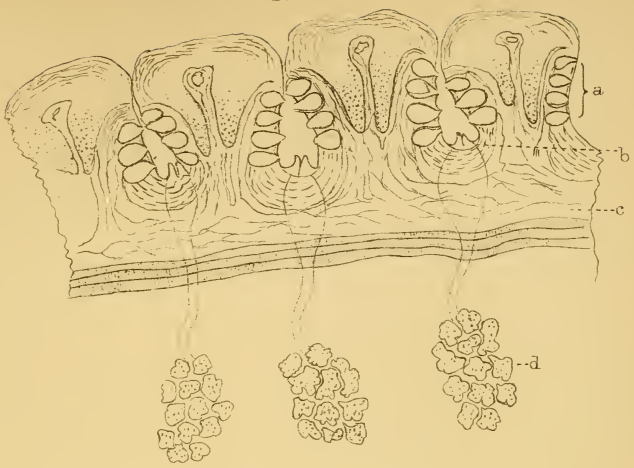


Plate 3.
DATE JULY 12TH
13TH
22ND
23RD
24TH
25TH
26TH
27TH
28TH
29TH
30TH
31ST
AUGUST 1ST
2ND
3RD
4TH
5TH
6TH
7TH
8TH
9TH
10TH
11TH
12TH
HOUR
I.
II.
Pulse in side measuring 6 x 4
Blue pressure
Temperature under tongue
Pulse in side measuring 6 x 4
Temperature under tongue
Blue pressure
Temperature
Pulse per minute
ARTERIOGRAM.

1.



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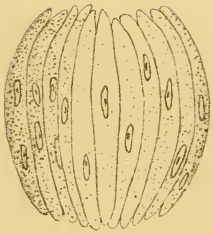

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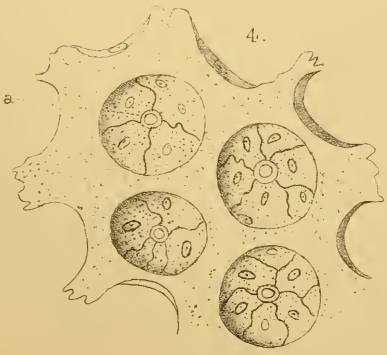
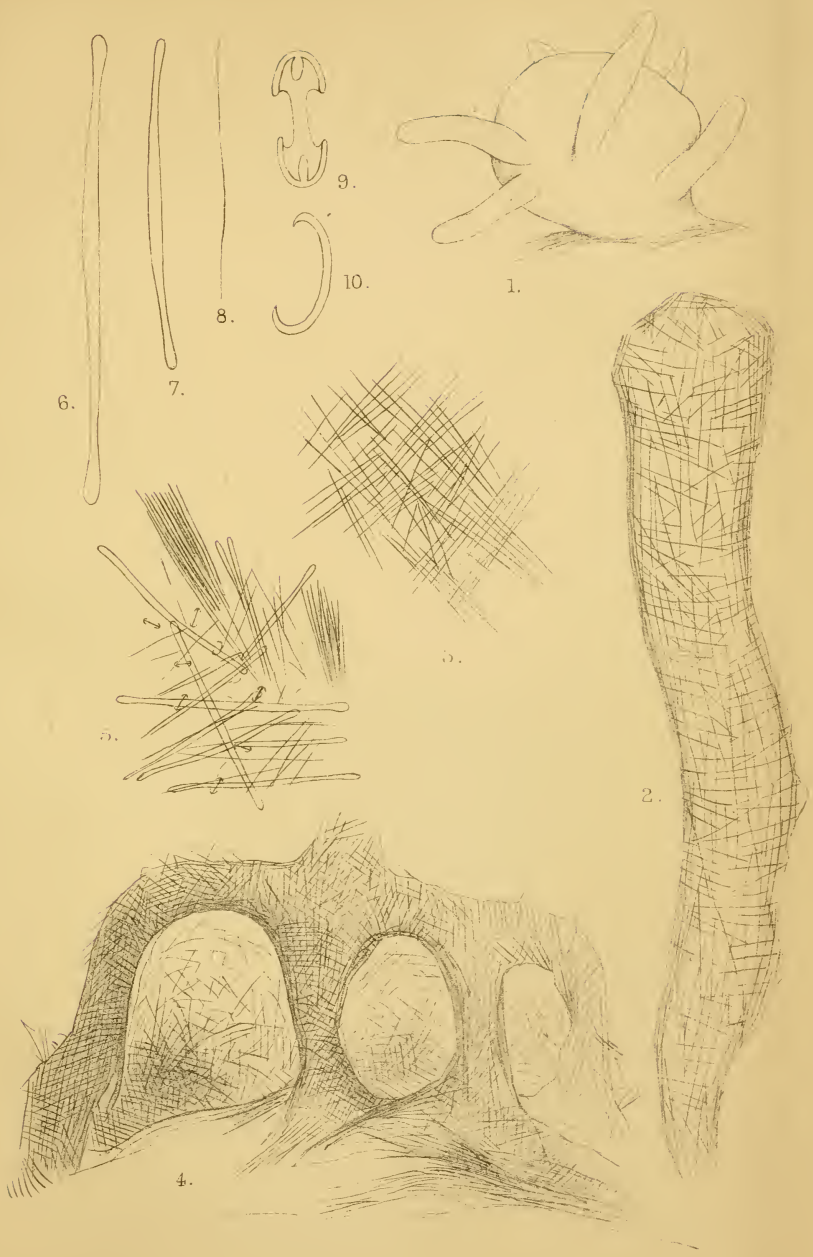


5.

T. C. White. del. Mintern Bros. imp.



J. G. Waller. del. Mintern Bros imp.

Polymastia biclavata.

Williams' Microtome adapted for Use with Ether as the Freezing Agent.

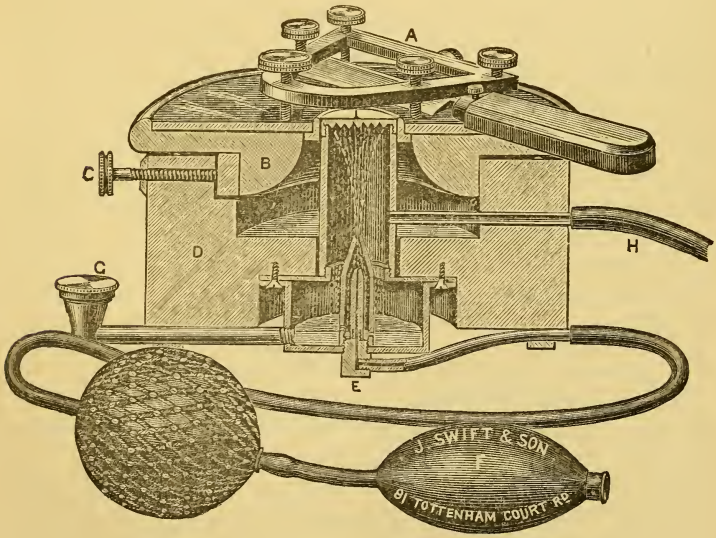
By J. W. Groves, F.R.M.S., Demonstrator of Physiology at King's College, London.

(*Read April* 22, 1881.)

Believing Williams' to be the best freezing microtome extant, it occurred to me that its adaptation to the use of Ether as the freezing agent would be an improvement, especially if the atomized Ether after use could be condensed for use over again or be carried away from the room in which the machine was in operation, so as to avoid headache and the other disagreeable effects of the continued inhalation of the Ether vapour.

Therefore, having made a rough sketch embodying my ideas, I took it to Mr. Swift, who has spent much time and trouble in trying experiments to secure the best arrangement for the purpose, which appears to be that shown in the sectional drawing (Fig. 1),

Fig. 1.



where D represents the wooden bowl of one of the old forms of machine (for use with ice and salt), adapted to hold the Ether

freezing apparatus. A and B are respectively the razor frame, with the razor *in situ*, and the bowl-cover with the glass plate top upon which the razor frame is moved. It will thus be seen that the whole of the section-cutting part of the machine is identical with that formerly used with ice and salt. The central brass cylinder, instead of being solid, is hollow, so that the Ether spray may play up the inside and impinge upon the lower surface of the brass plate I, upon the upper surface of which the material to be frozen is placed, In the figure, the hollowed cylinder is seen to open below into the Ether-containing chamber, into the lower part of which opens a horizontal tube, which turns up at right angles and ends in a funnel-shaped extremity (G), over which screws a cap.

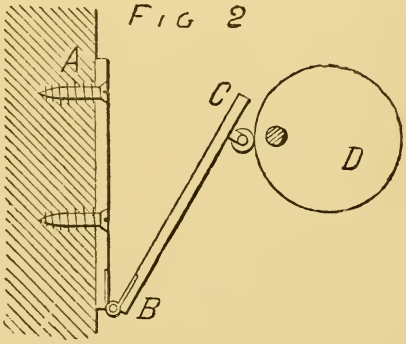
In the centre of the bottom of this chamber is a circular aperture closed by a piece of brass tubing, which passes up vertically to end in a cone with a very small aperture, and having another small hole in its side towards the bottom. The lower end of this tube is plugged, and through the plug (E) passes vertically a very fine tube, which is continuous inferiorly with the tube from the apparatus for pumping in air. This consists of an india-rubber pump (F), connected by a short piece of tubing with a slightly distensible ball covered with netting, and from the opposite side of which a piece of india-rubber tubing passes on towards E. In the side of the large hollow cylinder of the machine is inserted a small tube connected with a length of pipe (H) for the escape of the spray after use.

The method of freezing with this microtome is as follows :—After the material has been partially hardened, and the hardening agent removed, place it on the brass plate (I) with a little gum mucilage ;* then unscrew the cap (G), fill the chamber with Ether, replace the cap, and commence pumping by pressing the ball (F) vigorously and rapidly in the palm of the hand. Air will thus be pumped into the net-covered ball, from which it will issue in a continuous jet along the india-rubber tube, up the small tube, through the plug E, and again through the hole at the apex of the conical-ended vertical tube, to pass straight up against the under surface of the plate I. The rush of air thus produced causes pressure on the surface of the Ether, and also tends to produce suction at the space between the small central tube and the one which has the conical extremity, so that the Ether passes through the hole in the side of the latter tube, rises in the space between the two tubes, and is

* If the material is quite fresh the mucilage may be dispensed with.

forced as a jet of spray through the hole in the cone, and so on to the under service of the plate I. This is roughened in the form of teeth for the purpose of presenting a larger area to be acted upon, and also to facilitate drainage. A great deal of the Ether drops down into the chamber, and is used again, but a little passes out mingled with the air in such a finely atomized condition that it seems to be impossible to collect it, as I had hoped to be able to do, and is therefore conveyed along the tube H to the external air.

The advantages possessed by this form of the machine over the old one (used with ice and salt) are that all mess is avoided ; that Ether can always be kept at hand, whereas sometimes it is not possible to procure ice ; that while in all Ether freezing machines with which I am acquainted the vapour must necessarily be inhaled by the operator, in this one such discomfort is entirely obviated except just during the filling of the chamber. Common Methylated Ether, of ·730 specific gravity, answers perfectly, though it must be borne in mind that the greater the specific gravity the greater is the force required in pumping. The labour of pumping may be reduced by placing the ball pump between two pieces of wood hinged together like a pair of lemon-squeezers (Fig. 2, A, B, C). The outer board (A, B) should be a fixture, and the other (B, C) be worked by an eccentric (D) acting against a small roller (E), the eccentric being driven by a treadle ; or the action may be made automatic by using a steam engine or other motive power. I have been using a small Thirlmere Water Motor with perfect success. As an instance of the freezing power of this apparatus, it may be mentioned that material has been frozen in a room at 96° F., using Ether of .730 specific gravity, the pump being worked either by hand or with the motor. In conclusion, I beg to tender my best thanks to Mr. J. Swift, to whom is due the credit of working out all the details of the microtome.



On the Gustatory Organs of the Rabbit's Tongue.

By T. Charters White, M.R.C.S., F.L.S., &c., (President).

(*Read April 22nd*).

Plate XXII.

Judging by the exhibits shown here and at other Microscopical Societies one is led to imagine that Histology has been relegated by the microscopical observer to the domain of Medical Science as something peculiarly appropriate to that department of study, and consequently not appertaining to any student outside the pale of an anatomical school. It is a difficult matter to disabuse that mind which has once absorbed an error, but by perseverance in our endeavours to awaken an interest in this branch of study we may hope in time that those who now debar themselves erroneously from one of the most interesting pursuits in microscopical investigation will awake to the pleasures they now put aside, and will, by taking up the study of animal histology, find in the observation of the growth and development of the wonderful structures with which the animal frame is constructed, an extension of their microscopical enjoyments. It is with the view of showing what interesting work awaits the students of histology, that I have chosen for a short communication this evening, a subject which, to me, for months past, has been one of untiring interest, viz., the histology of the Gustatory Organs of the Rabbit's Tongue. This is neither the time nor place to enter into the physiology of the sense of taste, and its relation to these bodies ; it has been acknowledged by all leading physiologists that these organs are connected with the gustatory function, and as those nerves to which are allotted the power of discrimination between different flavours, are principally distributed to the region of these bodies, and undoubtedly are connected with them, we may accept them as performing the function of taste, and enter into an examination of the histological elements which enter into their formation.

If we examine the dorsum or upper surface of the tongue of a rabbit or hare, we shall notice first that it is divided into two por-

tions, a flat anterior and an elevated oval posterior part. The flat and front half of the tongue is of a redder colour than the more elevated posterior, and upon a closer examination of its surface a pile, like the pile of velvet, will be manifest, having scattered about it a few isolated and rounder bodies ; these are distinguished by anatomists into, 1st, the *filiform* papillæ, which are found covering the greater part of the dorsal surface of the tongue, while the more sparsely distributed round bodies are the *fungiform* papillæ. It is not with these papillæ that we have to deal this evening ; but in lingual anatomy there is a third class of papillæ with which the sense of taste is more intimately concerned ; these are the *circumvallate* papillæ. These in the human subject are arranged in a V shape across the back part of the tongue, but in the rabbit they are found occupying two patches, one on each side of the posterior part of the tongue, at the junction of the oval elevation with the root, in the position indicated by the black line in my diagram. They may be easily overlooked by a careless observer, but as I should like many of my hearers to work out this subject, I would advise them to procure a tongue of a hare or a rabbit as fresh as can be got—if from a recently killed animal the better—and wiping the mucus from its surface, they will perceive at the part indicated an oval depressed patch of a different colour to the surrounding tissues, and marked with about ten to fifteen striæ which cross its surface. If these patches are cut out of the tongue, and placed in any of the usual hardening agents, or, what is better, are frozen and cut into sections at right angles to the course of these laminæ, such a section will be represented by Fig. 1, Plate XXII.

By referring to that we shall notice a row of compound papillæ derived from off-shoots of the connective tissue, and we shall see that these laminæ or striæ which we saw in the oval patch were the tops of these compound papillæ which we now see in section—that they are ridges of papillæ, some of which are forked at intervals, giving rise to secondary papillæ, having furrows between them, but the furrows so filled in by epithelium that no evidence of the subjacent inequality exists. The epithelial layer is considerably thicker on the summit of the papilla, and on that portion of it which is not in approximation to its neighbour ; but on the sides where it is more protected by the adjacent papillæ the epithelial layer is thinner, and it is in this situation that these gustatory cells are found.

In the sectional view presented by Fig. 1 only three or four

of the "goblet cells" may be seen on each side of the papillæ, these, however, represent only a portion of a belt of these gustatory bulbs, which extends three or four deep entirely round each ridge, so that we have an immense number of these goblet cells concerned in the sense of taste. The aggregate number being estimated at 9,600 in the sheep, 9,500 in the pig, and as many as 35,000 in the ox, we can readily understand the extent of surface furnished by these cells, and the important part they play as taste-bulbs. Before proceeding to a description of the minute anatomy of these gustatory organs it will be as well if we take a brief glance at some of the surrounding tissues. Deep down below the connective tissue layer, and in the loculi presented by the interlacing network of muscular fibres, are the lingual glands; they exist in such abundance that any section taken from the region immediately below these gustatory patches will furnish an abundant supply of gland tissue. By tracing the course of the numerous excretory ducts which emerge from the glands we shall find that they open by a punctiform papilla at the bottom of the fossa formed between two adjacent papillæ, previously, on passing through the connective tissue layer, becoming distended just before they reach their point of exit. Scattered amongst the fibres of the connective tissue the cut ends of several fine nerves may be seen; these are part of a plexus derived from the terminal branches of the glossopharyngeus, which, after supplying the pharynx, the tympanum and eustachian tube, enters the tongue at its base, and becomes divided into two branches, one going to the upper surface and mucous membrane of the base, the other piercing the muscular structure, and being distributed to the lateral portions of the tongue, and especially supplying the *papillæ circumvallatæ*. Of the ultimate termination of the nerve fibres we shall see more in examining the histological characters of the taste bulbs. The epithelium covering the papillæ affords an admirable demonstration of the mode of its growth and development, for where it adjoins the connective tissues of the papilla it is globular for the first few layers, and afterwards becomes flattened in various degrees till it ultimately assumes at the summit of the papilla, the shape we are so familiar with in its squamous variety.

In describing the usual character of a circumvallate papilla as it occurs in these gustatory patches, we observed that it was generally formed by a central off-shoot of the connective tissue having a lateral offshoot on either side of it; these offshoots are merely the framework designed to support the capillary vessels and nervous fibrillæ which traverse its structure in a course at right angles to the axes of

the gustatory bulbs. The fibrils are pale and very difficult to trace, but from analogous instances in the Amphibia we may surmise that they end in brush-like filaments which become lost in the layer of epithelium.

Having now glanced briefly at the microscopical characters of the surrounding tissues, it remains for me to point out to you the histological elements entering into the formation of the bodies, to which foreign observers have given the names of bulbs, goblets, flasks or cells; and which are supposed to aid or even accomplish the function of taste, and therefore have been named *gustatory bulbs.* The nerve fibres last mentioned, under a high magnifying power, may be traced running up the lateral branch of the papilla, but not apparently diverging from their course to enter the bases of these bulbs. It is conceived that they do so in the proper fulfilment of their function, but as in many instances we are conscious of pain, and know from that fact that some nervous connection exists between the seat of the pain and the sensorium, and yet it is difficult to demonstrate the ultimate nerve fibres concerned in the phenomenon; so here we are met by a similar difficulty in demonstrating what we have every reason to believe exists; and if some of our friends with high and excellent powers and unbounded patience in showing the markings on a diatom, would but devote a little time and attention to the demonstration of ultimate nerve terminations, it would both add to their interest and our further knowledge, and be attended with quite sufficient difficulty in resolving as to tempt the most rabid diatomist.

According to the researches of Englemann, one or more fasciculi of nerves run up the axis of the papilla, whilst in many instances they penetrate its lateral portion, and there breaking up into numerous fine and frequently decussating sinuous branches, stream out towards the epithelium; but as these branches contain many more pale than dark bordered fibres, it is extremely difficult to trace them into the gustatory bulbs. But let us examine one of these bulbs after it has been isolated from its adjacent tissues, and then dissecting its component parts, we may obtain a slight clue to the course of this peripheral nerve fibre we are in search of. A section taken parallel to the lamellæ will probably cut off the upper portion of the neck, as we may call it, of one of these flask-like bodies; upon looking into the upper half of this detached epithelial casing, we shall perceive a small hole surrounded by epithelium, through which the pointed neck of the flask projected; this hole is termed the *gustatory pore.*

An examination of the part from which this casing became de-

tached will afford an explanation of why these bodies have been called "bulbs." On looking down upon the uncovered tops of them they present the appearance of the unopened buds of a flower; by breaking up this bud we can resolve it into its primary elements—an illustration of this I have endeavoured to give in Fig. 2. When such an isolated gustatory bulb is submitted to this examination, we shall find it composed of from fifteen to thirty long narrow cells of a granular texture, each containing a large nucleus; these cells stand closely compressed round the axis of the bud, the outermost being more concentrically curved than the rows interior to them.

The cells of the innermost layer are of a different character to any of the preceding description, being highly organised and specially differentiated, in all probability they may be regarded as continuous with the terminal fibres of the glossopharyngeus, and are consequently the taste nerves of these gustatory cells. There is one feature connected with the histology of these cells to which attention should be directed. In examining a thin section of the gustatory organ as shown in Fig. 1, a number of the flasks may be seen as if perforating the epithelial layer of the lateral surface of the papilla, and although this fact is difficult to demonstrate in most sections on account of their thickness, yet in such pieces as are cut so extremely thin that they break up and resist all endeavours to mount them permanently, it is in these pieces that we can see that the innermost layers of the bulb really pierce the gustatory pore and protrude from its orifice a short and very fine hair-like process.

A comparative examination of these organs in other animals, especially in the frog, furnishes us with such a constant recurrence of this histological element that we are justified in considering these hairs as important factors in the function of taste.

I have been induced to bring this subject before you this evening from having seen with much pleasure the interest with which sections of these organs have been examined by members at some of our conversational meetings, when I have placed some under my microscope, and I can assure those who care to work out this subject still further that there are enough difficulties to be overcome to stimulate the determination of the most determined amongst us, not to speak of the interest and advantages attendant on following out the comparative histology of the organs of taste in other departments of animal life. Indeed it seems that fresh interest awakens in the subject with every step we take. Who, for instance, would imagine

that organs similar to those we have been discussing have been found on the external skin of fresh water fish. Regarded at first by Leydig as tactile organs, they have since been proved by Schulze to be in reality gustatory organs; they have been found in the mouth, the palate and on the lips of cyprinoid fishes, and traced from these parts over the greater part of the external surface. The investigation of this subject has not to my knowledge been pursued to any extent in the direction of the invertebrata, and doubtless much of interest and importance awaits the student who has the courage to tap that histological spring. I cannot close this communication without acknowledging how much I am indebted to the valuable and interesting researches of Professor Englemann as published in Stricker's "Human and Comparative Histology," and also my thanks are due to Mr. J. W. Groves, who with his new freezing microtome has cut some of my thinnest and most instructive sections. In conclusion, I would warmly urge and encourage all who really wish to advance our knowledge by means of the microscope, to take up the investigation of the marvellous structures which enter into and help to make up the temple of the animal frame, and all other studies will "pale their ineffectual fires" before that which I urge you to adopt. Life is too short to spend in only testing the powers of our instruments, but having once proved them capable of good work, go onward and accomplish victoriously the conquests waiting at your very feet, then your cabinets will be filled with the spoils of your warfare, and your soul will be satisfied with the labours of your life.

DESCRIPTION OF PLATE XXII.

Fig. 1.—A diagrammatic section cut across the course of the gustatory lamellæ, showing—

a. Gustatory bulbs.
b. Punctiform papilla.
c. Connective tissue with nerves.
d. Lingual glands.

The muscular fibres of the tongue have been omitted for the sake of clearness.

Fig. 2.—Isolated gustatory bulb.

Fig. 3.—Isolated investing cells.

Fig. 4.—Upper half of epithelial covering of gustatory bulbs; *a* gustatory pore.

Fig. 5.—A gustatory bulb exposed in consequence of the detachment of upper half of epithelial covering.

On an Undescribed Species of Sponge of the Genus Polymastia, from Honduras.

By B. W. Priest.

(*Read June* 24, 1881.)

PLATE XXIII.

Some months back Mr. Curties placed in my hands a Sponge for description, sent by Mr. B. Wills Richardson, found in shallow water, 14 to 17 fathoms, near Belize, British Honduras, at a part of the coast not previously dredged. On examination it proved to belong to the genus *Polymastia* of Bowerbank, but to the best of my knowledge it is an undescribed species.

The generic name is derived from the Greek, πολὺς, many, and μάστις, a whip, scourge, or flail, from the presence of fistulæ, simulating those instruments more or less, projecting from the surface of the Sponge.

The specific name I propose is *bi-clavata*, for reasons which will be shown further on.

According to Dr. Bowerbank we have eight recognised British species, but none of them showing the three special characteristics of the one under consideration. In this, we have a Sponge which may be called massive and bulbous, measuring rather more than a quarter of an inch, not including the fistulæ, from the summit to the base, and rather larger in diameter, say, just under half an inch. The outer crust, along with the inner walls and supports of the sponge, as also the fistulæ—in fact, the whole skeleton—being composed of a beautiful network, abundantly supplied with bi-clavate fusiform spicules of various sizes, averaging from the $\frac{1}{50}$ to $\frac{1}{80}$ of an inch, the difference in size being probably due to states of development. The sarcode which fills the cavities of the Sponge, as also the interstitial membrane, when present in this specimen, are supplied with spicules of the same type as the skeleton, but fewer in number, and also abundantly with equi-tridentate anchorate spicules of two sizes, the larger measuring $\frac{1}{1500}$ of an inch, the

smaller the $\frac{1}{2000}$ of an inch. There are also a great many bi-hamate spicules, measuring the $\frac{1}{500}$ of an inch. Scattered throughout the interior of the Sponge are a number of fasciculi of fine hair-like spicules, each spicule measuring about the $\frac{1}{100}$ of an inch, and having just the same appearance as the raphides in plants.

A vertical section of the Sponge shows the position of the walls to the outer crust, and, as you will observe in Fig. 4, which was drawn from the section itself, it has the appearance of arches where the cavities are filled with the sarcode. Fig. 1 shows the Sponge much enlarged, before being mutilated for examination, having five of the fistulæ on the side exposed to view, and about three more on the other, the tip of one being observed showing over the top of the Sponge. In Fig. 2 we have an enlarged view of one of the fistulæ, with a portion of the network (Fig. 3) still further magnified, showing the relative positions of the spicules.

It reminds one rather of *Euplectella* on a small scale. Dr. Bowerbank noticed the same resemblance, and was led to consider that the genus must be closely allied to *Alcyoncellum* from that cause, though it is certainly not like it, to my mind, when thoroughly examined, as the spicules of *Polymastia* do not anastomatose as they do in *Euplectella*, besides wanting the flesh spicules of that group.*

Some of the species of *Polymastia* have only one fistula, as in *P. bulbosa*; in others they are very numerous, as in *P. robusta*, but our present species seems to be moderate in its number. The various species that I have come across have the skeleton spicules either acerate, fusiform-acerate, spinulate, or fusiform-spinulate, and in one case bi-spinulate, but none have bi-clavate fusiform spicules, or equi-tridentate anchorate or other anchorate, or bi-hamate spicules, both of which, as we have seen, are present in the Sponge I am describing. I propose, therefore, to name it

POLYMASTIA BICLAVATA (*B. W. Priest*).

Sponge massive, bulbous; fistulæ moderate in number; oscula at distal extremity; pores inconspicuous; dermal membrane pellucid, thin, with minute bi-clavate spicules dispersed over its surface; skeleton spicules bi-clavate fusiform, with abnormal forms of the same occurring occasionally through the Sponge; interstitial

* Since writing the above I find that Dr. Bowerbank mentions the same fact in one of his later volumes.

skeleton with the same spicules, along with equi-tridentate anchorate and bi-hamate spicules, as also fasciculi of fine acerate hair-like spicules dispersed through the Sponge. Examined after being in spirit, and then of a light fawn colour.

We have here the spicules of this Sponge in Figs. 6-10, the bi-clavate fusiform, the acerate fusiform spicule of the fasciculi, the anchorate, and the bi-hamate.

In conclusion, I have to apologise to Mr. Curties and Mr. Richardson for having been so long in bringing this description before the Club, and to tender my sincere thanks to my friend Mr. Waller for the assistance he has given me in the determination of the Sponge.

DESCRIPTION OF PLATE XXIII.

Fig. 1.—*Polymastia biclavata*, with fistulæ *in situ*.
Fig. 2.—Enlarged fistula of same, × 18 diam.
Fig. 3.—Portion showing arrangement of spicules in fistula.
Fig. 4.—Vertical section through centre of Sponge, showing cavities filled with sarcode, × 12 diam.
Fig. 5.—Portion of sarcode showing fasciculi of spicules.
Figs. 6 and 7.—Bi-clavate spicules of skeleton.
Fig. 8.—Acerate spicule of fasciculi.
Fig. 9.—Equi-tridentate anchorate spicule of sarcode.
Fig. 10.—Bi-hamate spicule of sarcode.

THE PRESIDENT'S ADDRESS

Delivered at the Annual General Meeting, July 22, 1881.

By T. Charters White, M.R.C.S., F.L.S., F.R.M.S.

Anniversaries may be regarded as so many resting places up the steep ascent to Time, on which, while we pause to gather breath and strength for the unknown path which lies before us, we can take a retrospective glance at the road by which we have come. We have to-day reached one of the resting-places in the history of our Club—we have arrived at its 16th anniversary, and, taking a look backward over its course, we may rejoice together in the retrospect of its popularity in the past, and its continued prosperity up to the present. Taking its rise in the fountain of that social union, which I hope will ever be the distinguishing feature of the Quekett Microscopical Club, we see it ever extending its influence and enlarging its stream till its name is known, not only over our own land, but even to foreign shores. Of late years there has been issued, with great appropriateness, with our Annual Reports, an extract from the original prospectus sketched out by our founders ; and, perhaps, you will pardon me if, stepping aside from the beaten path of my predecessors in this chair, I examine the different sections of this extract, and, as it were, take stock of the working appliances of the Club, so that, laying before you the plan originally designed, and at the same time showing you how that plan has been carried out, we may be enabled to render a good account of our stewardship. The opening clause in this extract strikes the key-note of our "*raison d'etre.*" It says, "The want of such a Club as the present has long been felt ;" and if we may judge from the number of members who, from its foundation, have sought and found an entrance within its circle, that conviction was fully justified. For many years previously the means of communication between lovers of the microscope were extremely scarce, and although for about 25 years before the institution of this Club we had "The Microscopical Society of London," now "The Royal Microscopical Society," yet this seemed too grand a society for the younger microscopists to aspire to. It reared its

head in towering and awful grandeur above the platform on which they were constrained to take their stand, and they were consequently in many cases compelled to work on alone, deprived of that enjoyment which springs from the sympathy of united tastes and united labour; but the want was no sooner recognised than it was removed. Our Club was instituted in 1865, and since that time over 1,500 members have been elected into it, of which number about 600 have always remained on our lists. The object for which it was instituted bears evidence of a knowledge on the part of our founders of the many difficulties experienced by the tyro in microscopical work. To quote again from the original prospectus, it was with a view that its members "might meet at stated periods to *hold cheerful converse with each other*, exhibit and exchange specimens, read papers on topics of interest, discuss doubtful points, compare notes of progress, and gossip over those special subjects in which they are more or less interested." Now, what scheme could have been more practical or more unpretending? It embraces all that the young microscopist can require. Here are none of the high-flown technicalities of overgrown science on the platform of some learned society, such mental pabulum might not be assimilated by the young beginner; but instead we have the *cheerful converse*, one with the other, upon subjects of mutual interest for mutual help and encouragement; and it needs but a brief glance over the records of the attendance at these meetings to show, by the high average number who meet on these occasions, how much they are appreciated, because it is at these meetings that those who, having a taste for microscopical pursuits, but knowing nothing, or next to nothing, of the best methods of investigation, get instructed in them, not in the form of set lectures or lessons, but by seeing the results and asking information relative to the methods adopted to produce them. And here it is that that warm brotherly feeling and sympathy, so characteristic of those who have a common taste and pursuit, becomes evident; and the right hand of fellowship is held out alike to old and young, rich or poor—for the band which binds together the workers in our Club is as strong as the bands of a masonic brotherhood, and as true and as loving; and because it is so (and all can prove it for themselves who join our ranks) that we can rejoice in its foundation as one means of obtaining that instruction in the use of our favourite instrument which cannot be found in books, however carefully written or elaborately illustrated.

But our founders were not content with providing for the meeting together of kindred spirits, and the verbal instruction acquired by this inter-communication, hence we are told by this extract we have been discussing, that it was their intention "*to acquire a Library of such books of reference as will be useful to enquiring students.*" This department of our work, by the wise administration of our predecessors, has been steadily growing, both by donations from members as well as by the purchase of such expensive books as were not readily attainable by the ordinary student. This department of our Club's work is receiving careful attention from our Committee, who have ever striven to increase the value and usefulness of our Library, feeling that nothing is more necessary to our advancement in the study of Natural History than the possession of standard works of reference to which we can readily gain access ; and as our Library is open to us every alternate Friday evening throughout the year, members have no difficulty in referring to such books as they may desire to consult.

After a Library of reference—but standing almost side by side in importance—is a collection illustrating the various branches of study which the student may wish to take up. This object is also shadowed forth in the prospectus of the embryo Club, when it was decided to collect "*a comprehensive Cabinet of objects.*" The Cabinet of our Club, numbering over 2,000 slides, illustrating Histology (animal and vegetable), Entomology, Botany, Geology, and Crystallography, may justly be considered *comprehensive*, so far as it has grown to the present time. The slides are freely circulated, and prove interesting to the members. I use the word interesting advisedly, because I believe the examination of slides from a Cabinet to be rather interesting than instructive to those who look at them for the first time. The author of a preparation who has, as it were, assisted at its birth, who is acquainted with its origin and its relations, who has seen it in its crude and unprepared condition, has thus gained a knowledge of its nature and attributes which no one casually taking it for the first time from the Cabinet can be expected to possess. And here I would suggest that if those amongst us, who have the time as well as the requisite ability (and there are many), would take such a book as Dr. Carpenter's "Microscope and its Revelations," and would make a series of preparations illustrative of the subjects therein treated of, a collection of slides would then be formed of incalculable value, not only to the beginners, but also to

the advanced students in the Club, and would at the same time greatly enhance the usefulness of that deservedly popular Manual. The same course might be pursued with other works treating of microscopical subjects. In this manner the tendency to desultory work would be restrained, and yet a sufficient variety imparted not to weary the manipulator by the monotony of his labours.

Another element in the scheme set forth in the original prospectus must not be overlooked, and that is the proposal to institute "*occasional field excursions for the collection of living specimens.*" This department of our Club's work has been, year by year, organised and carried out by our Excursion Committee, many members availing themselves of this opportunity of visiting, in company with adequate guides, the most favourable localities for obtaining those living specimens which form objects of great interest, not only to those who collect them, but also to others, who, less favourably situated in this busy city, and precluded from joining in the Saturday afternoon excursions, are yet enabled to enjoy the results of them at our gossip meetings.

Now, here, gentlemen, in this rough outline of our Club's work, we have depicted a scheme containing every assistance towards good work which could be desired; and when in addition we consider that we have the self-sacrificing and loyal assistance of such officers as our honorary Librarian, ever ready to point out to the enquiring student whatever suitable book he may require; or our honorary Curator, never absent from his post at our cabinet of objects; and the services of an indefatigable honorary Secretary, working with a will and a determination to forward the best interests of our Society, the consideration forces upon us a very serious reflection—with all this admirable organisation, what are we doing in advancing the knowledge of Microscopical Science? How is it that a body of six hundred energetic enthusiastic workers in microscopical wonders have so little to produce in our Journal as the result of their work?

I fear it must be traced to a want of system in our work. We seem to me to be like an army having the weapons of our warfare in our hands, but waiting for a commander who would lead us on to victory, while fields of interest lie unconquered at our feet, lines of investigation waiting to be worked out cross our every path; but while we are pausing in indecision, Time is slipping from beneath us, Life is not long enough to work out any line of investigation thoroughly—why then wait? There is no mine of microscopical

wealth exhausted ; there is no field of research completely worked out, leaving nothing more to be learned. The life history of many of our most favourite fresh water objects, although before us summer after summer in their adult forms, have many points in their early history and development which need working out, and this could be easily accomplished by systematic and painstaking observation. Our late President (Professor Huxley), when dealing with this subject of persistent observation, mentions that commonest of every common object, the Paramecium, as affording a field for this kind of study. He says, "Nobody certainly knows whether it has any other mode of reproduction except by fission. The like is true also of the Acinetæ—we know something about them, but nothing like a complete history." And this "complete history" is wanting in so many of the lower forms of animal life, that abundance of work awaits the microscopical student. There is scarcely a book on Biological Science we can open without its furnishing indications for further work ; shadows of doubt and uncertainty float across many a page, indicating the need of more light on the life history and development of some of our simplest forms of life. How many a tale of wondrous beauty lies unfolded in the various embryonic forms met with in a single dip from our collecting bottles? Thus you see there is no difficulty on the score of scarcity of subjects ; and many other lines of investigation must occur to the mind of the thoughtful student. Take the development of animal life under a diversity of conditions, and here we are met by a field of the most fruitful work—for instance, Carl Semper, in his recently published work on "Animal Life," mentions a fact in illustration of the modifications of character producible from varying the conditions under which development takes place. The fresh-water Crustacean *Branchipus stagnalis* is remarkably like the *Artemia salina*, nevertheless the differences between them have always seemed sufficiently conspicuous to justify their separation into two different genera. *Artemia salina* was kept in salt water, which was constantly being diluted by the addition of fresh water till it had become perfectly fresh. The *Artemia*, the meanwhile breeding, at the end of several generations, had so gradually and completely changed their characters, that finally they had acquired those of the genus *Branchipus*. These observations are certainly of the greatest interest, as evidence of the important changes which modifying influences, such as those mentioned by Semper, may, after a certain time, produce in the

character of all living creatures. Not the less wonderful is the illustration afforded by the same author of the morphological differences produced by varying the conditions under which animal life may be developed in the case of *Lymnea stagnalis*. Removing the patch of eggs, so familiar to all of us who keep a fresh-water aquarium, and dividing it into four portions, he found that by limiting the supply of water in which the subsequent development took place, the length of the shell was progressively increased in proportion to the volume of water in which each portion was placed. These are facts which have a most important bearing on the growth and development of higher forms of life than either *Artemia* or *Lymnea*, and worthy the earnest attention of every student in the Club; for when animal life, either of man or the lower animals, is developed under cramped conditions, modifications take place not favourable to the normal growth of the frame, and that man or that animal, subject to these conditions, becomes stunted and dwarfed, such development always being attended by morphological changes which are equally abnormal. This fact should always be borne in mind in assigning any fresh form of life to any particular species, as the danger of creating a *Lymnea* grown in a small quantity of water into a new species is very great, when its altered size would be only the result of the narrow area under which the diversity was developed.

Again, what a rich store of interest will be found in the study of the comparative anatomy of insects, and the various changes taking place in their organs in their progress from the larval condition to the perfect imago; in exemplification of this, see the diversity of character to be met with in only one organ—take the gizzard as an instance; and what a variety is presented in the cockroach, the flea, the cricket and the staphylinus, enough to repay for all the careful and delicate dissection necessary to demonstrate them; we might also point out a similar diversity in the anatomy of insect salivary glands. By taking up these studies we not only provide ourselves with highly interesting amusement, but we can help those who are engaged in these subjects as a profession, and whose time for work is greatly limited. If we take care that every fact is accurately observed, and our observations are verified by good preparations, our Club will be doing most serviceable work to advance the progress of biological studies. Of course you will be met by the remark that all this has been done before by our continental brethren; but, how-

ever true and however discouraging the statement, let it not deter us from the task; there is always a pleasure in going over and verifying the labours of others, for the student who does this is somewhat in the position of one who follows in the track of some great traveller through an unknown country, who may be accurate in all the main features of the physiography of that land, whose roads and rivers and mountains are carefully laid down in his chart, but whose details have to be filled in by those who come after; so in going over the work of past observers, in the light of our advanced knowledge, and by the aid of more perfect instruments, the attention of the student must be arrested by fresh facts and more elaborate details than ever greeted the eyes of others, however carefully they may have observed. Suggestions for work that might be accomplished by the members of this Club arise around me as a thick crowd; but I think I have pointed out the character of the work that might be attempted during the coming year. I fear the besetting temptation of a President is a tendency to preach, but I hope you will pardon me if I do possess, in common with my predecessors, a great and not unnatural solicitude that the Club should be worthy of the distinguished name we bear, and of him to whom we owe so much in microscopical research, and in whom we see an example of what steady systematic work can accomplish.

PROCEEDINGS.

April 22nd, 1881.—Ordinary Meeting.

T. Charters White, Esq., M.R.C.S., &c., President, in the Chair.

The minutes of the preceding meeting were read and confirmed.

The following gentlemen were balloted for and duly elected members of the Club :—Mr W. M. Cutting, Mr J. R. Green, Mr H. W. King, and Mr J. M. Moss.

The following donations to the Club were announced :—

"Proceedings of the Royal Society" ...	from the Society.
"Proceedings of the Bristol Naturalists' Society"	" "
"Proceedings of the Norfolk and Norwich Natural History Society" ...	" "
"Fourth Report of the Hackney Microscopical Society"	" "
"The Northern Microscopist"	from the Editor.
"The American Naturalist"	in Exchange.
"The American Monthly Microscopical Journal"	"
"The American Journal of Microscopy" ...	"
"The Analyst"	from the Editor.
"Science Gossip"	" Publisher.
Dr. Braithwaite's "British Moss Flora," Part 4	" Author.
"Monograph of British Aphides" (Ray Society)	by Subscription.
"Quarterly Journal of Microscopical Science"	Purchased.
"Annals of Natural History"	"
Van Heurck's "Synopsis of Belgian Diatomaceæ"	"
"Wythes on the Microscope"	"

The thanks of the meeting were voted to the donors.

The President said they had no doubt all received an announcement of the special exhibition meeting, which had been arranged for the following Friday. He should be very glad to have the co-operation of as many members as possible on that occasion. It had been suggested that it would be desirable to give their scientific friends an opportunity of seeing the Quekett Club as it was, without the assistance of members of other

societies or of the opticians who generally exhibited at their *Soirées*. The exhibition was to be scientific rather than popular; they wanted their friends to see just what sort of men they were when they were "at home." The Secretary would be glad to receive the names of any members who were willing to assist, and extra invitations could be obtained by asking for them.

Mr. W. J. Brown said he should like to ask if he rightly understood that this exhibition was intended to take the place of the *Soirée?* He hoped that it might be merely supplementary to it. To give up the *Soirée* would be to abandon one of the most pleasing features of the Club, and he thought that the Committee, before coming to such a decision should bear in mind that there was a large number of members who, like himself, were unable to attend most of the meetings, and that the journal and the *Soirée* were about the only return such men got for their subscriptions. He knew it had been said that members of that sort were of very little use, but he thought it would be admitted that their subscriptions were of equal pecuniary value to any others.

The President, in reply, stated that the Committee, whom the members had returned as their representatives, had considered that the cost of the *Soirée*, which amounted to about £70 or £80, would be very much better employed if placed upon the shelves of their bookcase, than expended in such an evanescent manner as providing a *Soirée* for their lady friends, however much they might enjoy it at the time. He was himself always in favour of a *Soirée*, but the matter did not rest with him; as chairman he could only give his casting vote in case opinions were evenly balanced. Their representatives had, however, decided against a *Soirée*, and he thought that for the present the matter must rest where it was.

Mr. W. J. Brown said that if the great expense of the *Soirée* consisted in the cost of refreshments, could they not abandon them as had been done in the case of other societies? Let them be provided, and those who wanted them pay for them at the time.

The Secretary said that the cost of the refreshments was £30. The amount paid for the *Soirée* always seemed large, but the items were all passed before the Committee, and they did not see how they could be reduced.

The President said that as he had served in former times in the position now held by Mr. Ingpen, he could say from experience that it was not possible to cut down the expense any lower if the thing was to be done decently.

Mr. W. J. Brown hoped that it would not be thought that he asked the questions in any captious spirit; his object was merely to obtain information for himself and others. He hoped that they might bear the matter in mind at the next annual meeting.

Mr. J. W. Groves exhibited and described a new form of freezing microtome, in which ether spray had been substituted for ice and salt. The internal construction of the apparatus, and the method of getting rid of the vapour of the discharged ether were further explained by drawings on the black board.

Mr. A. D. Michael described a typical specimen of *Platygaster*, which he had brought for exhibition, and which he also figured on the black board.

Mr. J. G. Waller read a short paper in reply to observations made at the preceding meeting in opposition to his paper on the so-called boring sponges. (See page 265).

The President said he was afraid the subject was one on which there was likely to be disagreement of opinion for a long time to come, so that he thought it would not be wise to open the discussion again; they would, however, be glad to hear anything which Mr. Stewart might like to say on the observations just made.

Mr. Chas. Stewart said that the remarks which he made at the last meeting were, in the first place, chiefly directed against a kind of false logic which it seemed to him was being employed, and it was for this reason that he referred to the action of the atmosphere on glass. Mr. Waller said that a soft body like the sponge was incapable of removing a hard substance like shell or rock, but this appeared now to be admitted as a possibility. Mr. Waller also said that the character of the surface of the cavity was such as alone could be made by the gnawing of some annelid, and therefore it *must* be done in that way. He, however, maintained that this was not a necessary conclusion, because the pieces of glass, which were very much harder than shell, showed the same or very similar effects of erosion; it was merely to show that the character of the cavity was not in itself conclusive. Mr. Waller seemed to feel great difficulty in recognising the similarity between the process going on in a living animal—in the removal and deposit of bone for instance—and that which might be going on in the case of some sponges; but it was clear that the living mantle of a mollusk could both deposit and destroy the same substance; and in the case of bone they could not regard the whole substance, though part of a living animal, as being itself alive—the lime, &c., was as practically dead as the shell—so that if they found a similar character of erosion produced in other hard substances by the action of soft ones, it was not improbable that they might find it in the case of *Cliona*. Two theories were put forward, one being that the borings were made by an annelid, and the other that they were made by a sponge, and he could only say that, looking at the matter on all sides, the greater probability seemed to be that the soft substance of the sponge made the borings.

Mr Waller said his contention was that the action of a soft substance could not produce sharp edges.

Votes of thanks to Mr. Groves, Mr. Michael, and Mr. Waller for their communications were unanimously passed.

Dr. Matthews having taken the chair,

The President read a paper "On the Histology of the Gustatory Organs of the Rabbit's Tongue," the subject being illustrated by coloured diagrams and specimens exhibited under the microscope in the room.

Dr. Matthews said he had listened with intense interest to this paper, and should be glad to hear the remarks of some of those present in further elucidation of the subject. He should like very much to know if in the

localization of taste the perception of certain kinds of tastes was assigned to certain special papillæ. Would the sensations of sweet, sour, or salt, for instance, be each perceived by a special set of papillæ?

The President, in reply, said he had not given any attention to that subject, which was rather more physiological than histological.

Mr. C. Stewart said that, as far as he was aware, there was no evidence to show that such was the case.

Dr. Matthews said he asked the question for information; he did not himself profess to know anything about the subject, but he had frequently noticed the localization of bitter taste to be chiefly in the posterior part of the tongue.

Mr. Parsons exhibited some curious specimens of malformation in the young fry of the trout. They had been hatched from spawn sent over from America, which by some means got warm during the voyage. Most of the fry showed a strong curvature of the spine, some being nearly bent into a circle; in one instance two were joined together like Siamese twins.

Announcements of meetings for the ensuing month were then made, and the proceedings terminated with the usual Conversazione, at which the following objects were exhibited:—

Gustatory bulbs of the Rabbit's Tongue ...	the President.
Sertularia rosea	Mr. F. W. Andrew.
Cyclosis in *Nitella*	Mr. H. R. Gregory.
Platygaster boscii, female, showing the remarkable projection from the abdomen	Mr. A. D. Michael.

Attendance—Members, 64; Visitors, 5.

April 29th, 1881.—Special Exhibition Meeting.

By permission of the College, a meeting was held in the Library for the purpose of bringing before the members and their friends a considerable number of the objects of interest exhibited at the Ordinary and Conversational Meetings.

About 200 members and 300 visitors attended, and the following is a list of the objects exhibited, so far as could be ascertained from the tickets collected. This list, however, is necessarily very imperfect, many members having omitted to communicate their names or particulars of their exhibits.

Clava squamata ... ... Circulation in Twin Salmon Trout...	The President.
Section of *Eozöön Canadense*, Polarized ...	Mr. F. W. Andrew.
Aulacodiscus formosus	Mr. W. J. Brown.
Mildew from Wall built with Sea-sand ...	Mr. E. Bartlett.
Longitudinal section through cloaca of *Grantia ciliata*	Mr. T. H. Buffham.
Hydra viridis	Mr. J. W. Cafe.
Actinosphenia splendens	Mr. E. Carr.
Gonium pectorale	Mr. F. Coles.

Leaf of *Elæagnus argentea*	Mr. A. L. Corbett.
Sections of Sponges showing their variety of structure	Mr. H. Crouch.
Parasites, series of	Mr. T. Curties.
Nitella, fruit and cyclosis in	Mr. E. Dadswell.
Drapernaldia, &c.	Mr. A. Dean.
Campanularia volubilis, with ovarian vescicles	Mr. C. G. Dunning.
Ova of *Acarus scabiei*	Mr. H. Epps.
Deutzia scabra	Mr. J. Epps, junr.
Vertical section through jaw of Kitten, showing development of teeth ... *Gonium pectorale*	Mr. A. Fieldwick, jun.
Bursa copulatrix of Blow-fly, showing the lateral folds of Lowne ...	Mr. F. Fitch.
Tyrosine, prepared from human fibrin ...	Mr. H. E. Freeman.
Gatherings from the last Club Excursion ...	Mr. F. W. Gay.
Growing point of *Pinus*, sp. ... ,, ,, *Dahlia* ...	Mr. W. H. Gilburt.
Stentor polymorpha	Mr. W. Goodwin.
Melicerta ringens ... ... Cyclosis in *Nitella*	Mr. H. R. Gregory.
William's Freezing Microtome, adapted to freezing by Ether	Mr. J. W. Groves.
Tongue of Dog, showing circum-vallate papillæ, taste-bulbs, &c. ... Spinal cord of Monkey ...	,, ,,
Anomalocera (?) male and female, a symmetrical antenna of male—spermatic tubes attached to female ...	Mr. A. Hammond.
An improved Diatom finder or index, &c. ...	Mr. J. D. Hardy.
Section of Upper Jaw of Mole ... ,, Lower ,, ,, ...	Mr. J. J. Hunter.
Parasite of Elephant, from Ceylon—Male, female, and immature form ...	Mr. J. E. Ingpen.
Larva of *Corethra plumicornis*	Mr. J. M. Knight.
Ear of Frog, showing tympanum	Mr. S. J. Larking, jun.
Zoathamnium arbuscula	Mr. C. Le Pelley.
Section of Eye of Privet Moth	Mr. S. J. McIntire.
Cyclosis in *Nitella*	Mr. A. Martinelli.
Diatomaceæ	Mr. G. A. Messenger.
Laomedea geniculata, compact form, with extended tentacles, as in life ...	Mr. A. D. Michael.
Epicrius geometricus, a Gamasid not hitherto recorded in Britain ...	,, ,,
Tanais vittatis (a wood-eating Shrimp), shown by oblique polarized light	,, ,,

Ixodes testudinata, and other parasites ...	Mr. T. S. Morten.
Pleurosigma formosum × 5,500, shown with Powell and Lealands' 1·60th water immersion objective, num. ap. 1·02 *Pleurosigma angulatum* × 1,200, shown with Powell and Lealands' 1·12th oil immersion objective, num. ap. 1·42	Mr. E. M. Nelson.
The "Micro-Megascope," arranged with Camera lucida for drawing objects with slight enlargement	Mr. E. T. Newton.
Stentor niger from Snaresbrook Excursion...	Mr. J. M. Offord.
Œcistes umbella, discovered by the exhibitor in 1878	Mr, F. Oxley.
Stephanoceros Eichornii	Mr. G. D. Plomer.
Head of Honey Bee	Mr. R. A. Potts.
Amphipleura pellucida, shown with 1-8th oil immersion objective, num. ap. 1·47, and achromatic condenser ...	Mr. Thos. Powell.
Dactyocalyx pumicea (Sponge)	Mr. B. W. Priest.
Gizzard of *Dytiscus marginalis* ... Tongue and lancets of Gad-fly ...	Mr. G. E. Quick.
Leaves of Gymnosperms:— *Pinus excelsa* ... ... *Encephalartos altensteini* ... *Juniperus communis* ... *Podocarpus koraiana* ...	Mr. J. W. Reed.
Larval forms of Echinodermata, from the Royal Microscopical Society's Collection:— *Toxopucustes brevispinosus*... *Echinocardium cordatum* ...	Mr. W. W. Reeves.
Gizzard of Flea	Mr. C. S. Rolfe.
Section of Agate—Granular arrangement...	Mr. James Russell.
Vorticella	Mr. Joseph Russell.
Various forms of modified crystals of Platino-cyanide of Ytrium ...	Mr. J. C. Sigsworth.
Hydra vulgaris	Mr. J. E. Simmonds.
Crustacean found in a Marine Aquarium ...	Mr. T. Simpson.
Echinorhynchus from Intestine of Trout ...	Mr. W. Smart.
Selected Desmids, Fungi, Vegetable cells,&c.	Mr. C. V. Smith.
Rock Section of Gneiss, Hebrides... ...	Mr. Geo. Smith.
Pedal ganglion and nerves of *Firoloides* ...	Mr. C. Stewart.
Diatomaceæ	Mr. M. J. Swift.
Hair of Rat	Mr. J. G. Tasker.
Arsenious Acid...	Mr. J. W. Tate.
Micro-rulings, with complex curvilinear tracery	Mr. W. Teasdale.

New Santa Monica Diatoms, mounted on ruled squares—large squares 10,000, and small squares 1,000,000 to the square inch	Mr. W. Teasdale.
Leg and foot of *Dytiscus marginalis* ...	Mr. J. J. Vezey.
Cliona, showing Early Development of minute bundles of Spicules ..	Mr. J. G. Waller.
Section of sucker of *Musa paradisiaca* (Banana Tree)	Mr. F. H. Ward.
Pleurosigma angulatum	Mr. T. P. Watson.
Image of hands of watch in motion, shown in Beetle's Eye	Dr. H. T. Whittell.
Section of Oat Grass	Mr. W. D. Wickes.
Xanthidia in Flint	
Section of Spine of *Echinus lividus*	Mr. George Williams.
,, ,, *Cidaris imperialis*	
,, Screw Pine	
,, Ovary of Poppy ...	
Head of *Vespa crabro*	Mr. F. Wood.
Hooklets of Hydatids, mounted by the late Mr. J. Cocken	The Club Microscope.

The Museum and the Flaxman Hall were open for the inspection of the visitors.

May 13th, 1881.—Conversational Meeting.

The following objects were exhibited :—

Vetches sativum, stained and polarized ...	Mr. F. W. Andrew.
Skin of *Iguana*, polarized	Mr W. R. Browne.
Eyes of a South African Spider	the Rev. H. J. Fase.
Dissection of Devil's Coach-horse (*Goerius oleus*)	Mr. F. Fitch.
Coccus of Nettle	Mr. H. E. Freeman.
Closterium lunula	Mr. H. R. Gregory.
Pond Life	Mr. R. Hailstone
Felspar from Norway	Mr. H. Morland.
Parasite of Spoonbill	Mr. T. S. Morten.
Growing point of *Dammara Moorei*	Mr. J. W. Reed.
,, ,, *Pinus excelsa* ...	
,, ,, *Podocarpus koraiana*	
Planorbis in the Egg	Mr. F. A. Stœssiger.
Cinchonodine	Mr. J. W. Tate.
Æcidium quadrifidum on leaf of *Anemone ranunculoides*	Mr. J. W. Walker.
Internal teeth of digestive organ of *Corethra plumicornis*	Dr. H. T. Whittell.
Braula cœca, parasite of Honey Bee...	Mr. Francis Wood.

Attendance—Members, 54 ; Visitors, 4.

May 27th, 1881.—Ordinary Meeting.

Chas. Stewart, Esq., M.R.C.S., &c., Vice-President, in the Chair.

The minutes of the preceding meeting were read and confirmed.

Mr. O. S. Bishopp and Mr Charles Botterill were balloted for and duly elected members of the Club.

The following additions to the Library were announced:—

"Proceedings of the Royal Society" ...	from the Society.
"Journal of the Royal Microscopical Society	" "
"Eighth Report, &c., of the New Cross Microscopical Society" ...	" "
"Proceedings of the Geologist's Association"	" "
"Proceedings of the Belgian Microscopical Society"	" "
"The Popular Science Review"	from the Publisher.
"Science Gossip"	" "
"The Northern Microscopist"	" "
"The American Monthly Microscopical Journal"	in Exchange.
"The Microscope in Medicine" (American)	from the Publisher.
Van Heurck's "Synopsis of Belgian Diatoms"	Purchased.
"Annals of Natural History"	"
Photograph for the Album	Mr. Morland.

The thanks of the meeting were unanimously voted to the donors.

The Secretary said that the members would no doubt be interested to know that the meeting which was held on April 29th, for the exhibition of objects, &c., was attended by at least 199 members, and 300 visitors. The number of exhibitors on the occasion, as far as could be ascertained by the cards collected after the meeting, was 73, but he was under the impression that this did not include all. He had prepared an alphabetical list of those whose names were ascertained from the cards, and this would be laid on the table for inspection at the end of the meeting in order that any members who had exhibited, and whose names did not appear, might be able to supply the omissions.

Mr. Ingpen said that as they were without a paper for the evening, it might be interesting to some of the members if he gave a description of the microscope with which he recently had the honour to be presented. He then exhibited and described the instrument and its accessories, and explained their mode of use and the advantages claimed for them, dwelling particularly upon the construction of Abbé's condenser, sectional drawings of which were made upon the board.

The thanks of the meeting were voted to Mr. Ingpen for his communication.

The Chairman said it seemed to him that this microscope had undoubtedly some great advantages for special work and methods of research,

but he confessed that the more he looked at it the more glad he was that they had the English microscopes as well. He should not like to use so elaborate an instrument as that for the ordinary purposes to which their commoner ones were applied, and though possibly these foreign instruments were better for more purely optical work, yet for every day use and for the ordinary rough and tumble work of microscopical study, he should prefer the more usual forms of English instruments. He thought that the flat bottom foot seemed to slide too easily on a smooth table, and that it would not be so steady as the tripod, with the claw-like projections, with which they were better acquainted. He could not see the advantage of the horse-shoe foot, with the single projection behind, and thought it would be steadier if reversed, especially when used for camera-lucida drawing.

Mr. Ingpen admitted that the foot appeared clumsy, but it was carefully considered for all that, and upon any ordinary table cloth it would be found quite steady in whatever position it was placed. Abroad the microscope was almost always used upright, and with the short six inch body, the camera lucida being arranged for drawing with the microscope vertical. With regard to the condenser, he could fully endorse all that Mr. Crisp had said, and he thought that no greater compliment could be paid to it than that Powell and Lealand's Diatom condenser had been adapted from it.

Mr. F. Crisp said that Abbé's condenser was undoubtedly the true type of all possible condensers. He then proceeded to show by means of black board drawings that whereas with low powers oblique light produced "shadow effects," it was not so when high powers were used, inasmuch as the objects were so minute that the light-waves passed round them, and all shadow effects were consequently lost. The value of oblique light in such a case was simply that it brought within the object-glass diffraction spectra which would otherwise be lost.

Announcements of meetings for the ensuing month were then made, and it was intimated that arrangements had been entered into by which the refreshment room of the College should be open on each of the meeting nights for the convenience of the members.

The proceedings terminated with the usual Conversazione, at which the following objects were exhibited:—

Ribbon Grass, polarized...	Mr. F. W. Andrew.
Eyes of Jumping Spider, *Salticus tardigradus*	Mr. F. Enock.
Larva of Water Boatman emerging from egg	Mr. W. Goodwin.
Batrachospermum, from Tottenham Marsh...	Mr. J. D. Hardy.
Egg shell of *Clausilia bideus*, showing crystals of carbonate of lime ...	Mr. H. Hensoldt.
Amphipleura pellucida shown with oil immersion, 1-8th, and achromatic condenser	Mr. Thos. Powell.
Section of Skin of *Echinus lividus* ...	Mr. B. W. Priest.
Longitudinal and transverse sections of leaf of *Welwitschia*... ...	Mr. J. W. Reed.
Sexual organs of Male Humble Bee ...	Mr. F. Wood.

Attendance—Members, 58; Visitors, 5.

June 10th, 1881.—Conversational Meeting.

The following objects were exhibited :—

Medusa, probably *Cladonema*	The President.
Adiantum cuneatum	Mr. F. W. Andrew.
Section of Queen Bee, *Apis mellifica*, showing ovaries, &c.	Mr. F. Enock.
Maple Aphis	Mr H. E. Freeman.
Tongue of Whelk stained	Mr. H. G. Glasspoole.
Nettle Cluster-cups	Mr. H. R. Gregory.
Transverse section of stem of *Smilax officinalis* stained with Methyl violet, iodine green, and magenta ...	Mr. J. W. Groves.
Testa of seed of *Nemesia versicolor*, polarized	Mr. H. Morland.
Amphipleura pellucida, × 1,200, shown in checks, with Powell and Lealand's 1-12th oil immersion objective, num. ap. 1.42, illuminated by the oil immersion condenser, and vertical illuminator used simultaneously	Mr. E. M. Nelson.
Sections showing male organs of *Polytrichum*	Mr. J. W. Reed.
Section through embryo of Bean...	
Fredericella sultana	Mr. Fras. Wood.

Attendance—Members, 45; Visitors, 1.

June 24th, 1881.—Ordinary Meeting.

T. Charters White, Esq., M.R.C.S., &c., President, in the Chair.

The minutes of the preceding meeting were read and confirmed.

The following gentlemen were balloted for and duly elected members of the Club :—Dr. E. W. Alabone, Mr. H. T. Crosby, Mr. H. Gilburt, Mr. F. W. Harris, Mr. J. J. Pilley, Mr. W. Potts, Mr. F. Ransom, and Mr. A. W. Stokes.

The following additions to the Library and Cabinet were announced, and the thanks of the meeting accorded to the Donors.

"Proceedings of the Royal Society" ...	from the Society.
"Transactions of the Linnean Society" ...	,, Mr. T. C. White.
"Transactions of the Hertford Natural History Society"	,, the Society.
"Twenty-ninth Report of the East Kent Natural History Society" ...	,, ,,
"Tenth Report of the South London Natural History Society" ...	,, ,,

"The American Naturalist"	in Exchange.
"Science Gossip"	from the Publisher.
"Report of the Smithsonian Institution ...	„ the U.S. Government
"The American Journal of Microscopy" ...	in Exchange.
"The Microscope in Medicine"	from the Editor.
"The Analyst"	„ „
"Annals of Natural History"	purchased.
"Burmeister's Manual of Entomology" ...	„
Dr. J. E. Smith's "How to See with the Microscope"	„
Van Heurck's "Diatomaceæ"	„
"Grevillea"	„
"The Northern Microscopist"	in Exchange.
"The American Monthly Microscopical Journal"	„
3 Slides—Sponge Sections. &c.	from Mr. B. W. Priest.
7 Slides—Desmids	„ Mr. C. V. Smith.

A letter from Mr. Curties relating to these slides was read to the meeting.

The President remarked that if Mr. Vance Smith had succeeded in doing what was stated, he had done a very great thing. He had himself tried a great many things, but all the various mixtures he had used had been found to fail, except the water in which the Desmids were found. Some time ago he saw a suggestion in the "Royal Microscopical Journal" that pickling vinegar had been used with success, and he had given it a trial, and found that it had not at present disturbed the endochrome, but it appeared to have changed the colour to that peculiar green which was commonly observed in pickles.

Mr. Sigsworth said he had mounted some Desmids in a mixture of glycerine and camphor water, and they had kept their appearance up to the present time.

Mr. Michael thought that success with such a medium depended very much on the kind of Desmid which was tried.

Mr. Ingpen said that Dr. Cooke considered it best in many cases to get rid of the endochrome, which sometimes prevented a complete examination being made. The specimens before the meeting had not been prepared very long, but they were very beautifully mounted, and it was to be hoped that they would stand the test of time.

Mr. Hailes said he had some slides of Desmids which were mounted twelve or fourteen years ago by Dr. Dempsey, and they were now as good as ever, and quite bright and green.

Dr. Matthews said he also had some of Dr. Dempsey's slides; he believed they were only mounted in glycerine and water.

Mr. Hailes said he believed that some specimens lost their colour from exposure to the action of light.

The President read a letter from the Ealing Microscopical Society thanking those members of the Club who assisted them on the occasion of their recent *Soirée*.

The President reminded the members that their next monthly meeting would be their anniversary, at which it would be necessary to elect Officers and members to supply vacancies upon the Committee. The time had now arrived for nominations for these offices to be made, and he would call upon those present to propose any gentlemen whom they might consider suitable. The President, Vice-Presidents, and Officers were nominated by the Committee, but any member was at liberty to substitute another name on the ballot paper if he wished to do so.

The following list of nominations made by the Committee was then read :—

As President, Mr. T. C. White; as Vice-Presidents, Dr. Cooke, Mr. Dadswell, Mr. Groves, Mr C. Stewart ; as Hon. Treasurer, Mr. Gay ; as Hon. Secretary, Mr. Ingpen ; as Hon. Secretary for Foreign Correspondence, Dr. M. C. Cooke ; as Hon. Reporter, Mr. R. T. Lewis ; as Hon. Librarian, Mr. Alpheus Smith ; as Hon. Curator, Mr. C. Emery.

The President intimated that there were four vacancies upon the Committee, caused by the retirement, in accordance with the rules, of Messrs. Dadswell, Oxley, Groves, and Coles, and invited nominations accordingly.

The following nominations were made :—

Dr. Matthews	Proposed by	Mr. Sigsworth	Seconded by	Mr. Gregory.
Mr. Gregory	,,	Mr. Freeman	,,	Mr. Waller.
Mr. Priest	,,	Mr. Michael	,,	Mr. Dadswell.
Mr. E. M. Nelson	,,	Mr. Gilburt	,,	Mr. Waller.
Mr. Waller	,,	Mr. Priest	,,	Mr. Reed.
Dr. Cobbold	,,	Mr. Reed	,,	Dr. Matthews.

The President said that Mr. Hainworth had been appointed Auditor on behalf of the Committee, and requested the members to nominate another gentleman to act with him on behalf of the Club.

Dr. Whittell was proposed by Mr. Crisp, seconded by Mr. Buffham, and unanimously elected.

Mr. B. W. Priest read a paper "On an Undescribed Sponge of the Genus *Polymastia*," the subject being illustrated by diagrams and by specimens exhibited under the microscope in the room.

Mr. J. G. Waller said this was an exceedingly interesting species, and he was very glad to find that it had been first described by a member of the Club. Dr. Bowerbank's description of the genus to which it belonged was so accurate that no one could possibly mistake it, and it might be taken as a testimony to the value of his mode of classification, and of the care with which his descriptions were given. The arched structure was a very curious feature, though it was not altogether unlike what was found elsewhere in the genus *Desmacidon*. Mr. Priest had omitted to mention one very peculiar feature of this Sponge, namely, the very numerous abnormal forms of spicules which were to be met with ; he had never found so many abnormal shapes as in this instance, certainly in no marine species were they so abundant.

Mr. Buffham did not quite gather from Mr. Priest's description the character of the cavities. Was the whole of the area of the Sponge

interspersed with vertical pillars, or were there in some one direction two or three cavities, of which the drawings showed sections? Did he observe any connection between these cavities and the oscula?

Mr. Priest said that the Sponge having been in spirit much of it was hardened, but apart from that it appeared in its natural condition. The section was made through the walls of the Sponge, and had the appearance of arches, as shown in the diagram. In one of the slides the cavity could be traced from the centre up to the oscula, where the water passed out.

Mr. Buffham wanted to know whether there were a number of vertical pillars dotted about the whole base of the Sponge, and running up to its roof, or whether there were three principal cavities through which the diagram showed a section?

Mr. Priest said the openings seemed to be all over the Sponge, the pillars supporting the outer crust.

The President enquired if they were pillars supporting the roof, or the wall of the channels?

Mr. Buffham said supposing they began at the base, was the whole space divided into numerous channels, or were there three principal ones running right through? He should gather that there were a number of cavities communicating with each other all over the Sponge.

Dr. Matthews asked if they were cavities or channels?

Mr. Priest, in reply, said that they were channels, and had the appearance shown only in section.

A vote of thanks to Mr. Priest for his paper was unanimously carried.

Mr. W. H. Gilburt said that some little time ago Dr. Cooke called his attention to some leaves of a species of *Bomaria* which he had found in Kew Gardens. These plants belonged to the same order as the Snowdrop, but differed in appearance from the British members of the order, the Bomarias being climbers. The special point about them which called for remark was that the whole structure was reversed—what should be at the top being found near the bottom surface of the leaves, and *vice versâ*. In an ordinary leaf—say of Aucuba or Laurel—they would find on the upper surface a well developed cuticle, and beneath that a layer of flattened cells, sometimes containing chlorophyl; then came another layer of cells arranged with their greatest length at right angles to the surface of leaf, and then a quantity of more or less branched cells, and immediately under that came the lower epidermis containing the stomata. On the upper surfaces of leaves stomata were comparatively rare, except in the case of such as grew vertically, like the Hyacinth; but in the instance before them they had a leaf in which the lower surface was a true cuticle without stomata, the order of the arrangement of the cells was reversed throughout, and the upper surface contained stomata in abundance; and remembering the functions of the various parts of the leaf and the provision made by nature for protecting the stomata from dust, &c., this reversal of the usual order of things was very remarkable. So far as he knew it had never been observed before. Dr. Cooke had made enquiries of Mr. Baker, one of our best authorities on the order; but he knew of no one having previously observed it. The leaves are developed normally in the bud, but as soon

as they assumed the horizontal position they turned over, but it is only in the petiole that any torsion can be observed. How it came about that this plant first began to develope the leaves in the wrong direction, or what circumstances had induced it to do so, was certainly a very puzzling point, as there is nothing in the habit of the plant to account for it. It had been suggested that it might at one time have done this as an assistance in climbing, but this he thought could hardly be the case, seeing that the climbing was all done by the twining of the stem round its support. If any one could give any suggestions on the matter he should be very much obliged.

Two slides in illustration were exhibited.

The President thought that Mr. Gilburt had made a most interesting communication, and one of a type which he should like to see more often brought before them, for the members seemed to have got too much into the habit of bringing up objects for exhibition, and saying nothing about them.

Mr. Michael said he should like to know if there was any reason for assuming that the inversion of the leaf occurred first, and the torsion was to utilise the structure? It seemed far more probable that the torsion was the original thing, and that the development took place in consequence.

A vote of thanks was passed to Mr. Gilburt for his communication.

The Secretary called attention to a series of admirable photo-micrographs received from Dr. Woodward of the U.S. Army Medical Department, illustrative of cases of Pseudopolypi of the Colon.

Mr. Frank Crisp said that the photographs were of general interest as being the best that had yet been seen in this country in illustration of histological subjects; in this respect they would mark a distinct advance in photo-micrography.

The President announced the meetings for the ensuing month, and called attention to the abandonment of the excursion to Great Marlow, arranged for July 9th, in consequence of the disorganisation of the ordinary traffic on the Great Western Railway on that day, on account of the Volunteer Review at Windsor.

The proceedings then terminated with the usual Conversazione, at which the following objects were exhibited:—

Section of Flint, polarized, showing section of Chalcedony	Mr. F. W. Andrew.
Leaf of *Bomaria Caldesiana*, showing reversed structure, hairs, &c. ...	Mr. W. H. Gilburt.
Section of leaf of *Bomaria Carderi*	
Polytrema rubra, parasitic Foraminifera from Mentone	Mr. H. G. Glasspoole.
Tadpole of Water Newt	Mr. A. Martinelli.
Section of Meteorite with cavities containing fluid	Mr. G. D. Plomer.
Transverse section of leaf of *Pinus Coulterii*	Mr. J. W. Reed.

Attendance—Members, 45; Visitors, 7.

July 8th, 1881.—Conversational Meeting.

The following objects were exhibited:—

Section of Cotton Seed, polarized ...	Mr. F. W. Andrew.
Sand from the Indian Ocean, water-worn and polished...	Mr. W. Goodwin.
Cocconema lanceolatum, front and side views	Mr. H. Morland.
Banksia serrata, showing position of stomata	Mr. J. W. Reed.
Oxyuris (sp. ?)	Mr. Fras Wood.

Attendance—Members, 44; Visitors, 3.

July 22nd, 1881.—Annual Meeting.

T. Charters White, Esq., M.R.C.S., &c., President, in the Chair.

The minutes of the preceding meeting were read and confirmed.

Mr. William A. Firth and Mr. Henry Perigal were balloted for and duly elected members of the Club.

The following additions to the Library and Cabinet were announced:—

"Proceedings of the Royal Society" ...	from the Society.
"Proceedings of the Bristol Naturalists' Society"	" "
"Second Annual Report of the Lewisham and Blackheath Scientific Association"	" "
"Proceedings of the Linnean Society" ...	" Mr. T. C. White.
"Popular Science Review" ...	" the Publisher.
"Science Gossip"	" "
"The Analyst"	" the Editor.
"The Northern Microscopist"	" "
"The American Naturalist"	in exchange.
"Proceedings of the American Society of Microscopy"	from the Society.
"American Monthly Microscopical Journal"	in exchange.
"The Microscope in Medicine" (American). .	from the Editor.
Dr. Carpenter's "The Microscope and its Revelations," new Edition ...	" the Author.
Marsh's "Section Cutting"	" Mr. F. Wood.
Kent's "Infusoria," part iv.	by subscription.
"Quarterly Journal of Microscopical Science"	Purchased.
"Annals of Natural History"	"
"Klein's Atlas of Histology"	"
"Leidy's Rhizopods"	"
"Challenger Reports," vols. i. and ii. ...	"

The thanks of the meeting were voted to the donors.

The President read the following communication from Mr. E. M. Nelson :—

"While studying a slide of various kinds of *Bacteria* and *Micrococci*, stained with methyl violet and mounted in Canada balsam, I found that some of the *Micrococci* had a flagellum. I first observed this with a 1-25th oil immersion objective, by Messrs. Powell and Lealand. Mr W. Watson Cheyne has kindly verified these results. So much attention is now directed to the study of *Bacteria* and *Micrococci*, both here and in foreign countries, that I thought these results would interest some of our members. I shall have much pleasure in exhibiting the object at one of our meetings."

The President announced the engagements for the ensuing month, and the business of the Annual Meeting was then proceeded with.

The President appointed Mr G. D. Brown and Mr M. H. Johnson to act as Scrutineers of votes at the ballot for Officers and Members of Committee.

The Secretary read the 16th Annual Report of the Committee.

Mr. J. G. Waller moved the adoption of the Report.

Mr. W. H. Gilburt seconded the motion.

Mr. Curties said that, before putting the motion for the adoption of the Report, he should like to take the opportunity of expressing his regret that the Report contained no reference to the circumstance that the customary *Soirée* had not been held. He believed that a large number of the members looked for it, and that it was to be regarded as a bond of union amongst many who were unable to be often present at the meetings. In this way it had proved a means of advancing microscopy, and had been a source of gratification to a large number of persons. He thought, therefore, that before such a lapse should be allowed to occur, it was due to the members that some reasons should be given for it. If the reason was one of economy, they would be glad to know that such was the case; or if it was from a feeling that the labour involved in making the arrangements was greater than the Committee could bear, no doubt assistance could be afforded from outside if needed. He had no feeling or desire to come into contact with the Committee on the matter, but he thought it well that the Club generally should be made aware of the reasons which had induced the Committee to withhold the customary enjoyment, particularly as the reasons why there *should* be a *Soirée* appeared to be so many. He had no desire for discussion at that time, and imagined there could be none, but he had the facts and figures relating to the subject ready to be brought forward on some other occasion.

Mr. H. F. Hailes said that perhaps, as one of the founders of the Club, he might be permitted to say that he quite agreed with Mr. Curties that their *Soirées* had met with approbation from a number of the members, but that they had advanced the cause of microscopy was an opinion he could hardly agree with. No doubt a great many persons had enjoyed them; but if they had card parties and quadrilles, a good many

would enjoy such amusements too, without much gain to the interests of microscopy. He thought it was hardly generous for a minority of the members to expect the Club to entertain them instead of devoting their funds to the advancement of microscopy. Such entertainments should, he thought, be left for larger and more wealthy societies than theirs. To carry the principle out into private life, what would they think if they saw a clerk with £150 a year giving balls and parties? The result would be clear, and if the Club were to act in the same way they would soon come to an end. They had not held a *Soirée* for several years, but they had a good reason for it, and the Committee might reasonably object to be called to account in this way not for what they had done but for what they had left undone.

Mr. Curties enquired if they might take this as being the expression of the Committee, or was it that of an individual member?

Dr. Matthews enquired if he might anticipate the Treasurer's statement by asking what was their present balance in hand?

The Secretary informed him that it was £174.

Dr. Matthews enquired the estimated cost of issuing the next number of the Journal?

The Secretary thought it would be about £40, and that the cost of the Report and list of members would probably be about £20.

Dr. Matthews asked what was about the cost of a *Soirée?*

The Secretary said that their first *Soirée* cost £27, and the next three or four from £40 to £60. Then there was a demand for increased accommodation, and for a band, and for extra refreshments for exhibitors, &c., so that the cost was run up to about £84, and he did not think they could undertake to reduce this amount. Though it seemed large, he should think from what he heard of the expenses incurred by other societies that they were lucky to get it done for this. The expenses were looked into by the Committee, and they did not see how they could be cut down.

Dr. Matthews said he was not questioning the economy of the matter, but he was anxious to get at the amounts, because it appeared to him that when they took away £80 for a *Soirée* and £40 for Journal, as well as something more for the Report, it would leave them a very small balance indeed, and the prudence of this did not commend itself to him. He did not think that *Soirées* were of any use in advancing science, though no doubt they promoted social intercourse, and in that respect they had now a very excellent substitute in the extra meeting held for exhibition of objects, and which he thought was greatly to be preferred to a thing called a *Soirée*, which cost so much and was worth so little.

Mr. Curties said that it must be remembered that they had now arrived at the end of their financial year, and that they had this money now in hand. They were about to get in their subscriptions, and any future expenditure would of course come out of future income; this, he thought, disposed of the question raised by Dr. Matthews. As regarded the general question, he was in possession of the facts and figures, and as the subject had been gone into by Mr. Hailes, perhaps he had better

state them as they appeared from letters he had received upon the subject from various members of the Club. It appeared that, altogether, 11 *Soirées* had been held; that they had been held annually up to 1875. In 1876 the *Soirée* was omitted for the first time, and it was omitted also in 1878, 1880 and 1881. In 1876 (the first time the *Soirée* was omitted), the first complaint appeared in the Report about large arrears of subscriptions being due (£111), and on the next occasion (1878) the Report again mentioned with regret "a large and increasing arrear of subscriptions due." The balance in hand at the end of the last year when they had a *Soirée* was £87 9s 3d, the balance in 1880 being £139 16s 8d. The average cost of a *Soirée* per head had ranged from 10d in 1869 to 1s 1¼d in 1875. The lowest cost of any *Soirée* was that of 1867 (one of the best and pleasantest they ever had), amounting to £27 14s 11d. The highest cost was £88 15s 9d, for the very crowded and uncomfortable gathering of 1877. The number of new members proposed at the monthly meetings following the four last *Soirées* were respectively 23, 10, 11 and 20—total 64, whilst in the corresponding months of the four years when there had been no *Soirées* the numbers had been 7, 5, 4 and 2—total 18.

Mr Gilburt said that the Committee were placed in a rather awkward position by the way in which this matter had been brought forward. No notice had been given, and therefore, not having come officially before the Committee, they were not prepared to answer it. Mr Curties asked them now for the first time ("No," from Mr. Curties) to consider the question, and under the circumstances the Committee were not in a position to give a reply, and any explanation which might be offered by any of their number could only be that of an individual member. Not that the Committee were at all divided upon the matter, for with one exception only—and that in the case of one not in a position to vote—they were unanimous in their resolution not to have a *Soirée* this year and not to have one in the future. Taking into consideration the primary objects for which the Club was established, that it was to be a society for the promotion of the study of microscopy, and that it sought to do this in such ways as providing a library of such works as were of value to the student, and which people were not in a position to purchase for themselves, in providing instruments—of which they certainly had too few for a society like theirs; also in providing a cabinet of specimens for comparison and reference—when they looked at the question from this point of view they could see in a *Soirée* only a large expenditure without any adequate results in the proper direction. Mr Curties had given them a number of figures, and these he thought furnished one of the best possible arguments against a *Soirée*. Mr. Curties had told them that the total number of members added to the Club from four *Soirées* was 64—not only not enough to provide the expenses for one year, but not half enough to pay for a single *Soirée*. If they took the year's subscription of these 64 members they would find that, after deducting from them the cost of the Journals and other expenses, they had left just £16 towards this purpose. So that, looking at the matter from a purely financial point of view, he thought the Committee were justified in the course they had

adopted, and when, in addition to that, they considered what they might have had in the library and in the cabinet if the *Soirées* had not been held, he thought the members generally would agree that the Committee were perfectly justified in trying to do without *Soirées* in the future.

Mr. Hopkins said he was a new member. He did not care anything about a *Soirée*, but he came for instruction, and he had joined the Club because he heard that there was a good library. On his part he had therefore to thank the Committee for their decision.

The President said that the remarks of Mr. Gilburt had so clearly set forth the views taken by the Committee that it was scarcely necessary for him to add anything further on the subject. The matter had come before the Committee, and had been well considered by them, and as the representatives of the members, and acting for them, it had been felt desirable not to hold a *Soirée*. However enjoyable *Soirées* might be to large numbers of the members and their friends, it had been felt that they were the means of sacrificing funds which might have been more usefully employed. The Committee were elected by the members as their representatives, and they had come to this conclusion. The figures brought forward by Mr. Curties were no doubt correct, but had they been laid before the Committee he did not know that they would have caused them to modify their views, as the general feeling seemed to be against *Soirées*. Some persons were no doubt disappointed—he was himself disappointed—in not having had the opportunity of inviting a number of distinguished persons from outside to come and see what they were doing, but he thought if they had special exhibition meetings, similar to that which had been recently held, and if these were held without ladies, who took up a good deal of room on the last occasion, it would no doubt be found that such meetings would be very agreeable, and perhaps more beneficial to the Club.

The President then put the motion for the adoption of the Report, which was carried unanimously.

Dr. G. D. Brown thought that what had been said did not answer the remarks of Mr. Curties, and asked if the Committee could not consider whether they might not have some opportunities for meeting together for exhibition of specimens?

The President said that it was their intention to do so.

The Annual Statement of Account was read by the Secretary, it being explained, at the request of Mr. Hainworth, one of the auditors, that, owing to the absence of Mr. Suffolk, it had not been possible to verify the amount of stock standing to the credit of the Club at the Bank of England, but that this would be done as soon as possible after that gentleman's return.

The adoption of the Treasurer's Report having been moved by Mr. Hardy, and seconded by Mr. Emery, was put to the meeting and carried unanimously.

The President then rose to read the Annual Address, but regretted to have to inform the members that, though he had written it and put it into his pocket on leaving home, it had disappeared *en route* to the meeting, and he

presumed it was somehow left in the cab. He then proceeded to deliver an extemporaneous address, which was of a practical character, dealing chiefly with the specific objects of the Club, and suggesting to the members the means by which they might be realised in a higher degree than hitherto.

Dr. Horatio Whittell said he had great pleasure in proposing a vote of thanks to the President—first of all for having prepared an elaborate paper which he had intended to read to them, and next for having lost it, and thirdly for having delivered to them one of the best extempore addresses which had ever been delivered in that room. He had referred in it to the value of the Quekett Club, to the work it had done already, and to the method which he should like its members to pursue in future. He was himself disposed to think that the written address could not have been more valuable, even supposing it had not been lost. Remarks such as they had just listened to, coming from a gentleman like the President, with his great knowledge and experience, and who had spent so many years in coming there and giving to the Club his assistance and advice, could hardly fail to be most valuable to the members, supposing that they rightly applied them. He could not, however, help feeling that he ought to take exception to one remark—that they came together there for the purpose of amusing one another, and he was sure that in saying this he should have the sympathy of his fellow-members. Living for the greater part of his life at the other side of the world, and being far away from the centres of scientific investigation he had looked with longing eyes to the old country and read about what was going on, always hoping that he might some day visit this far-off land and see what they were doing. When at last the opportunity occurred he came, almost as soon as he landed, to the Quekett Club, and having attended nearly the whole of its meetings while he had been in England, he could say that he had not seen one member whom he should be disposed to look upon as coming there simply to be amused. For his own part, he had derived instruction from every meeting; he had never come into that room without learning something or picking up some wrinkle. Some of those things he hoped to be able to carry back to Australia with him, and to make them useful there to others who were not so well situated. He had expected a great deal from the Quekett Club; he was acquainted with its history and poceedings; but he had no notion until he came and saw for himself what was the extent and value of the work which they were doing; and, after seeing a good number during his stay, he could only add that he believed the Quekett to be one of the most valuable and best conducted of any of the societies in the world. He should have very soon to leave, but could not sit down without thanking all for the great courtesy received and the amount of information he had gained. He had great pleasure in moving a vote of thanks to their "shepherd"—or whatever else he liked to call himself—for the very admirable address which he had given to them.

Mr. Waller having seconded the proposition,

Mr. Ingpen said it was his privilege and pleasure to put this proposal to the meeting, and in doing so he ventured to hope—in spite of what Dr.

Whittell had said—that the written address would after all turn up, and therefore he would couple with the vote of thanks a request that the President would allow it to be printed and circulated in the usual way.

The vote of thanks was carried unanimously.

The President expressed his thanks to the meeting for the cordial way in which the vote had been passed. He could only say that he had always met with the greatest kindness from all, and he considered it one of the distinguishing features of the Club that every one of its members could be regarded as a kind-hearted, loving friend, and that the union amongst them was as strong as the bond of brotherhood in any masonic union. He did not take their expression as being due to anything in himself, for he knew that they had numbers of men more able than himself to occupy the position; he attributed it all to their kindness, and thanked them very heartily for it.

The result of the ballot was then announced to be as follows:—

President—Mr. T. Charters White.

Vice-Presidents—Dr. M. C. Cooke, Mr. E. Dadswell, Mr. J. W. Groves and Mr. Charles Stewart.

Four new Members of Committee—Dr. T. S. Cobbold, Dr. J. Matthews, Mr. B. W. Priest and Mr. J. G. Waller.

The Officers were all re-elected.

Dr. G. D. Brown moved a vote of thanks to the President, Members of Committee, and Officers of the Club for the services which they had so ably rendered during the past year. He felt sure that the Club would be pleased at the re-election of the President, because he had always been regarded as one of themselves.

Mr. Morland seconded the motion, and the President, in putting it to the meeting, referred to the special indebtedness of the Club to the various Officers.

The vote of thanks was carried unanimously.

A vote of thanks to the Auditors and Scrutineers was moved by Mr. Curties, seconded by Mr. Vezey, and carried *nem. dis.*

The President moved a vote of thanks to the Council and Authorities of University College for the continuance of their permission to meet in that room. This vote of thanks he thought was deserved in every respect, for their kindness did not end there, but they were always ready to meet the wishes of the Club in every way, and in their personal contact with them they had always met with the greatest kindness and courtesy.

The Secretary seconded this motion with very great pleasure, because he was the one who came most into contact with the College, and could testify personally to their kindly feelings. He might, he thought, also venture to say that not only was the Club satisfied with the College, but that the College was satisfied with the Club, and that the Authorities were glad to assist a Society that was instrumental in furthering the spread of education, of which they considered themselves the Trustees.

The proceedings then terminated.

Attendance—Members, 44; Visitors, 3.

FIFTEENTH REPORT

OF THE

QUEKETT MICROSCOPICAL CLUB,

LIST OF MEMBERS,

PRESIDENT'S ADDRESS, &c.

MEETING AT UNIVERSITY COLLEGE, LONDON, ON THE SECOND AND FOURTH FRIDAYS OF EVERY MONTH.

LONDON.

July 1880.

(*Extract from original Prospectus, July* 1865.)

"The want of such a Club as the present has long been felt, wherein "Microscopists and Students with kindred tastes might meet at stated periods "to hold cheerful converse with each other, exhibit and exchange specimens, "read papers on topics of interest, discuss doubtful points, compare notes of "progress, and gossip over those special subjects in which they are more or "less interested: where, in fact, each member would be solicited to bring his "own individual experience, be it ever so small, and cast it into the treasury "for the general good. Such are some of the objects which the present Club "seeks to attain. In addition thereto it hopes to organize occasional Field "Excursions, at proper seasons, for the collection of living specimens; to "acquire a Library of such books of reference as will be most useful to "enquiring students; and, trusting to the proverbial liberality of Micro-"scopists, to add thereto a comprehensive Cabinet of Objects. By these and "similar means, the Quekett Microscopical Club seeks to merit the support "of all earnest men who may be devoted to such pursuits; and, by fostering "and encouraging a love for Microscopical studies, to deserve the approval "of men of science and more learned societies."

OFFICERS AND COMMITTEE.

(Elected July 1880.)

President.

T. Charters White, M.R.C.S., F.L.S., F.R.M.S.

Vice-Presidents.

T. Spencer Cobbold, M.D., F.R.S., F.L.S., &c.
M. C. Cooke, M.A., LL.D., A.L.S.
John Matthews, M.D., F.R.M.S.
Charles Stewart, M.R.C.S., F.L.S., F.R.M.S.

Committee.

Frederick Oxley, F.R.M.S.
Ferdinand Coles, F.L.S.
Edward Dadswell.
J. W. Groves, F.R.M.S.
J. W. Reed, F.R.G.S.
J. C. Sigsworth, F.R.M.S.
W. H. Gilburt, F.R.M.S.
J. W. Goodinge, F.R.G.S., &c.
H. F. Hailes.
A. D. Michael, F.L.S., &c.
E. T. Newton, F.G.S.
W. W. Reeves, F.R.M.S.

Hon. Treasurer.

F. W. Gay, F.R.M.S., 113, High Holborn, W.C.

Hon. Secretary.

J. E. Ingpen, F.R.M.S., 7, The Hill, Putney, S.W.

Hon. Secretary for Foreign Correspondence.

M. C. Cooke, M.A., LL.D., A.L.S.

Hon. Reporter.

Richard T. Lewis, F.R.M.S.

Hon. Librarian.

Alpheus Smith.

Hon. Curator.

Charles Emery.

Excursion Committee.

F. W. Gay, F.R.M.S.
Frederick Oxley, F.R.M.S.
James Spencer, F.R.M.S.
W. W. Reeves, F.R.M.S.
T. Rogers, F.L.S., F.R.M.S.
Edward Dadswell.

PAST PRESIDENTS.

	Elected.
EDWIN LANKESTER, M.D., F.R.S. - -	July, 1865.
ERNEST HART - - - - - - -	„ 1866.
ARTHUR E. DURHAM, F.R.C.S., F.L.S., &c.	„ 1867.
„ „ „ - -	„ 1868.
PETER LE NEVE FOSTER, M.A. - -	„ 1869.
LIONEL S. BEALE, M.B., F.R.S., &c. - -	„ 1870.
„ „ „ - -	„ 1871.
ROBERT BRAITHWAITE, M.D., F.L.S., &c.	„ 1872.
„ „ „ - .	„ 1873.
JOHN MATTHEWS, M.D., F.R.M.S. - -	„ 1874.
„ „ „ - -	„ 1875.
HENRY LEE, F.L.S., F.G.S., F.R.M.S., F.Z.S.	„ 1876.
„ „ „ - -	„ 1877.
THOS. H. HUXLEY, LL.D., F.R.S., &c. -	„ 1878.
T. SPENCER COBBOLD, M.D., F.R.S., F.L.S., &c.	„ 1879.

REPORT OF THE COMMITTEE.

Your Committee have the pleasure of presenting their Fifteenth Annual Report, showing the progress made by the Club during the past year.

Your Committee are again able to announce the renewal of the permission by the Committee of Management of University College for the meetings of the Club to be held here, and take the opportunity of expressing their appreciation of that valuable privilege.

Five members have died since the last Annual Meeting—Mr. T. D'Aubeny, Dr. Dowson, Mr. John Hunter, Mr. D. Sowerby, and Dr. Sharpey. The last-named member rendered the Club most important assistance in obtaining its present place of meeting, and otherwise furthered its interests in former years. His valuable services will not, it is hoped, be forgotten by us.

Nineteen members have resigned—the names of five have been removed from the list for non-payment of several years' subscription. Sixty-one new members have been elected, and our present number is 603.

The communications during the past year have been

numerous and interesting. The principal of them are the following:—

1879.

Aug. 22. "On Collecting and Mounting Spiders' Webs for the Microscope," by Mr. G. Hind.

" " "On a Growing Slide," by Mr. Julien Deby.

Sept. 26. "Inaugural Address," by the President.

" " "On a New Machine for Cutting Sections of Hard Tissues," by Dr. Matthews.

Oct. 24. "On the Germination of a Seed," by Mr. A. Martinelli.

Nov. 28. "On a Method of Dry Mounting," by Professor Hamilton Smith.

" " "On a New Form of Tilting-stage," by Mr. R. G. West.

" " "On the Essential Act of Impregnation in *Achimenes picta*," by the President.

1880.

Jan. 23. "On the Resting Spores of *Protococcus pluvialis*," by Mr. T. Charters White.

" " "On the Association of Bodies resembling *Hydrospermium* with the Degeneration of Hydatid Cysts," by Dr. Horatio Whittell.

" " "On a Specimen of *Ornithobia avicularis*," by Mr. A. D. Michael.

Feb. 27. "On Bleaching and Mounting Microscopical Sections," by Dr. Sylvester Marsh.

" " "On Human and Canine *Filariæ*, from communications by Drs. Manson, Somerville, Bancroft, Da Silva Lima, Paterson, De Magalhaes, and Mortimer Granville." Commuicated, with an Introduction, by the President.

" " "On a New Form of Turn-table," by Mr. C. G. Dunning.

April 23. "On a New British Sponge of the Genus *Raphiodesma*," by Mr. J. G. Waller.

" " "On the Structure of the Stomata of the Holly," by Mr. A. Martinelli.

" " "On a Section Machine," by Mr. E. T. Newton.

May 28. "On the Results of some Recent Excursions," by Dr. M. C. Cooke.

" " "On a Large Specimen of a Flea," by Mr. J. G. Tatem.

May 28. "On *Labidostomma luteum* and *Pygmephorus spinosus*," by Mr. A. D. Michael.

June 25. "Further Observations on *Filariæ*," by the President.

" " "On certain Helminthological Observations," by the President.

" " "On the Histology of Pitcher Plants," by Mr. W. H. Gilburt.

Besides these, there have been several verbal communications, which either have appeared or will appear in the Journal.

The following additions have been made to the Library:—

	PRESENTED BY
Jules Michelet's The Insect (Translation)	*Mr. J. C. Sigsworth.*
Report of the Smithsonian Institution for 1877	*United States Government.*
The Medical and Surgical History of the War of the Rebellion (2nd Medical volume)	" "
Catalogue of the Library of University College	*The Council.*
Quain's Elements of Anatomy	*Mr. J. W. Groves.*
The Woodlands (Natural History Rambles)	*Dr. M. C. Cooke.*
Rutherford's Outlines of Practical Histology	*Mr. J. W. Reed.*
Lubbock's Monograph of the Collembola and Thysanura	*The President.*
Balfour's Treatise on Comparative Embryology. Vol. I.	*Mr. T. Charters White.*
Dr. Braithwâite's Monograph of the British Moss-Flora. Families 1—3	*The Author.*
Proceedings of the Royal Society	*The Society.*
Journal of the Royal Microscopical Society	"
Popular Science Review	*The Publisher.*
Hardwick's Science Gossip	"
Brady's Monograph of the British Copepoda. Vol. II.	*Ray Society, by Subscription.*
American Naturalist	*In Exchange.*
American Journal of Microscopy	"
American Monthly Microscopic Journal	"
Midland Naturalist	"

Beale's How to Work with the Microscope. Fifth Edition	*Purchased.*
Hincks' British Marine Polyzoa	„
Annals and Magazine of Natural History	„
Quarterly Journal of Microscopical Science	„
Grevillea	„

Sundry Reports and Proceedings of Societies and various Pamphlets.

The following donations have been made to the Cabinet of Objects:—

Mr. J. F. Cocken	24
„ T. Curties	1
„ J. Deby	6
The Dinner Committee	20
Mr. F. Enock	3
„ H. Epps	3
„ H. Gibbes	2
„ H. F. Hailes	6
„ A. D. Michael	46
„ H. Morland	4
„ E. T. Newton	17
„ J. W. Reed	8
Dr. H. Stolterfoth	4
Mr. J. G. Tatem	1
„ F. Wood	1
	146

Professor Rupert Jones has presented a portrait of the late Professor Quekett.

The sum of £10 has been given by Miss Morrell as a memorial of the late Mr. James Annett, one of the earliest members of the Club. This sum has been expended in apparatus for the Club Microscope. Mr. Crouch, from whom this apparatus has been purchased, has added a silver side reflector as a donation.

Three numbers of the Journal have been published, containing the communications and proceedings down to the February meeting. Another number is nearly ready, which will include the proceedings of April and May, and part of those of June. In its future publication there will be no avoidable delay; so that papers of interest communicated to the Club may as speedily as possible find their way into various British and Foreign publications of large circulation, and become public property, while advancing the prestige of the Club.

Your Committee have decided, with the approval of Mr. Frank Crisp, to devote the greater part of his donation to the purchase of some valuable books of reference, for which the funds of the Club would not be properly applicable. A portion of the fund will still be retained for its original purpose, should the occasion arise for its appropriation in that manner.

The meetings have been very well attended. On one of the Conversational evenings ladies were admitted, and about 40 availed themselves of the opportunity of examining the numerous and interesting objects exhibited by the members. It will be a matter of consideration whether this experiment can advantageously be repeated.

The Excursions during the past year, though going over the old localities, have been pleasant and instructive; and show that one of the original features of the Club still proves an attraction. It is to be wished that good lists of the micro-

scopic objects usually found in each locality could be prepared by competent persons, and kept for reference and comparison.

Your Committee avail themselves of the opportunity of thanking the Treasurer, Secretaries, Reporter, Librarian, and Curator, for their services to the Club during the past year.

Your Committee look forward with confidence to the continuance of the present prosperity of the Club, and to a wider extension of its career of usefulness in scientific instruction and research.

TREASURER'S STATEMENT OF ACCOUNT.

Dr. June 30th, 1880.	£	s.	d.	Cr. June 30th, 1880.	£	s.	d.
To Balance in hand July 1st, 1879 - -	87	9	3	By Printing and Stationery - - -	34	2	6
,, Subscriptions received - - -	238	5	6	,, Postage - - - - - -	9	11	3
,, Dividends on Compounding-Fees -	1	6	0	,, Attendance, Lighting, &c. - - -	21	6	0
,, Sale of Journals - - - -	12	18	2	,, Property Purchased - - - -	23	16	10
,, Miss Morrell's Donation - - -	10	0	0	,, Petty Expenses - - - -	2	10	9
				,, Journal - - - - - -	118	14	11
				,, Balance in hand - - - -	139	16	8
	£349	18	11		£349	18	11

MR. CRISP'S DONATION FUND ACCOUNT.

	£	s.	d.		£	s.	d.
To Balance in hand July 1st, 1879 - -	45	5	10	By Balance in hand - - - -	45	5	10
	£45	5	10		£45	5	10

Amount invested in New 3 per Cent. Annuities, £40.

We, the undersigned, having examined the above statement of Income and Expenditure, and the Vouchers relating thereto, hereby certify the same to be correct.

WM. HAINWORTH, Jun., } *Auditors.*
JAS. D. HARDY,

HONORARY MEMBERS.

Date of Election.	
Jan. 24, 1868	Arthur Mead Edwards, M.D. (*President of the Newark Scientific Association*), 120, Belleville Avenue, Newark, New Jersey, U.S.A.
Mar. 19, 1869	Rev. E. C. Bolles, Salem, Mass., U.S.A.
July 26, 1872	S. O. Lindberg, M.D., Professor of Botany, University of Helsingfors, Finland.
July 26, 1872	Prof. Hamilton L. Smith, President of Hobart College, Geneva, New York, U.S.A.
July 26, 1872	J. J. Woodward, Assist. Surgeon, U.S. Army, War Department, Surgeon General's Office, Washington, U.S.A.
July 23, 1875	Lionel S. Beale, M.B., F.R.S., F.R.M.S., &c., 61, Grosvenor-street, W.
Sept. 22, 1876	Frederick Kitton, Hon. F.R.M.S., &c., 10, Haymarket, Norwich.
July 25, 1879	W. B. Carpenter, C.B., M.D., F.R.S., &c., &c., 56, Regent's-park-road, N.W.
July 25, 1879	Dr. E. Abbe, University, Jena, Saxe Weimer, Germany.
July 23, 1880	F. H. Wenham, C.E., 3, Gothic Villas, Warbeck Road, Shepherd's Bush, W.

LIST OF MEMBERS.

Date of Election.	
Sept. 24, 1869	Ackland, William, L.S.A., F.R.M.S., 416 Strand, W.C.
June 25, 1880	Adams, Charles Albert, 33 Loughborough-park, Brixton, S.W.
Nov. 28, 1879	Adams, Stephen C., 65 Blomfield-road, Maida-hill, W.
June 23, 1876	Addis, W., 44 Herbert-street, New North-road, Hoxton, N.
Nov. 27, 1868	Adkins, William, 268 Oxford-street, W.
Mar. 23, 1866	Allbon, W., F.R.M.S., 37 Gloucester-place, Portman-square, W.
April 25, 1879	Allen, Edward H., 17 Carlisle-street, W.
Jan. 25, 1878	Allinson, John, M.R.C.S., Oxford-rd., Walthamstow.
June 23, 1876	Allison, Charles, 71 Graham-road, Dalston, E.
July 26, 1872	Alstone, John, Fortis-green, N.
Dec. 17, 1869	Ames, George Acland, F.R.M.S., Union Club, Trafalgar-square, W.C.
Sept. 25, 1868	Andrew, Arthur R., 1, St. George's-villas, Middleton-road, Hornsey, N.
Dec. 22, 1865	Andrew, F. W., 3 Neville-terrace, Onslow-gardens, S.W.
Aug. 22, 1879	Arch, A. J. E., 20 Sydenham-park, Sydenham, S.E.
May 28, 1875	Arrowsmith, Wastell, 99 Adelaide road, Haverstock-hill, N.W.
July 25, 1879	Ashbridge, Arthur, 76 Leadenhall-street, E.C.
Sept. 27, 1878	Ashby, H. T., 8 Bartholomew-road, Kentish-town, N.W.
Nov. 24, 1876	Atkins, Walter George, Mem. Soc. Eng., 62 Fleet-street, E.C.
Dec. 22, 1865	Atkinson, John, 33 Brook-street, W.

Date of Election.	
Feb. 26, 1869	Atkinson, Wm., F.L.S., 47 Gordon-square, W.C.
Jan. 24, 1879	Avery, Arthur, 40 Belsize-park, N.W.
July 23, 1875	Ayling, J. J., 37 Edward-st., Newington-butts, S.E.
June 26, 1874	Badcock, John, F.R.M.S., 278 Victoria-park-road, South Hackney, E.
Dec. 27, 1867	Bailey, John W., 75 Broke-road, Dalston, E.
April 24, 1868	Baker, Chas., F.R.M.S., 244 High Holborn, W.C.
May 25, 1877	Baker, G. Levett, 15 Windsor-road, Denmark-hill, S.E.
Feb. 25, 1876	Ballard, Dr. W. R., jun., 26 Manchester-square, W.
Jan. 24, 1879	Barham, Geo. Titus, Danehurst, Hampstead, N.W.
July 28, 1876	Barnard, Hy., 1 St. Peter's-road, De Beauvoir-square, Kingsland-road, N.
Dec. 27, 1872	Barnard, Herbert, 33 Portland-place, W.
April 22, 1870	Barnes, Chas. Barritt, 4 Egremont-villas, White Horse-lane, South Norwood, S.E.
Aug. 28, 1874	Barnett, E. W., The Larches, Penge-lane, Sydenham, S.E.
Sept. 27, 1872	Bartlett, Edward, jun., L.D.S., M.R.C.S.E., 40 Elgin-road, St. Peter's-park, W.
Oct. 26, 1877	Basevi, Col. G. H., Elm-lodge, Prestbury, Cheltenham.
Dec. 28, 1877	Batchelor, J. A., Avenue-road, Bexley, Kent.
May 22, 1874	Bate, George Paddock, M.D., F.R.C.S.E., F.R.M.S., 412 Bethnal Green-road, E.
July 26, 1878	Battersby, John, 61 Queen's-road, St. John's-wood, N.W.
Mar. 27, 1874	Beach, Richard, J., 59 Ashburton-grove, Lower Holloway, N.
Jan. 25, 1878	Beaman, Geo. Hulme, 80 Moray-road, Tollington-park, N.
May 28, 1869	Bean, Charles E., Brooklyn-house, Goldhawk-road, Shepherd's-bush, W.
Feb. 28, 1879	Bear, John, 2 Birkbeck-grove, Acton, W.
Nov. 26, 1875	Beaulah, John, Bracken-hill, Brigg.
May 24, 1878	Beddard, Frank E., New College, Oxford.
May 26, 1871	Bedwell, Fras. Alfred, M.A., Cantab., F.R.M.S., Fort-hall, Bridlington-quay, Yorkshire.

Date of Election.	
May 28, 1880	Bennett, Lionel C., 48, Ladbroke-grove-road, Notting-hill, W.
Mar. 24, 1871	Bentley, Algernon Royds, 36 Portland-place, W.
Dec. 27, 1867	Bentley, C. S., F.R.M.S., Hazelville-villa, Sunnyside-road, Hornsey-rise, N.
May 22, 1868	Berney, John, F.R.M.S., 61 North-end, Croydon.
Oct. 23, 1868	Bevington, W. A., F.R.M.S., 80 Avondale-square, Old Kent-road, S.E.
Mar. 28, 1879	Bird, Fredk. Elliott, 36 Stockwell-road, Clapham, S.W.
July 28, 1871	Bishop, Wm., 4 Whitley-villas, Caledonian-rd., N.
Feb. 23, 1866	Blake, T., 6 Charlotte-terrace, Brook-green, Hammersmith, W.
Mar. 19, 1869	Blankley, Frederick, F.R.M.S., Brightholm, Oakfield-road, Upper Tollington-park, N.
July 27, 1877	Blenkinsop, Benj., 176, Queen Victoria-st., E.C.
May 26, 1876	Blundell, Joseph, St. George's Club, 2 Savile-row, W.
Jan. 25, 1878	Bogue, David, F.R.M.S., 3 St. Martin's-place, Trafalgar-square, W.C.
Jan. 22, 1875	Bolton, Thos., F.R.M.S., 17 Ann-st., Birmingham.
Jan. 24, 1879	Bond, R. C. C., 36 Keppel-st., Russell-sq., W.C.
May 23, 1879	Bonser, Edward, 51 St. Augustin's-road, Camden-square, N.W.
April 22, 1870	Bossy, Alfred Horsley, Walton-lodge, 118 Stoke Newington-road, N.
Jan. 28, 1876	Bowcher, W., 6 Brownswood-villas, Stroud Green-road, N.
Oct. 27, 1865	Braithwaite, R., M.D., M.R.C.S.E., F.L.S., F.R.M.S., The Ferns, 303 Clapham-road, S.W.
May 25, 1877	Bramhall, Rev. John, R.D., Terrington St. John's, near Lynn, Norfolk.
June 28, 1878	Brewster, W., 25 Myddelton-square, E.C.
May 26, 1876	Brigstock, John Wm., 4 Comberton-road, Upper Clapton, E.
May 27, 1870	Brown, George Dransfield, M.R.C.S., Henley-villa, Uxbridge-road, Ealing, W.
Sept. 26, 1879	Brown, Wm., B. Sc., 16 Blythwood-road, Crouch-end-hill, N.

Date of Election.	
May 22, 1868	Brown, W. J., 4 Marlborough-terrace, Maple-road, Penge, S.E.
May 26, 1871	Browne, George, 45 Victoria-road, Kentish-town, N.W.
May 28, 1875	Browne, J. W., Frascati, Mason's-hill, Bromley, Kent.
Feb. 27, 1872	Browne, Rev. Thomas Henry, F.R.M.S., F.G.S., M.E.S., High Wycombe, Bucks.
Jan. 23, 1880	Browne, Wm. Robert, 90 Morton-rd., Islington, N.
Jan. 26, 1877	Buffham, T. Hughes, 2 Connaught-road, Walthamstow.
Sept. 27, 1872	Bugby, Wm., 2 Grange-park-gardens, Ealing-common, W.
Aug. 22, 1879	Burton, Wm., 27 Wigmore-street, W.
Sept. 27, 1872	Bush, Wm., Hanworth-house, Hanworth.
May 23, 1879	Button, Arthur, 123 Brecknock-road, N.W.
Aug. 24, 1877	Buxton, A. St. Clair, M.R.C.S., L.R.C.P., L.M., 17 Stowe-road, Shepherd's-bush, W.
June 14, 1865	Bywater, Witham M., F.R.M.S., 5 Hanover-sq.W.
Nov. 22, 1878	Cafe, James Watt, 46 Clifton-hill, St. John's-wood, N.W.
June 25, 1880	Cambridge, John, Bury St. Edmund's, Suffolk.
Sept. 22, 1876	Canton, Fredk., L.R.C.P., M.R.C.S., &c., 17 Great Marlborough-street, Regent-street, W.
Dec. 17, 1875	Caplatzi, A., 1 North-crescent, Bedford-square, W.C.
May 23, 1879	Carpenter, H. S., F.R.M.S., Beckington-house, Weighton-road, Anerley, S.E.
July 23, 1880	Carr, Ebenezer, Conrad-villa, Windsor-road, Denmark-hill, S.E.
May 22, 1874	Carruthers, Herbert.
Jan. 23, 1880	Cassidy, Joseph Lamont, M.D., 82 Guildford-st., Russell-square, W.C.
May 26, 1871	Catchpole, Robert, 10 The Mall, Ealing, W.
April 25, 1879	Cazaux, Denis B., F.R.M.S., 61 Finsbury-park-road, N.
April 25, 1879	Chantrell, George F. (*V.P. and late Pres. Liverpool Mic. Soc.*), 1 St. James's-mount, Liverpool.
Dec. 27, 1878	Chatto, Andrew, 214 Piccadilly, W.

Date of Election.	
Oct. 22, 1875	Cheshire, F., Avenue-house, Acton, W.
Nov. 27, 1874	Chippindale, Geo., Grape-villa, Rothschild-road, Turnham-green, W.
Mar. 24, 1876	Clarkson, A., 49 Southampton-street, Pentonville-road, N.
May 22, 1874	Clayton, James, 25 Hemingford-road, Islington, N.
Oct. 25, 1878	Clifford, Rev. H. M., M.A., 43 Onslow-gardens, S.W.
July 25, 1879	Cobbold, T. Spencer, M.D., F.R.S., F.L.S. (*Vice-President*), 74 Portsdown-road, Maida-vale, W.
May 22, 1868	Cocks, W. G., 36 Gayhurst-road, Dalston, E.
Sept. 22, 1876	Cole, Arthur, C., F.R.M.S., St. Domingo-house, Oxford-gardens, Notting-hill, W.
Nov. 27, 1874	Cole, B. G., Laurel-cottage, King's-place, Buckhurst-hill, Essex.
April 24, 1874	Cole, Wm., M.E.S., Laurel-cottage, King's-place, Buckhurst-hill, Essex.
Jan. 25, 1867	Coles, Ferdinand, F.L.S., 18 Brooks-road, Stoke Newington-common, N.
Mar. 24, 1876	Colsell, Geo. Dannett, 5 Austin-friars, E.C.
Feb. 23, 1872	Colvin, Alexander, Beaconside, Penrith, Cumberland.
Sept. 27, 1872	Connolly, Charles, T., L.S.A., 3 Church-hill-villas, Wood-green, N.
June 14, 1865	Cooke, M. C., M.A., LL.D., A.L.S. (*Vice-President, Hon. Sec. for Foreign Correspondence*), 2 Grosvenor-villas, Junction-road, Upper Holloway, N.
Feb. 22, 1867	Cooper, Frank W., L.R.C.S. Edin., Leytonstone, E.
June 27, 1873	Corbett, Alfred L., 103 Fentiman-road, Clapham-road, S.W.
May 28, 1869	Cottam, Arthur, F.R.A.S., H.M. Office of Woods, Whitehall-place, S.W.
Jan. 28, 1876	Cotton, Thos., M.D., 214 Seven-sisters'-road, N.
July 26, 1872	Cowan, Thos. Wm., F.G.S., F.R.M.S., Compton Lea, Horsham, Sussex.
May 25, 1877	Coxhead, Albert C., 47 Russell-square, W.C.
Nov. 28, 1879	Crighton, Arthur J., Farncombe-villa, Godalming.
Aug. 28, 1868	Crisp, Frank, LL.B., B.A.Lond., F.L.S. (*Hon. Sec. Royal Microscopical Society*), 5 Lansdowne-road, Notting-hill, W.

Date of Election.	
Dec. 23, 1870	Crisp, John S., F.R.M.S., Ashville, Lewin-road, Streatham, S.W.
July 26, 1878	Crockford, Wm., 2 St. Peter's-road, Mile-end, E.
Aug. 24, 1877	Croft, R. C., M.D., 204 Camden-road, N.W.
Feb. 23, 1877	Crofton, Edward, M.A. Oxon., F.R.M.S., 45 West Cromwell-road, South Kensington, S.W.
Sept. 28, 1866	Crouch, Henry, F.R.M.S., 66 Barbican, E.C.
June 22, 1877	Cunliffe, P. G., F.R.M.S., The Elms, Handforth, Manchester.
Nov. 26, 1875	Cunningham, Francis Bertram, 8 Durham-terrace, Westbourne-park, W.
June 25, 1880	Curties, Charles Lees, 244 High Holborn, W.C.
May 25, 1866	Curties, Thos., F.R.M.S., 244 High Holborn, W.C.
June 25, 1880	Curties, Walter Irvin, 244 High Holborn, W.C.
Sept. 26. 1879	Curtis, Charles, 29 Baker-street, Portman-sq., W.
Aug. 22, 1879	Cuttell, G. F., 52 New Compton-street, Soho, W.C.
Jan. 22, 1875	Dadswell, Edward (*Hon. Sec. S. Lond. Mic. and Nat. Hist. Soc.*), 42 Barrington-road, Stockwell, S.W.
Nov. 23, 1877	Dallas, Wm. S., F.L.S., &c., The Geological Society, Burlington-house, Piccadilly, W.
May 23, 1879	Dallmeyer, Thos. R., 19 Bloomsbury-street, W.C.
Mar. 22, 1878	Darby, The Ven. Archdeacon, St. Bridget's Rectory, Chester.
Mar. 22, 1878	Darke, Edward, 2 Brecknock-crescent, Camden-road, N.W.
May 23, 1874	Davey, Robert F., War Office, Pall-mall, S.W.
Oct. 22, 1869	Davis, Henry, 19 Warwick-street, Leamington.
May 23, 1879	Dawson, Wm., 24 Abbeygate-street, Bury St. Edmunds, Suffolk.
May 28, 1875	Dean, Arthur, 11 Caxton-street, Addington-road, Bow, E.
Feb. 23, 1877	Death, James, Jun., 38 Gladstone-street, St. George's-road, Southwark, S.E.
Feb. 28, 1879	Debenham, Edw. H., 9 Mincing-lane, E.C.
Jan. 24, 1879	Deby, Julien, C.E., F.R.M.S., 75 Holland-road, Kensington, W.
May 28, 1875	Defriez, Joseph George, M.R.C.S., L.S.A., 173 Bethnal-green-road, E.

Date of Election.	
Feb. 23, 1877	Delferier, Wm. Adrien, 15 Penywern-road, South Kensington, S.W.
Nov. 24, 1876	Despointes, Francis, 16 St. George's-square, Regent's-park-road, N.W.
June 26, 1868	Dickens, Charles, Latimer-house, Hadley, Middlesex.
Jan. 28, 1876	Dillnot, Geo., Hayling, Havant, Hants.
May 23, 1879	Dixon, Wm. Fras., 18 University-street, W.C.
Nov. 24, 1865	Dobson, H. H., F.R.M.S., Holmesdale, Grange-park, Ealing, W.
Nov. 27, 1868	Douglas, Rev. R. C., Manaton-rectory, Moreton-hampstead, Exeter.
Oct. 25, 1878	Dowler, Captain F. E., Naval and Military Club, Piccadilly, W.
Jan. 23, 1880	Dowsett, Geo. Harris, 38 Egerton-road, Blackheath-road, S.E.
Nov. 22, 1878	Drayton, H. F. Ernest, Horton-house, Beckenham, Kent.
July 28, 1871	Drew, G. C., Milton-house-school, Clapton-common, S.E.
July 25, 1879	Driver, Alfred, 8 Victoria-chambers, Westminster, S.W.
Aug. 26, 1872	Dudgeon, R. E., M.D., 53 Montagu-square, W.
Oct. 25, 1872	Dunning, Chas. G., 22 Oseney-crescent, Camden-road, N.W.
Sept. 22, 1865	Durham, Arthur E., F.R.C.S., F.L.S., F.R.M.S., &c., 82 Brook-street, Grosvenor-square, W.
Jan. 24, 1879	Easty, Chas. Wm., 19 Edith-road, St. Mary's-road, Peckham, S.E.
Sept. 25, 1868	Eddy, James Ray, F.R.M.S., F.G.S., The Grange, Carleton, Skipton, Yorkshire.
June 28, 1867	Edmonds, R., 178 Burrage-road, Plumstead, S.E.
May 26, 1876	Emery, Charles (*Hon. Curator*), 6 Laburnam-cottages, Middle-lane, Crouch-end, N.
May 26, 1871	Enock, Fredk., 30 Russell-road, Seven Sisters'-road, N.
Feb. 28, 1879	Epps, Hahnemann, West-house, North-end, Hampstead, N.W.

Date of Election.	
Dec. 27, 1878	Erlebach, H. A., Mill-hill-school, Mill-hill, N.W.
Dec. 17, 1875	Farries, Thomas, F.C.S.
July 25, 1873	Fase, Rev. H. J., 5 Bessborough-gardens, S.W.
June 25, 1875	Faulkner, Hy., jun., Fernwood, Roehampton-park, S.W.
Jan. 28, 1876	Faulkner, John, 2 Mornington-crescent, N.W.
Feb. 27, 1880	Fieldwick, Alfred, jun., 288 Dalston-lane, Hackney, E.
July 26, 1867	Fitch, Frederick, F.R.G.S., F.R.M.S., Hadleigh-house, Highbury New-park, N.
Nov. 28, 1879	Forster, Wm., jun., Cleveland-road, Woodford, Essex.
Mar. 24, 1871	Foulerton, J., M.D., Scientific-club, 4 Savile-row, W.
July 26, 1878	Fowke, Francis, F.R.M.S., 40 Nottingham-place, W.
Dec. 28, 1866	Fox, C. J., F.R.M.S., 26 South Molton-street, Oxford-street, W.
Nov. 26, 1875	Freckelton, Rev. T. W., F.R.M.S., 28A Lonsdale-square, Islington, N.
Jan. 23, 1880	Freeland, Fredk. John, M.R.C.S., J.P., The Infirmary, Chichester.
June 23, 1871	Freeman, Henry E., 1 Templeton-road, Finsbury-park, N.
Feb. 26, 1869	Fricker, C. J., 4 Westow-hill-terrace, Upper Norwood, S.E.
May 22, 1868	Fryer, Geo. H., 82 Belsize-road, N.W.
July 23, 1880	Funston, James, 93 Finsbury-pavement, E.C.
Oct. 26, 1868	Furlonge, W. H., Rossiter-house, Balham, S.W.
Mar. 25, 1870	Garden, Robert Spring, 42 Carlton-hill, St. John's-wood, N.W.
May 25, 1866	Gardiner, G., F.M.S., 23 St. Paul's-road, N.W.
Feb. 26, 1875	Gardner, Edmund, 454 Strand, W.C.
July 27, 1877	Gardner, J. H., A.K.C., Royal Polytechnic Institution, Regent-street, W.
April 24, 1868	Garnham, John, F.R.M.S., 123 Bunhill-row, E.C.
April 23, 1880	Gates, G. W. H., 21 Lombard-street, E.C.
July 7, 1865	Gay, F. W., F.R.M.S. (*Hon. Treasurer*), 113 High Holborn, W.C.

Date of Election.	
Jan. 28, 1870	Gellatly, Peter, Loughton, Essex.
June 25, 1880	George, C. F., M.R.C.S., Kirton-in-Lindsey, Lincolnshire.
July 26, 1867	George, Edward, F.R.M.S., 12 Derby-villas, Forest-hill, S.E.
April 26, 1878	Gibbins, G. W., 44 Parkfield-street, Islington, N.
July 22, 1870	Gibson, Joseph F., F.R.M.S., Clovelly, Wood-church-road, West Hampstead, N.W.
June 14, 1865	Gibson, W., 3 Bridge-street, Westminster, S.W.
April 27, 1877	Gilbertson, Henry, Mangrove-house, Hertford.
Oct. 27, 1876	Gilburt, W. H., F.R.M.S., 48 Wetherell-road, South Hackney, E.
June 27, 1873	Glasspoole, Hampden G., 34 Bernard-st., Russell-square, W.C.
Feb. 25, 1876	Godwin, John, 219 Brompton-road, S.W.
Nov. 22, 1872	Goodchild, J. E., Prospect-hill-lodge, Walthamstow, E.
Nov. 28, 1879	Goodinge, Alfred Charles, 18 Aldersgate-st., E.C.
April 26, 1872	Goodinge, James Wallinger, F.R.G.S., F.R.M.S., 18 Aldersgate-street, E.C.
Nov. 23, 1877	Goodwin, Wm., 93 Birkbeck-road, Hornsey-rise, N.
Mar. 27, 1866	Gray, S. Octavus, Bank of England, E.C.
Dec. 22, 1865	Gray, W. J., M.D., F.R.M.S., 41 Queen Anne-street, Cavendish-square, W.
Nov. 27, 1874	Grayling, J. Francis, Sittingbourne, Kent.
May 22, 1874	Green, G., 6 Helmet-row, St. Luke's, E.C.
Jan. 28, 1870	Green, Nathaniel E., F.R.A.S., 39 Circus-road, St. John's-wood, N.W.
Aug. 22, 1879	Greenhough, D. W., F.R.M.S., South-bank, Breakspeare-road, Lewisham-high-road, S.E.
Oct. 23, 1868	Greenish, T., F.R.M.S., 20 New-street, Dorset-square, N.W.
Oct. 23, 1868	Gregory, Henry R., 1 Wellington-square, King's-road, Chelsea, S.W.
May 22, 1874	Grey, Ernest, 290 Essex-road, Islington, N.
July 24, 1868	Groves, James William, F.R.M.S., 15 Carlyle-square, Chelsea, S.W., and Physiological Laboratory, King's College, W.C.
May 28, 1880	Groves, William, 28 Manor-park, Lee, S.E.

Date of Election.	
July 24, 1868	Grubbe, E. W., C.E., 73 Redcliffe-gardens, S.W.
Jan. 27, 1871	Guimaraens, Augustus de Souza, F.R.M.S., 50 Lowden-road, Herne-hill, S.E.
Aug. 24, 1877	Habirshaw, Fredk., F.R.M.S., 6 West 48th-street, New York, U.S.A.
Aug. 24, 1877	Habirshaw, John, M.D., F.R.M.S., 6 West 48th-street, New York, U.S.A.
Jan. 23, 1874	Hadland, J. H., 11 King William-street, E.C.
Sept. 28, 1877	Hagger, John, Repton-school, Burton-on-Trent.
June 14, 1865	Hailes, Henry F., 4 Westfield-road, Hornsey, N.
Aug. 26, 1870	Hailstone, Robert H., 91 Adelaide-road, N.W.
Feb. 23, 1867	Hainworth, W., jun., Clare-villa, Cricketfield-road, Lower Clapton, E.
July 28, 1876	Halford, Edwd., 18 Leinster-square, Bayswater, W.
Dec. 28, 1866	Hallett, R. J., 123 Seymour-st., Euston-sq., N.W.
Nov. 26, 1875	Halley, Alex. Hay, 7 Elgin-road, Kensington-park, W.
Mar. 28, 1879	Hallowes, Fras., F.R.G.S., F.Z.S., Scientific Club, Savile-row, W.
Feb. 22, 1869	Hammond, A., F.L.S., 13 Rock Mount-road, Central-hill, Norwood, S.E.
June 25, 1880	Hancock, H. S. H., 93 Aden-grove, Stoke Newington, N.
Jan. 24, 1879	Harding, Burcham, 128 Adelaide-road, N.W.
July 23, 1880	Hardingham, Arthur Shortridge, 3 Serjeant's-inn, Chancery-lane, E.C.
July 25, 1879	Hardingham, George Gatton, F.R.M.S., 33 St. George's-square, S.W.
Jan. 23, 1874	Hardy, James Daniel, 73 Clarence-road, Clapton, E.
Sept. 28, 1866	Harkness, W., F.R.M.S., Laboratory, Somerset-house, W.C.
May 23, 1879	Harris, C. J., M.R.C.S., L.S.A., 11 Kilburn-priory, N.W.
June 23, 1871	Harris, Edward, F.R.M.S., Rydal-villa, Longton-grove, Upper Sydenham, S.E.
Jan. 25, 1878	Harrison, D. H., Argyll-villas, Mattock-lane, Ealing, W.
April 23, 1875	Harrison, James, 150 Akerman-road, North Brixton, S.W.

Date of Election.	
July 26, 1872	Harrod, John, Mark-lane-square, E.C.
Jan. 26, 1877	Harvey, G., 45 High-street, Kensington, W.
Mar. 28, 1879	Hawkins, C. E., H.M. Geological Survey, Jermyn-street, S.W.
June 24, 1870	Hawkins, S. J.
June 28, 1867	Hawksley, Thos. P., 97 Adelaide-road, N.W.
Sept. 28, 1877	Headley, Robt., F.R.G.S., 44 Walham-grove, Walham-green, S.W.
Aug. 23, 1872	Hembry, F. W., F.R.M.S., 150 Stockwell-park-road, Brixton, S.W.
June 26, 1868	Henry, A. H., 73 Redcliffe-gardens, S.W.
June 26, 1874	Hewitt, W. W., F.R.M.S., 5 Torriano-gardens, Camden-road, N.W.
May 22, 1868	Hicks, J. J., 8 Hatton-garden, E.C.
June 22, 1877	Hill, R. W., 41 Lothbury, E.C.
Sept. 24, 1869	Hilton, T. D., M.D., Upper Deal, Deal, Kent.
Sept. 28, 1866	Hind, F. H. P., Bartholomew-house, Bartholomew-lane, E.C.
May 22, 1874	Hind, George, 244 High Holborn, W.C.
July 26, 1872	Hinton, Ernest.
Aug. 26, 1870	Hirst, John, F.R.M.S., Ladcastle, Dobcross, Manchester.
Sept. 26, 1879	Hobden, Horace, St. Bartholomew's Hospital, E.C.
Feb. 26, 1875	Holford, Chr., Bounty-office, Dean's-yard, Westminster, S.W.
Jan. 23, 1880	Holland, Chas. Fredk., 14 Wayland-avenue, Sandringham-road, Hackney, E.
April 26, 1867	Hooton, C., Sunningdale-house, Bickerton-road, Upper Holloway, N.
May 22, 1868	Hopkinson, John, F.L.S., F.G.S., F.M.S. (*Hon. Sec. Hertfordshire Nat. Hist. Soc.*), Wansford-house, Watford.
April 28, 1876	Horn, Wm. E., A.I.C.E., 10 Vincent-square, Westminster, S.W.
Oct. 26, 1866	Horncastle, H., Whitemoor-house, near Ollerton, Notts.
June 25, 1869	Houghton, W., Hoe-street, Walthamstow, E.
May 22, 1874	Hovenden, C. W., F.R.M.S., 95 City-road, E.C.
April 26, 1867	Hovenden, F., F.R.M S., Glenlea, Thurlow-park-road, Dulwich, S.E.

Date of Election.	
June 23, 1876	How, Wm. Samuel, 75 Great Portland-street, W.
Oct. 27, 1876	Howard, D., 60 Belsize-park, N.W.
Jan. 22, 1875	Howard, F. W., The Grove, Teddington.
Oct. 25, 1878	Howling, W. E., Crowley's Brewery, Alton, Hants.
Feb. 25, 1870	Hudleston, W. H., J.P., F.G.S., 23 Cheyne-walk, S.W.
Feb. 28, 1879	Hudson, C. T., M.A., LL.D. Cantab., V.P.R.M.S., Manilla Hall, Clifton, Bristol.
Jan. 26, 1872	Hudson, Robert, F.R.S., F.L.S., F.R.M.S., &c., Clapham-common, S.W.
Nov. 28, 1879	Hughes, R. J., L.R.C.P., L.R.C.S., L.M., 15 Queen's-road, Finsbury-park, N.
Jan. 23, 1880	Hunt, Fredk., York-lodge, Stamford-hill, N.
Dec. 28, 1866	Hunt, W. H. B., F.R.M.S., 23 Eversholt-street, Oakley-square, N.W.
Dec. 22, 1876	Hunter, J. J., 20 Cranbourne-street, W.C.
July 25, 1873	Hurst, John Thomas, Royal Engineer Office, Portsmouth.
Nov. 25, 1870	Hutton, Rev. Wyndham M., Hungarton Vicarage, Leicester.
June 28, 1878	Huxley, Prof. T. H., F.R.S., &c., Science Schools, South Kensington, S.W.
May 24, 1867	Ingpen, J. E., F.R.M.S. (*Hon. Secretary*), 7 The Hill, Putney, S.W.
May 23, 1879	Isaac, Thos., Maldon, Essex.
Aug. 22, 1873	Israel, S., 18 Stepney-green, Mile-end-road, E.
Dec. 17, 1869	Jackson, B. D. (*Hon. Sec. Linnean Society*), F.R.M.S., 30 Stockwell-road, S.W.
Dec. 17, 1875	Jackson, C. L., F.Z.S., F.R.M.S., Hill Fold, Sharples, Bolton.
July 24, 1868	Jackson, F. R., Culver-cottage, Slindon, Arundel, Sussex.
June 25, 1880	Jacques, Walter, 2 Fenchurch-buildings, E.C.
June 14, 1865	Jaques, Edward, B.A., F.R.M.S., H.M. Office of Woods, Whitehall-place, S.W.
Feb. 28, 1873	Jenkins, J. W., 1 St. John's-hill, Wandsworth, S.W.

Date of Election.	
July 24, 1868	Jennings, Rev. Nathaniel, M.A., F.R.A.S., 1 Grove-terrace, Highgate-road, N.W.
Jan. 25, 1867	Johnson, John A., 15 Wellington-road, Stoke Newington, N.
Feb. 24, 1871	Johnson, M. Hawkins, F.R.M.S., F.G.S., 379 Euston-road, N.W.
June 23, 1876	Johnson, Tom Richard.
Feb. 23, 1877	Johnston, J. M. C., 161 Grove-lane, Camberwell, S.E.
Mar. 24, 1871	Johnstone, James, Stanhope-lodge, Bideford.
Oct. 25, 1872	Jones, E. W., F.R.A.S., F.R.M.S., 53 Cowley-road, North Brixton, S.W.
Feb. 28, 1873	Jones, Geo. J., 50 Loughborough-road, Stockwell, S.W.
June 25, 1875	Jones, J. Birdsall, F.R.M.S., The Athenæum, Liverpool.
Nov. 25, 1870	Jones, Lieut.-Col. Lewis, St. Bernards, Maple-road, Surbiton.
May 23, 1873	Jones, Captain Loftus F., United Service Club, Pall Mall, S.W.
June 23, 1876	Jones, Thomas E., 46 Park-street, Stoke Newington, N.
May 22, 1874	Jones, W. W., 14 Lancaster-street, Lancaster-gate, Hyde-park, W.
May 23, 1873	Karop, Geo. C., M.R.C.S., &c, 198 Holland-road, Kensington, W.
Dec. 27, 1878	Kellow, Frank C., Commercial-road, Guildford.
Aug. 23, 1867	Kiddle, Edward, The War Office, Pall Mall, S.W.
Mar. 19, 1869	Kilsby, Thomas W., 4 Brompton-villas, Edmonton.
Dec. 23, 1870	King, Robert, F.R.M.S., Fern-house, Upper Clapton, E.
May 24, 1878	King, Wm. Talbot, M.D., M.R.C.S., 74 Victoria-park-road, South Hackney, E.
April 26, 1867	Kirk, Joseph, 11 Blossom-st., Norton Folgate, E.
Nov. 27, 1874	Kirkman, Rev. Joshua, Thurlow-road, South Hampstead, N.W.
Feb. 28, 1873	Kitsell, Francis J., 7 John's-terrace, Latymer-road, W.

Date of Election.	
Mar. 23, 1877	Kluht, H. J., 42 Westbourne-grove, Bayswater, W.
Oct. 24, 1873	Knight, John Mackenzie, 50 Bow-road, E.
Nov. 25, 1870	Ladd, Wm., F.R.A.S., F.R.M.S., 12 Beak-street, Regent-street, W.
Nov. 23, 1866	Lambert, W., 1 New Broad-street, E.C.
Jan. 24, 1879	Lancaster, Arthur H., 7 Campden-hill-gardens, Kensington, W.
Mar. 22, 1867	Lancaster, Thos., Bownham-house, Stroud, Gloucestershire.
May 25, 1877	Lane-Fox, Hon. Sackville F. H.
May 28, 1875	Larkin, John, 24 Charterhouse-square, E.C.
May 28, 1875	Laws, Joseph C., 41 St. John's-park, Upper Holloway, N.
June 25, 1869	Layton, Charles E., 12 Upper Hornsey-rise, N.
Aug. 28, 1868	Leaf, C. J., F.L.S., F.R.M.S., &c. (*President of the Old Change Microscopical Society*), Old Change, E.C.
Mar. 19, 1869	Lee, Henry, F.L.S., F.R.M.S., &c., Ethelbert-house, Margate.
May 27, 1874	Leefe, Frederick Ewbank, 289 Goswell-road, E.C.
June 23, 1876	Leeson, Herbert Seymour, 4 Old-buildings, Lincoln's-inn, W.C.
Oct. 25, 1867	Leifchild, J. R., M.A., 21 St. Lawrence-road, Notting-hill, W.
Sept. 22, 1865	Leighton, W. H., 2 Merton-place, Chiswick, W.
July 25, 1873	Le Pelley, C., 17 Underwood-street, Shepherdess-walk, Hoxton, N.
April 27, 1866	Lewis, R. T., F.R.M.S. (*Hon. Reporter*), 1 Lowndes-terrace, Knightsbridge, S.W.
June 26, 1868	Lindley, W., jun., 29 Blittersdorffs Platz, Frankfort-on-Maine.
May 26, 1871	Locke, John, 16 Georgiana-street, Camden-town, N.W.
April 23, 1869	Long, Henry, 90 High-street, Croydon.
Nov. 24, 1866	Lovibond, J. W., F.R.M.S., St. Anne-street, Salisbury.
Sept. 22, 1865	Lovick, T., 53 Queen's-crescent, Haverstock-hill, N.W.

Date of Election.	
Dec. 18, 1868	Lowne, B. Thompson, F.R.C.S., F.L.S., F.Z.S., 65 Cambridge-gardens, Bayswater, W.
April 27, 1866	Loy, W. T., F.R.M.S., Garrick-chambers, 11 Garrick-street, W.C.
Nov. 23, 1866	McIntire, S. J., F.R.M.S., 14 Hettley-road, Uxbridge-road, Shepherd's-bush, W.
Jan. 26, 1872	Mackechnie, J. Hamilton, M.D., 60 Wimpole-street, Cavendish-square, W.
Jan. 23, 1880	Mackenzie, James, Warden-villa, Uxbridge-road, Ealing, W.
June 28, 1878	Magor, John Bernard, L.D.S., 24 Chapel-street, Penzance.
July 26, 1874	Magor, Thomas, M.D., Myddelton-rd., Hornsey, N.
Feb. 28, 1879	Mann, James H.
Sept. 27, 1872	Manning, H.E. the Cardinal Archbishop, Archbishop's House, Westminster, S.W.
Jan. 23, 1880	Martin, Francis, R.N., H.M.S. "Hydra," Sheerness.
Sept. 22, 1876	Martin, W. H., 11 Markham-square, Chelsea, S.W.
Dec. 27, 1867	Martinelli, A., 106 Albany-street, N.W.
Dec. 27, 1878	Martiney, M. G., 11 Castlenau-gardens West, Barnes, S.W.
April 26, 1867	Matthews, G. K., St. John's-lodge, Beckenham, Kent.
Oct. 26, 1866	Matthews, John, M.D., F.R.M.S. (*Vice-President*), 30 Colebrooke-row, Islington, N.
Jan. 26, 1877	Matthews, Wavell, 12 Wigmore-street, W.
Sept. 24, 1869	Matthews, William, 374 Camden-road, N.
May 26, 1871	May, John William, F.R.M.S., Arundel-house, Percy-cross, Fulham, S.W.
Feb. 27, 1874	May, Lewis J., 371 Holloway-road, N.
Dec. 17, 1875	May, Thomas, 14 Smirk's-road, Old Kent-rd., S.E.
Feb. 25, 1876	May, W. R., 69 St. Mark's-square, Dalston, E.
Mar. 22, 1867	Meacher, John W., 10 Hillmarten-road, Camden-road, N.
Feb. 28, 1879	Menzies, James, 13 Leighton-grove, N.W.
May 22, 1874	Messenger, G. A., 21 Glengall-grove, Old Kent-road, S.E.
Dec. 18, 1868	Mestayer, Richard, F.L.S., F.R.M.S., 7 Buckland-crescent, Belsize-park, N.W.

Date of Election.	
July 27, 1877	Michael, Albert D., F.L.S., F.R.M.S., 3 & 4 Great Winchester-street, E.C.
May 28, 1880	Miles, Andrew, 185 Camden-grove, Peckham, S.E.
July 7, 1865	Millett, F. W., F.R.M.S., 13 Milner-square, Islington, N.
May 25, 1866	Moginie, W., F.R.M.S., 26 Lichfield-grove, Finchley, N.
Jan. 23, 1874	Moreland, Richard, jun., M.I.C.E., F.R.M.S., 4 The Quadrant, Highbury, N.
July 26, 1878	Morland, Henry, Cranford, near Hounslow.
Oct. 27, 1866	Morrieson, Colonel R., F.R.M.S., Oriental Club, Hanover-square, W.
Dec. 27, 1876	Morris, J. Griffith, M.R.C.S., 135 St. Owen-street, Hereford.
Oct. 27, 1876	Morris, W. G., L.D.S., 12 White-friars, Chester.
Nov. 23, 1877	Morten, T. S., 42 Haverstock-hill, N.W.
Jan. 24, 1879	Murray, James, Osborne-house, 50 Percy-road, Shepherd's-bush, W.
Jan. 25, 1867	Murray, R. C., 69 Jermyn-st., St. James's, S.W.
Mar. 23, 1866	Nation, W. J., 30 King-square, Goswell-road, E.C.
Feb. 22, 1878	Needham, S. H., F.R.G.S., F.G.S., 5 Mecklenburg-street, Mecklenburg-square, W.C.
Mar. 24, 1876	Nelson, Edward M., 9 Marlborough-hill, N.W.
Mar. 24, 1871	Nelson, James, 3 Oakden-street, Kennington road, S.E.
Feb. 28, 1879	Nesbitt, Henry, 12 Victoria-villas, Kilburn, N.W.
May 23, 1879	Newcombe, Prout, Northcote, East Croydon.
Nov. 23, 1877	Newth, A. H., M.D., Scientific Club, 4 Savile-row, W.
Jan. 26, 1872	Newton, Edwin Tulley, F.G.S., Geological Museum, Jermyn-street, S.W.
Feb. 27, 1880	Niven, George, 41 Albert-road, Finsbury-park, N.
May 22, 1874	Nixon, Philip Charles, Oporto.
Aug. 24, 1877	Oates, Parkinson, M.D., L.S.A., M.R.C.S., 48 Lupus-street, S.W.
Jan. 24, 1879	Offord, John Milton, 31 Hereford-square, S.W.
Dec. 22, 1876	Ogilvy, C. P., F.L.S., Sizewell-house, Leiston, near Saxmundham, Suffolk.

Date of Election.	
May 24, 1878	O'Hara, Lt.-Col. Richard, F.R.M.S. (late Royal Artillery), West-lodge, Galway.
June 22, 1877	Oswin, Frederick, F.S.A., 10 Gower-street, W.C.
Dec. 27, 1867	Oxley, Frederick, F.R.M.S., 8 Crosby-square, Bishopsgate-street, E.C.
July 25, 1879	Palmer, Greville H., 95 Cornwall-gardens, S.W.
May 22, 1874	Palmer, Thomas, B.Sc., F.R.M.S., Holme Lee, Lower Camden, Chislehurst, Kent.
Oct. 27, 1871	Parsons, Fred. A., 90 Leadenhall-street, E.C.
Dec. 28, 1877	Partridge, Thos., M.D., Stroud, Gloucestershire.
April 23, 1875	Peal, C. N., Fernhurst, Mattock-lane, Ealing, W.
May 22, 1874	Pearce, George Alonzo Creech, B.A., M.B., B.C.N., 26 Gracechurch-street, E.C.
May 24, 1867	Pearce, George, Villa Helvetia, Tufnell-park, N.
Feb. 23, 1872	Pearce, W. E. Grindley, L.R.C.P., 24 Bessborough-gardens, S.W.
April 27, 1877	Pearcy, Alfred Copley, 31 Packington-street, Islington, N.
May 24, 1867	Pearson, John, 212 Edgware-road, W.
Dec. 22, 1876	Perry, George, 82 Finborough-road, South Kensington, S.W.
Oct. 27, 1865	Pickard, J. F., 195 Great Portland-street, W.
May 23, 1879	Pilcher, Wm. John, F.R.C.S., &c., Boston, Lincolnshire.
Jan. 22, 1869	Pillischer, M., F.R.M.S., 88 New Bond-street, W.
Nov. 24, 1871	Pitts, Frederick, Harvard-house, St. John's-hill, Clapham, S.W.
Sept. 27, 1878	Plomer, Geo. Danl., F.R.M.S., 48 Springfield-road, St. John's-wood, N.W.
Sept. 28, 1877	Pocklington, Henry, F.R.M.S., Cedar-grove, Armley, Leeds.
Nov. 23, 1866	Potter, George, F.R.M.S., 42 Grove-road, Holloway, N.
Jan. 25, 1878	Potts, R. A., 26 South Audley-street, W.
June 22, 1866	Powe, I., 71 George-street, Richmond, Surrey.
May 25, 1866	Powell, Hugh, F.R.M.S., 170 Euston-road, N.W.
April 25, 1879	Powell, Hugh Peter, The Butts, Brentford.
May 26, 1876	Powell, J. T., 146 Glenarm-road, Lower Clapton, E.

Date of Election.	
July 7, 1865	Powell, Thomas, 18 Doughty-street, Mecklenburg-square, W.C.
July 24, 1874	Powell, Thomas Henry, 116 Denmark-hill, S.E.
Jan. 22, 1875	Power, H. D'Arcy, F.L.S., 109 Camberwell New-road, S.W.
April 25, 1879	Preedy, Wm. Halcomb, 41 Oseney-crescent, Camden-road, N.W.
June 27, 1873	Priest, B. W., 22 Parliament-street, S.W.
May 23, 1879	Pritchard, J. D., Crymlyn Burrows, near Swansea.
July 26, 1867	Pritchett, Francis, 131 Fenchurch-street, E.C.
April 23, 1868	Quekett, Alfred J. S., 51 Warwick-road, Maida-hill, W.
April 23, 1868	Quekett, Arthur Edwin, 51 Warwick-road, Maida-hill, W.
April 23, 1868	Quekett, Rev. William, The Rectory, Warrington.
Feb. 23, 1866	Quick, George E., 109 Long-lane, Bermondsey, S.E.
Oct. 26, 1866	Rabbits, W. T., Highfield, Dartmouth-park, Forest-hill, S.E.
Sept. 24, 1869	Radcliffe, J. D.
June 25, 1875	Radford, W. S., M.D., F.R.M.S., Sidmouth.
Oct. 26, 1866	Ramsden, Hildebrand, M.A. Cant., F.L.S., F.R.M.S., 26 Upper Bedford-place, Russell-square, W.C.
Aug. 28, 1868	Rance, T. G., Elmside, Bickley, Kent.
May 22, 1868	Rawles, W., 64 Kentish-town-road, N.W.
July 23, 1880	Read, Rev. Wm., M.A., F.R.A.S., F.R.M.S., &c., Worthing, Sussex.
June 27, 1879	Readaway, Wm., 39 Robert-street, Hampstead-road, N.W.
Dec. 27, 1878	Reed, John Murray, 43 Walham-grove, S.W.
June 22, 1877	Reed, John W., F.R.G.S., 27 Clarence-street, Islington, N.
June 27, 1873	Reeve, Fredk., 37 Fentiman-road, Clapham-road, S.W.
July 7, 1865	Reeves, W. W., F.R.M.S., 30 Ashburnham-grove, Greenwich, S.E.
May 22, 1874	Reid, Wm. Wardlaw, 16 Warwick-place, Peckham-rye, S.E.

Date of Election.	
Mar. 25, 1870	Richardson, Thomas Hyde, 1 Belgrave-villas, Holmesdale-road, Selhurst, S.E.
May 23, 1879	Rideout, Wm. (*Hon. Sec. Bolton Microscopical Club*), Hulliwell, Bolton.
June 25, 1869	Roberts, John H., F.R.C.S., 82 Finchley-road, St. John's-wood, N.W.
April 26, 1872	Roberts, S. Hackett, F.R.M.S.
May 22, 1868	Rogers, John, F.R.M.S., 4 Tennyson-street, Nottingham.
Oct. 26, 1866	Rogers, Thomas, F.L.S., F.R.M.S., Selmeston-house, Thurlow-park-road, West Dulwich.
Mar. 22, 1872	Rolfe, Charles Spencer, 5 Westminster-chambers, S.W.
May 22, 1868	Roper, Freeman C. S., F.L.S., F.G.S., F.R.M.S., Palgrave-house, Eastbourne, Sussex.
June 23, 1876	Roper, Henry John, F.R.M.S., 5 Lausanne-road, Peckham, S.E.
Oct. 27, 1876	Roper, Robert, 29 Hampton-road, Upton, Essex.
July 24, 1868	Rowe, James, jun., M.R.C.V.S., 65 High-street, Marylebone, W.
May 23, 1879	Rowe, Thos. Smith, M.D., Cecil-square, Margate.
Oct. 26, 1866	Rowlett, John, 92 Enville-road, Walworth, S.E.
July 14, 1865	Ruffle, G. W., F.R.M.S., 131 Blackfriars-road, S.E.
July 24, 1874	Rushton, William, 61 Tufnell-park-road, Holloway, N.
Oct. 27, 1865	Russell, James, 10 High-street, Shoreditch, E.
Oct. 26, 1866	Russell, Joseph, Blenheim-house, Middle Mall, Hammersmith, S.W.
May 22, 1868	Russell, Thomas D., 21 Park-road, West Dulwich, S.E.
Feb. 22, 1867	Rutter, H. Lee, 1 St. Barnabas-villas, Lansdowne-circus, South Lambeth, S.W.
Feb. 27, 1880	Ryley, Thomas, Lee Park-house, Blackheath, S.E.
Nov. 22, 1878	Sabel, Ernest E., 185 Maida-vale, W.
May 23, 1873	Salkeld, Lt.-Colonel J. C., F.R.M.S., 29 St. James's-street, S.W.
Dec. 27, 1878	Salmon, C. W., 137 Graham-road, Hackney, E.

Date of Election.	
Dec. 17, 1869	Salmon, John, 24 Seymour-street, Euston-square, N.W.
Dec. 28, 1877	Sands, Chas., 5 Woburn-place, Russell-sq., W.C.
May 28, 1875	Saul, Geo. William.
June 27, 1879	Sawyer, Geo. D., F.R.M.S., 55 Buckingham-place, Brighton.
Feb. 27, 1880	Schulze, Adolf, 1 St. James's-street, Hillhead-square, Glasgow.
Feb. 26, 1875	Scofield, W. J., M.R.C.S., F.L.S., 13 South Hill Park-gardens, Hampstead, N.W.
May 24, 1872	Sequeira, H. L., M.R.C.S., 1 Jewry-street, Aldgate, E.C.
July 27, 1868	Sewell, Richard, Ashmore-house, Keston, Kent.
July 23, 1880	Shaw, Henry Vincent, Fir Croft, Keymer, Hurstpierpoint, Sussex.
Oct. 22, 1869	Shaw, Wm. Forster, Mosshall-grove, Finchley, N.
Oct. 24, 1879	Shelley, A. J., 1 Trevor-square, S.W.
May 26, 1876	Shepheard, Thomas, F.R.M.S., 12 Bridge-street, Row, Chester.
May 26, 1871	Sigsworth, J. C., F.R.M.S., 18 Chaucer-road, Herne-hill, S.E.
June 27, 1873	Simmonds, Joseph E.
Aug. 23, 1867	Simmons, James J., L.D.S., 18 Burton-crescent, Euston-road, N.W.
May 26, 1876	Simpson, Edwd., 24 Grummant-road, Peckham-road, S.E.
Nov. 23, 1877	Simpson, Thomas, Audley-lodge, Florence-road, Ealing, W.
Mar. 27, 1868	Simson, Thos.
May 28, 1869	Sketchley, H. G., 75 Bailgate, Lincoln.
Dec. 28, 1866	Slade, J., Fern-villa, Lion-rd., Bexley-heath, Kent.
Oct. 23, 1868	Smart, William, 27 Aldgate, E.
May 25, 1866	Smith, Alpheus (*Hon. Librarian*), 42 Choumert-road, Rye-lane, Peckham, S.E.
April 23, 1880	Smith, Archd. S., Silvermere, Cobham, Surrey.
Oct. 26, 1877	Smith, Bernard E., Aucklands, Wandsworth-common, S.W.
July 25, 1879	Smith, Charles Vance, 5 Parade, Carmarthen.
Feb. 25, 1876	Smith, Edward, F.S.S., St. Mildred's-house, Poultry, E.C.

Date of Election.	
Mar. 25, 1870	Smith, Francis Lys, 3 Grecian-cottages, Crown-hill, Norwood, S.E.
June 27, 1873	Smith, G. J., 73 Farringdon-street, E.C.
Oct. 26, 1866	Smith, H. Ambrose, 2 King William-street, E.C.
June 26, 1868	Smith, James, F.L.S., F.R.M.S., 233 Dalston-lane, Hackney, E.
Dec. 23, 1870	Smith, Joseph A., Granville-lodge, Croydon-road, Penge, S.E.
Oct. 26, 1877	Smith, Samuel, 331 Hackney-road, E.
Feb. 28, 1873	Smith, W. Lepard, Southfield-house, Watford.
Aug. 23, 1872	Smith, W. Stuart, 30 Loraine-road, Holloway, N.
April 24, 1868	Snellgrove, W., 58 Cranfield-road, Wickham-park, S.E.
Aug. 22, 1879	Soames, H. A., Ravenscroft, Bromley, Kent.
May 24, 1878	Southey, A., 145 Fenchurch-street, E.C.
Sept. 22, 1865	Southwell, C., 44 Princes-street, Soho, W.
May 26, 1876	Southwell, Chas. Wm., 35 Douglas-road, Canonbury, N.
May 22, 1874	Spencer, James, F.R.M.S., 50 South-street, Greenwich, S.E.
June 26, 1876	Spencer, John, Brook's Bank, 81 Lombard-street, E.C.
Nov. 22, 1872	Spencer, Thomas, F.C.S., F.R.M.S., 32 Euston-square, N.W.
Mar. 24, 1866	Starling, Benjamin, 9 Gray's-inn-square, W.C.
Aug. 23, 1878	Steel, John Henry, M.R.C.V.S., F.Z.S., The Royal Veterinary College, Camden-town, N.W.
Feb. 23, 1872	Stevens, C. R., 7 Ashby-road, Canonbury, N.
Aug. 24, 1866	Steward, J. H., F.R.M.S., 406 Strand, W.C.
June 22, 1877	Stewart, Chas., M.R.C.S., F.L.S., *Hon. Sec. R.M.S.*, &c. (*Vice-President*), St. Thomas' Hospital and 42, Sinclair-road, Kensington, W.
April 23, 1880	Stewart, Fredk. (*Hon. Sec. New Cross Mic. Soc.*), 25 Lime-villas, Foxberry-road, Brockley, S.E.
Sept. 22, 1876	Stiles, M. H.
May 23, 1879	Stocken, James, 40 Euston-square, N.W.
Jan. 23, 1880	Stœssiger, Fredk. Aug., 70 Windsor-road, Holloway, N.
Mar. 19, 1869	Stokes, Frederick.

Date of Election.	
July 25, 1879	Stone, Edwd. Mulready, Hill-side, West-hill, Sydenham.
Oct. 27, 1871	Stuart, David John, 14 The Avenue, Hornsey-park, N.
May 23, 1879	Stubbins, John, F.G.S., Chester-cottage, Old-lane, Halifax.
May 23, 1879	Sturt, Clifton, King's-college, W.C., and The University, Melbourne, Australia.
July 7, 1865	Suffolk, W. T., F.R.M.S., Stettin-lodge, St. Faith's-road, Lower Norwood, S.E.
June 27, 1873	Suter, Edward D., Kent-lodge, Douglas-road-north, Canonbury, N.
June 24, 1870	Swain, Ernest, 34 Elsham-road, Kensington, W.
Nov. 22, 1867	Swainston, J. T., 3 St. Mark's-square, Regent's-park, N.W.
Nov. 24, 1866	Swansborough, E., 20 John-st., Bedford-row, W.C.
Dec. 18, 1868	Swift, James, 43 University-street, W.C.
Dec. 17, 1875	Swift, Mansell J., 43 University-street, W.C.
Jan. 23, 1880	Symons, Wm. Hy., F.G.S., 2 Queen's-terrace, St. John's-wood, N.W.
July 27, 1877	Tanqueray, A. C., Reid's Brewery, Theobald's-road, E.C.
Sept. 28, 1877	Tarrant, Kenneth J., Litchford-house, Hatch-end, Pinner.
Nov. 28, 1879	Tasker, J. G., 18 Junction-rd., Upper Holloway, N.
Aug. 22, 1879	Tate, J. W., 6 Clarendon-terrace, Brentford-road, Turnham-green, W.
May 22, 1868	Tatem, J. G., Russell-street, Reading.
Aug. 23, 1878	Teasdale, Washington, F.R.M.S., Rosehurst, Headingley, Leeds.
Dec. 22, 1865	Terry, J., 109 Borough-road, S.E.
Aug. 23, 1872	Terry, Thomas, 5 Austin-friars, E.C.
July 23, 1869	Thin, James, Ormiston-lodge, Claremont-place, Brixton-road, S.W.
May 23, 1879	Thompson, Isaac Cooke (*Hon. Sec. Liverpool Microscopical Soc.*), Woodstock, Waverley-rd., Liverpool.
May 28, 1875	Thomson, John Reid, 18 Highbury-place, N.
Feb. 24, 1871	Thornthwaite, W. H., 416 Strand, W.C.

Date of Election.	
April 27, 1877	Thorpe, George, 20 Eastcheap, E.C.
Jan. 22, 1875	Tinney, William A., Clifford's-inn, Fleet-st., E.C.
Nov. 27, 1867	Tomkins, Samuel Leith, Apsley, East Grinstead.
June 23, 1871	Topping, Amos, 28 Charlotte-street, Caledonian-road, N.
July 26, 1872	Townsend, John Sumsion, F.R.M.S., Stamford-lodge, St. John's, Sevenoaks.
July 24, 1868	Tulk, John A., M.D., F.R.M.S., Burton-lodge, Staines-road, Twickenham.
July 26, 1867	Turnbull, Joseph, Laurel-house, North-hill, Highgate, N.
Aug. 24, 1877	Turner, Ernest Blaker, 46 Malmesbury-road, Bow, E.
June 25, 1869	Turner, R. D., Roughway, near Tonbridge.
June 25, 1875	Turner, Sydney, A.R.I.B.A., 7 Mark-lane, E.C.
May 25, 1877	Veasey, Robt. Geo., Ashchurch-lodge, Ashchurch-road, Shepherd's-bush, W.
July 27, 1866	Veitch, Harry, F.H.S., The Royal Exotic Nursery, King's-road, Chelsea, S.W.
Feb. 28, 1879	Venables, W., 253 Camden-road, N.W.
Feb. 27, 1880	Vereker, The Hon. J. G. P., 10 Warwick-sq., S.W.
May 23, 1879	Vezey, John Jewell, F.R.M.S., 39 St. Donatt's-road, New Cross, S.E.
June 25, 1880	Waddington, Henry J., 10 Evering-villas, Upper Clapton, E.
Feb. 27, 1874	Walker, John C., Highfield, Avenue-road, Crouch-end, N.
July 25, 1873	Walker, John Stringer, Warwick-road, Upper Clapton, E.
June 26, 1868	Walker, J. W., Fairfield-house, Watford.
May 22, 1868	Waller, J. G., 68 Bolsover-street, Portland-road, W.
Jan. 23, 1880	Wallis, Whitworth, 4 The Residences, South Kensington, S.W.
Oct. 26, 1877	Walters, W., B.A. Lond., 3 Park-road-terrace, Forest-hill, S.E.
Aug. 26, 1870	Warburton, Samuel, Merton-villa, New-road, Lower Tooting, S.W.

Date of Election.	
Nov. 22, 1867	Ward, F. H., M.R.C.S., F.R.M.S., Springfield-house, near Tooting, S.W.
June 28, 1878	Ward, Richard John, Silver-street, Lincoln.
Dec. 18, 1868	Warner, Alfred, care of Mr. W. F. Stanley, 13 Railway-approach, London-bridge, S.E.
May 25, 1866	Warrington, H. R., 7 Royal Exchange, Cornhill, E.C.
July 25, 1879	Waterman, Thos. L., 103 Antill-road, Bow, E.
Oct. 27, 1865	Watkins, C. A., 10 Greek-street, Soho, W.
Oct. 25, 1872	Watkins, J., L.C.P., 40 Store-street, Bedford-square, W.C.
Aug. 23, 1878	Watson, Geo. F., 313 High Holborn, W.C.
Nov. 28, 1879	Watson, Robert Walker, 22 Highbury-new-park, N.
Sept. 28, 1877	Watson, Thos., P., 313 High Holborn, W.C.
Dec. 28, 1877	Watson, Thos. W., 4 Pall Mall, S.W.
May 23, 1879	Watts, The Rev. G. E., M.A., F.R.M.S., Kensworth Vicarage, Dunstable, Herts.
Dec. 28, 1866	Way, T. E., 65 Wigmore-street, W.
Oct. 26, 1877	Weatherley, Capt. H. C. S., 64 Cheapside, E.C.
July 24, 1874	Webb, C. E., Wildwood-lodge, North-end, Hampstead, N.W.
April 25, 1879	Webster, Hy. Wm., M.D., St. George's Infirmary, Fulham-road, West Brompton, S.W.
May 24, 1867	Weeks, A. W. G., 36 Gunter-grove, West Brompton, S.W.
Sept. 27, 1878	West, Robt. G., 39 Lombard-street, E.C.
Feb. 25, 1876	Wheeler, George, 27 Tibberton-street, Islington, N.
May 23, 1879	Wheldon, John, F.R.M.S., 58 Great Queen-street, Lincoln's-inn-fields, W.C.
April 23, 1869	White, Charles Frederick, F.R.M.S., 42 Windsor-road, Ealing, W.
May 22, 1868	WHITE, T. CHARTERS, M.R.C.S., L.D.S., F.L.S., F.R.M.S. (*President*), 32 Belgrave-rd., S.W.
July 25, 1873	White, Walter, Litcham, Norfolk.
June 25, 1875	Whitney, Edward Underwood, 13 Great College-street, Westminster, S.W.
Aug. 22, 1879	Whittell, Horatio, T., M.D., F.R.M.S., 112 Ledbury-road, W.
June 25, 1880	Wickes, Wm. Dickerson, 65 Malmesbury-rd., Bow, E.
July 24, 1868	Wight, James F., F.R.M.S., Grazeley, Gipsy-hill, Upper Norwood, S.E.

Date of Election.	
April 23, 1880	Williams, Arthur, 48 Osnaburg-street, Regent's-park, N.W.
Mar. 24, 1871	Williams, George, F.R.M.S., 1 Devonport-road, Shepherd's-bush, W.
Nov. 23, 1877	Williams, Geo. Sawyer, 10 Clifton-villas, Maida-hill, W.
May 28, 1880	Williams, J. Michael, The Hawthorns, Bootle, Liverpool.
June 23, 1876	Williams, Jas. W., New-court, St. Swithin's-lane, E.C.
Oct. 24, 1873	Williams, John R., F.R.M.S., 59 Albion-road, Stoke Newington, N.
June 27, 1879	Willson, James, 2 Oval-road, Regent's-park, N.W.
Mar. 24, 1876	Wilson, Chas. Joseph, 14 Highbury-crescent, N.
Feb. 22, 1867	Wilson, Frank, 110 Long-acre, W.C.
Jan. 24, 1879	Wilson, S. K., F.R.G.S., F.R.M.S., M.R.I., 3 Portland-terrace, Regent's park, N.W.
April 23, 1880	Winney, Hy. John, 1 Shorters-court, Throgmorton-street, E.C.
Oct. 24, 1879	Wood, Fergus H., 30 Gauden-road, Clapham, S.W.
June 27, 1879	Wood, Francis, 63 Mayfield-road, Dalston, E.
Aug. 27, 1869	Woods, W. Fell, 1 Park-hill, Forest-hill, S.E.
Jan. 28, 1876	Woollett, John, 58 Cloudesley-road, Islington, N.
Oct. 25, 1867	Worthington, Richard, Champion-park, Denmark-hill, S.E.
June 27, 1873	Wrey, George E. B., Addington-house, Addington-road, Reading.
Aug. 22, 1879	Wright, Bryce McMurdo, 54 Guildford-street, Russell-square, W.C.
May 25, 1877	Yates, Francis, Rockwood, Surbiton-hill.
Jan. 25, 1878	Yates, Robert, 64 Park-street, Southwark, S.E.
Oct. 26, 1866	Yeats, Christopher, Mortlake, Surrey, S.W.

NOTICE.

Members are requested to give the Hon. Secretary early information of any change of Residence, so as to prevent miscarriage of Journals and Circulars.

RULES.

I.—That the Quekett Microscopical Club hold its meetings at University College, Gower Street, on the fourth Friday Evening in every month, at Eight o'clock precisely, or at such other time or place as the Committee may appoint.

II.—That the business of the Club be conducted by a Committee, consisting of a President, four Vice-Presidents, an Honorary Treasurer, one or more Honorary Secretaries, an Honorary Secretary for Foreign Correspondence, an Honorary Reporter, an Honorary Librarian, an Honorary Curator, and twelve other members,—six to form a quorum. That the President, Vice-Presidents, Treasurer, Secretaries, Reporter, Librarian, Curator, and the four senior members of the Committee (by election) retire annually, but be eligible for re-election. That the Committee may appoint a stipendiary Assistant Secretary, who shall be subject to its direction.

III.—That at the ordinary Meeting in June, nominations be made of Candidates to fill the offices of President, Vice-Presidents, Treasurer, Secretaries, Reporter, Librarian, Curator, and vacancies on the Committee. That such nominations be made by resolutions duly moved and seconded, no Member being entitled to propose more than one Candidate. That the President, Vice-Presidents, Treasurer, Secretaries, Reporter, Librarian, and Curator, be nominated by the Committee. That a list of all nominations made as above be printed upon the ballot paper; the nominations for vacancies upon the Committee being arranged in such order as shall be determined by lot, as drawn by the President and Secretary. That at the Annual General Meeting in July all the above officers be elected by ballot from the candidates named in the lists, but any member is at liberty to substitute on his ballot-paper any other name or names in lieu of those nominated for the offices of President, Vice-Presidents, Treasurer, Secretaries, Reporter, Librarian, and Curator.

IV.—That in the absence of the President and Vice-Presidents the Members present at any ordinary Meeting of the Club elect a Chairman for that evening.

V.—That every Candidate for Membership be proposed by two or more Members, who shall sign a certificate (see Appendix) in recommendation of him—one of the proposers from personal knowledge. The certificate shall be read from the chair, and the Candidate therein recommended balloted for at the following Meeting. Three black balls to exclude.

VI.—That the Club include not more than twenty Honorary Members, elected by the Members by ballot upon the recommendation of the Committee.

VII.—That the Annual Subscription be Ten Shillings, payable in advance on the 1st of July, but that any Member elected in May or June be exempt from subscription until the following July. That any Member desirous of compounding for his future subscription may do so at any time by payment of the sum of Ten Pounds; all such sums to be duly invested in such manner as the Committee shall think fit. That no person be entitled to the full privileges of the Club until his subscription shall have been paid; and that any Member omitting to pay his subscription six months after the same shall have become due (two applications in writing having been made by the Treasurer) shall cease to be a Member of the Club.

VIII.—That the accounts of the Club be audited by two Members, to be appointed at the ordinary Meeting in June.

IX.—That the Annual General meeting be held on the fourth Friday in July, at which the Report of the Committee on the affairs of the Club, and the Balance Sheet duly signed by the Auditors shall be read. Printed lists of Members nominated for election as President, Vice-Presidents, Treasurer, Secretaries, Reporter, Librarian, Curator, and Members of the Committee having been distributed, and the Chairman having appointed two or more Members to act as Scrutineers, the Meeting shall then proceed to ballot. If from any cause these elections, or any of them, do not take place at this Meeting, they shall be made at the next ordinary Meeting of the Club.

X.—That at the ordinary Meetings the following business be transacted:—The minutes of the last Meeting shall be read and confirmed; donations to the Club since the last Meeting announced and exhibited; ballots for new Members taken; papers read and discussed; and certificates for new Members read; after which the Meeting shall resolve itself into a Conversazione.

XI.—That any Member may introduce a Visitor at any ordinary Meeting, who shall enter his name with that of the Member by whom he is introduced in a book to be kept for the purpose.

XII.—That no alteration be made in these Laws, except at an Annual General Meeting, or a Special General Meeting called for that purpose; and that notice in writing of any proposed alteration be given to the Committee, and read at the ordinary Meeting at least a month previous to the Annual or Special Meeting at which the subject of such alteration is to be considered.

APPENDIX.

Form of Proposal for Membership.

Quekett Microscopical Club.

Mr.

of

being desirous of becoming a Member of this Club, we beg to recommend him for election.

(*on my personal knowledge*).

This Certificate was read 18

The Ballot will take place 18

MEETINGS

OF THE

QUEKETT MICROSCOPICAL CLUB,

AT

UNIVERSITY COLLEGE, GOWER STREET, LONDON.

1880.—August	13	....	27
September	10	....	24
October	8	....	22
November	12	....	26
December	10	....	*
1881.—January	14	....	28
February	11	....	25
March	11	....	25
April	8	....	22
May	13	....	27
June	10	....	24
July	8	....	22

* December 24—No Meeting.

The Ordinary Meetings are held on the *fourth* Friday in each month:—business commences at 8 o'clock p.m.

The Meetings on the *second* Friday in the month are for Conversation and Exhibition of Objects; from 7 to 9.30 p.m.

The Annual General Meeting will be held on July 22nd, 1881, at 8 o'clock, for Election of Officers and other Business.

EXCURSIONS, 1880.

April 3rd.	BARNES. To meet at Waterloo Station, Richmond Line.
April 17th.	CHISLEHURST. To meet at Charing Cross Station.
May 1st.	SNARESBROOK. To meet at Fenchurch Street Station at 2 o'clock.
May 15th.	TOTTERIDGE, returning by Mill Hill. To meet at Moorgate Street Station.
May 29th.	NORTHFLEET, for SWANSCOMBE. To meet at Cannon Street Station.
June 12th.	CATERHAM, for GODSTONE. To join the Croydon Club. To meet at Cannon Street Station.
June 18th.	EXCURSIONISTS' ANNUAL DINNER. Arrangements will be duly announced.
June 26th.	WOKING, returning by Weybridge. To meet at Waterloo, Suburban Station, Main Line.
July 3rd.	BRIGHTON, DAY EXCURSION. To meet at London Bridge Station (Aquarium Train), 9.30 a.m.
July 10th.	HAMPTON COURT. To meet at Waterloo, Suburban Station, Main Line.
July 24th.	CHINGFORD. To meet at Liverpool Street Station.
Sept. 4th.	BROMLEY, for KESTON. To meet at Holborn Viaduct Station.
Sept. 18th.	HOMERTON. To meet at Broad Street Station, at 3 p.m.
Oct. 2nd.	WANDSWORTH. To meet at Clapham Junction at 3 o'clock.

The time of departure from Town, unless otherwise specified, will be the First Train after TWO o'clock.

E. Dadswell,
F. W. Gay,
F. Oxley,
W. W. Reeves,
T. Rogers,
J. Spencer,
} Excursion Committee.

SIXTEENTH REPORT

OF THE

QUEKETT MICROSCOPICAL CLUB,

LIST OF MEMBERS,

PRESIDENT'S ADDRESS, &c.

MEETING AT UNIVERSITY COLLEGE, LONDON, ON THE SECOND AND FOURTH FRIDAYS OF EVERY MONTH.

LONDON.

July 1881.

(*Extract from original Prospectus, July* 1865.)

"The want of such a Club as the present has long been felt, wherein "Microscopists and Students with kindred tastes might meet at stated periods "to hold cheerful converse with each other, exhibit and exchange specimens, "read papers on topics of interest, discuss doubtful points, compare notes of "progress, and gossip over those special subjects in which they are more or "less interested: where, in fact, each member would be solicited to bring his "own individual experience, be it ever so small, and cast it into the treasury "for the general good. Such are some of the objects which the present Club "seeks to attain. In addition thereto it hopes to organize occasional Field "Excursions, at proper seasons, for the collection of living specimens; to "acquire a Library of such books of reference as will be most useful to "enquiring students; and, trusting to the proverbial liberality of Micro-"scopists, to add thereto a comprehensive Cabinet of Objects. By these and "similar means, the Quekett Microscopical Club seeks to merit the support "of all earnest men who may be devoted to such pursuits; and, by fostering "and encouraging a love for Microscopical studies, to deserve the approval "of men of science and more learned Societies."

OFFICERS AND COMMITTEE.

(Elected July 1881.)

President.

T. Charters White, M.R.C.S., F.L.S., F.R.M.S.

Vice-Presidents.

M. C. Cooke, M.A., LL.D., A.L.S.
Edward Dadswell.
J. W. Groves, F.R.M.S.
Charles Stewart, M.R.C.S., F.L.S., F.R.M.S.

Committee.

J. W. Reed, F.R.G.S., F.R.M.S.
J. C. Sigsworth, F.R.M.S.
W. H. Gilburt, F.R.M.S.
J. W. Goodinge, F.R.G.S., F.R.M.S.
H. F. Hailes.
A. D. Michael, F.L.S., &c.
E. T. Newton, F.G.S.
W. W. Reeves, F.R.M.S.
T. S. Cobbold, M.D., F.R.S., &c.
J. Matthews, M.D., F.R.M.S.
B. W. Priest.
J. G. Waller.

Hon. Treasurer.

F. W. Gay, F.R.M.S., 113, High Holborn, W.C.

Hon. Secretary.

J. E. Ingpen, F.R.M.S., 7, The Hill, Putney, S.W.

Hon. Secretary for Foreign Correspondence.

M. C. Cooke, M.A., LL.D., A.L.S.

Hon. Reporter.

Richard T. Lewis, F.R.M.S.

Hon. Librarian.

Alpheus Smith.

Hon. Curator.

Charles Emery.

Excursion Committee.

Edward Dadswell.
F. W. Gay, F.R.M.S.
Frederick Oxley, F.R.M.S.
W. W. Reeves, F.R.M.S.
T. Rogers, F.L.S., F.R.M.S.
James Spencer, F.R.M.S.

PAST PRESIDENTS.

		Elected.
EDWIN LANKESTER, M.D., F.R.S. - -	July,	1865.
ERNEST HART - - - - - - -	„	1866.
ARTHUR E. DURHAM, F.R.C.S., F.L.S., &c.	„	1867.
„ „ „ - -	„	1868.
PETER LE NEVE FOSTER, M.A. - -	„	1869.
LIONEL S. BEALE, M.B., F.R.S., &c. - -	„	1870.
„ „ „ - -	„	1871.
ROBERT BRAITHWAITE, M.D., F.L.S., &c.	„	1872.
„ „ „ - .	„	1873.
JOHN MATTHEWS, M.D., F.R.M.S. - -	„	1874.
„ „ „ - -	„	1875.
HENRY LEE, F.L.S., F.G.S., F.R.M.S., F.Z.S.	„	1876.
„ „ „ - -	„	1877.
THOS. H. HUXLEY, LL.D., F.R.S., &c. -	„	1878.
T. SPENCER COBBOLD, M.D., F.R.S., F.L.S., &c.	„	1879.

REPORT OF THE COMMITTEE.

Your Committee, in presenting the Sixteenth Annual Report, need only to refer, under the usual heads, to the record of the work done during the past year, to indicate the position and progress of the Club.

The courtesy shown to the Club by the Council of University College continues unabated; and the permission to hold our meetings here has been most kindly renewed for the ensuing year.

The deaths of two members, Mr. W. H. Furlonge and Mr. A. J. Shelley, have been recorded. The former gentleman was well known among us in the earlier years of the Club, when he brought several interesting communications before the meetings. Twenty-four members have resigned, six have been struck off for being several years in arrear of subscription, forty-two new members have been elected; thus bringing our present number to 613.

The following are the principal communications made to the Club during the past year:—

1880.

August. "On some Immature Forms of Diatomaceæ," by Mr. G. C. Karop.

"On a method of Dry Mounting for Opaque Objects," by Mr. H. J. Roper.

August. "On Mounting Opaque Objects with Beeswax," by Mr. Hy. Morland.

"On the use of Arabin in Mounting," by Mr. H. J. Waddington.

Sept. "On a Simple Growing Slide," by the President.

Oct. "On New Fresh-water Algæ discovered during the year," by Dr. M. C. Cooke.

Nov. "On a New Live Trough or Vivarium," by Mr. J. D. Hardy.

"On some Specimens of *Strongylus*," by Dr. T. S. Cobbold.

1881.

Jan. "On the Natural History and Histology of Sponges," by Mr. B. W. Priest.

"On the Periodicity of Filarial Migrations," by Dr. Manson, communicated by Dr. Cobbold.

Feb. "On a Zoophyte Trough Live-box or Vivarium," by the Rev. H. J. Fase.

March. "On *Cliona celata*," by Mr. J. G. Waller.

"On the Histology of Sponges," additional paper, by Mr. B. W. Priest.

April. "On *Cliona*," additional paper, by Mr Waller.

"On the Histology of the Gustatory Organs of the Rabbit's Tongue," by the President.

June. "On an Undescribed Sponge of the genus *Polymastia*," by Mr. B. W. Priest.

"On some Peculiarities in the Leaves of *Bomaria*," by Mr. W. H. Gilburt.

Several short communications have also been made, and will be found recorded in the Proceedings. Some of these are notices or descriptions of objects brought for exhibition. Such communications are frequently of much interest; and the practice of giving short accounts of objects, to be followed by the examination of the specimens, is a very beneficial one.

The following books have been added to the Library by donation, exchange, and purchase:—

	PRESENTED BY
Harris and Power's Manual for the Physiological Laboratory	*Mr. J. W. Groves.*
McAlpine's Biological Atlas	"
Greene's Manual of the Protozoa and Cœlenterata	*Mr. J. E. Ingpen.*
Huxley's "The Crayfish"	*Mr. J. C. Sigsworth.*
Curiosities of Entomology	*Dr. J. Matthews.*
Kirby and Spence's Entomology	"
Journal of the Linnean Society	*Mr. T. Charters White.*
Dr. Braithwaite's Monograph of the British Moss-Flora, Parts 2—4	*The Author.*
Reinsch's New Investigations into the Microscopical Structure of Coal	"
Report of the Smithsonian Institution for 1879	*U.S. Government.*
Proceedings of the Royal Society	*The Society.*
Journal of the Royal Microscopical Society	"
Popular Science Review	*The Publisher.*
Hardwicke's Science Gossip	"
J. Edwards Smith's How to See with the Microscope	*Purchased.*
Wythe's Microscopist	"
W. Saville Kent's Infusoria, Parts 1—3	"
Van Heurck's Synopsis of the Diatoms of Belgium, Parts 1—3	"
Rye's British Beetles	"
Rymer Jones's Animal Kingdom	"
Sach's Text-Book of Botany	"
Harley and Brown's Demonstrations on Microscopical Histology	"
Brady's Monograph of the Copepoda. Vol. III.	*Subscription to Ray Society.*
Buckton's Monograph of the British Aphides. Vol. III.	" "
American Naturalist	*In Exchange.*
American Monthly Microscopical Journal	"
The Northern Microscopist	"
Annals and Magazine of Natural History	*Purchased.*
Quarterly Journal of Microscopical Science	"
Grevillea	"

Reports and Proceedings of various Societies, and sundry Pamphlets.

The balance of Mr. Crisp's donations has also, in accordance with his request, been expended in the purchase of books, of which the following is a list:—

Bell's British Stalk-eyed Crustacea.
Bate and Westwood's Sessile-eyed Crustacea.
Nicholson's Palæontology. 2 vols.
Bentham's British Flora. 2 vols.
Harvey's Phycologia Britannica. 4 vols.
Newman's British Moths.
„ Butterflies.
Walker's Diptera. 3 vols.
Stainton's Tineina. 1 vol.
Reports of H.M.S. Challenger Expedition. Vols. I. and II.
Stein's Infusoria. 4 vols.
Hepp's Lichen Flora.
Burmeister's Entomology, translated by Schuckard.
Leidy's Freshwater Rhizopods of North America.
Klein and Noble Smith's Atlas of Histology.

The following donations of objects to the Cabinet have been made:—

	SLIDES.
By The President	4
„ Mr. J. Crowther	2
„ The Rev. H. J. Fase	9
„ Mr. H. E. Freeman	4
„ Mr. H. Morland	4
„ Mr. E. M. Nelson	2
„ Mr. E. T. Newton	1
„ Mr. B. W. Priest	9
„ Mr. J. W. Reed	3
„ Mr. W. H. Symons	2
„ Mr. C. Vance Smith	7
	47

Four Photographs have been presented for the Album.

A donation of special interest has been received from the Royal Microscopical Society, being a bronze copy of their "Quekett" medal. It forms a pleasing memento of an honoured name, as well as a recognition of the friendly feeling existing between the Royal Microscopical Society and the Club.

The publication of the Journal has, from unavoidable circumstances, fallen considerably in arrear. The papers and proceedings down to April 8th are, however, now in the press, and will be in the hands of the members in the course of a few days. The remainder, to the present date, will follow as speedily as possible.

By the permission of the College, a "Special Exhibition Meeting" was held on the 29th of April last. This meeting was attended by about 200 members and more than 300 visitors. A large number of beautiful and interesting specimens were shown under about 80 microscopes. This result appears to justify the holding of similar meetings at suitable intervals.

The Excursions of the past season have been less successful than in some previous years, not on account of any decrease in the interest taken in them by the members, but partly from the fact that on some of the days (which have to be fixed long in advance) the weather proved unfavourable, and partly from the necessity of travelling longer distances than formerly to reach suitable localities; thus increasing the difficulties of arrangement, and making the attendance more uncertain. It should be remembered, however, that circumstances unfavourable to one branch of microscopy

may be well suited to others; and the botanical results of some of the excursions have been very satisfactory.

Your Committee offer their cordial thanks to the Officers of the Club for their long-continued honorary services, to the efficient performance of which the Club owes so much of its present prosperity.

Your Committee hope that the Club, while pursuing the course which has hitherto proved successful, will not be unmindful of the necessity for continued exertions, to meet the ever-increasing demand for scientific culture.

TREASURER'S STATEMENT OF ACCOUNT.

Dr. June 30th, 1881.	£	s.	d.
To Balance in hand July 1st, 1880 - -	139	16	8
,, Subscriptions received - - -	239	10	6
,, Compounding Fee to Invest - -	10	0	0
,, Dividends on Compounding Fees -	1	6	0
,, Sale of Journals - - - -	12	1	6
,, Balance of Mr. Crisp's Donations -	45	5	10
	£448	0	6

Cr. June 30th, 1881.	£	s.	d.
By Printing and Stationery - - -	30	4	2
,, Postage, Carriage, &c. - - -	9	2	4
,, Attendance, Lighting, and College Expenses - - - - -	32	10	0
,, Property purchased - - - -	22	12	10
,, Journal - - - - - -	102	18	4
,, Expenses of "Special Exhibition" Meeting - - - - -	15	16	8
,, Books Purchased with Balance of Mr. Crisp's Donations - - -	45	5	10
,, Compounding Fee Invested - -	10	0	0
,, Petty Expenses - - - - -	4	19	6
,, Balance at Banker's - - - -	174	10	10
	£448	0	6

Amount invested in New 3 per Cent. Annuities, £50.

We, the undersigned, having examined the above statement of Income and Expenditure, and the Vouchers relating thereto, hereby certify the same to be correct.

WM. HAINWORTH, JUN.,
H. T. WHITTELL, } *Auditors.*

HONORARY MEMBERS.

Date of Election.	
Jan. 24, 1868	Arthur Mead Edwards, M.D., 120, Belleville Avenue, Newark, New Jersey, U.S.A.
Mar. 19, 1869	The Rev. E. C. Bolles, Salem, Mass., U.S.A.
July 26, 1872	S. O. Lindberg, M.D., Professor of Botany, University of Helsingfors, Finland.
July 26, 1872	Prof. Hamilton L. Smith, President of Hobart College, Geneva, New York, U.S.A.
July 26, 1872	J. J. Woodward, Assist. Surgeon, U.S. Army, War Department, Surgeon General's Office, Washington, U.S.A.
July 23, 1875	Lionel S. Beale, M.B., F.R.S., F.R.M.S., &c., 61, Grosvenor-street, W.
Sept. 22, 1876	Frederick Kitton, Hon., F.R.M.S., &c., 2, Bedford-street, Unthank-road, Norwich.
July 25, 1879	W. B. Carpenter, C.B., M.D., F.R.S., &c., &c., 56, Regent's-park-road, N.W.
July 25, 1879	Dr. E. Abbe, University, Jena, Saxe Weimer, Germany.
July 23, 1880	F. H. Wenham, C.E., 3, Gothic Villas, Warbeck Road, Shepherd's Bush, W.

LIST OF MEMBERS.

Date of Election.	
Sept. 24, 1869	Ackland, William, L.S.A., F.R.M.S., 416 Strand, W.C.
June 25, 1880	Adams, Charles Albert, 33 Loughborough-park, Brixton, S.W.
Nov. 28, 1879	Adams, Stephen C., 65 Blomfield-road, Maida-hill, W.
June 23, 1876	Addis, W., 44 Herbert-street, New North-road, Hoxton, N.
Nov. 27, 1868	Adkins, William, 268 Oxford-street, W.
June 24, 1881	Alabone, Edwin W., M.D., 175 Highbury-new-park, N.
Mar. 23, 1866	Allbon, W., F.R.M.S., 37 Gloucester-place, Portman-square, W.
April 25, 1879	Allen, Edward H., 17 Carlisle-street, Soho-square, W.
June 23, 1876	Allison, Charles, 71 Graham-road, Dalston, E.
July 26, 1872	Alstone, John, 14 Richmond-crescent, Barnsbury, N.
Dec. 17, 1869	Ames, George Acland, F.R.M.S., Union Club, Trafalgar-square, W.C.
Sept. 25, 1868	Andrew, Arthur R., 1 St. George's-villas, Middleton-road, Hornsey, N.
Dec. 22, 1865	Andrew, F. W., 3 Neville-terrace, Onslow-gardens, S.W.
Aug. 22, 1879	Arch, A. J. E., 20 Sydenham-park, Sydenham, S.E.
May 28, 1875	Arrowsmith, Wastell, 99 Adelaide road, Haverstock-hill, N.W.
July 25, 1879	Ashbridge, Arthur, 76 Leadenhall-street, E.C.
Sept. 27, 1878	Ashby, H. T., 8 Bartholomew-road, Kentish-town, N.W.

Date of Election.	
Dec. 22, 1865	Atkinson, John, 33 Brook-street, W.
Feb. 26, 1869	Atkinson, Wm., F.L.S., 47 Gordon-square, W.C.
July 23, 1875	Ayling, J. J., 47 Chantry-road, Stockwell, S.W.
June 26, 1874	Badcock, John, F.R.M.S., 270 Victoria-park-road, South Hackney, E.
Dec. 27, 1867	Bailey, John W., 75 Broke-road, Dalston, E.
April 24, 1868	Baker, Chas., F.R.M.S., 244 High Holborn, W.C.
May 25, 1877	Baker, G. Levett, 15 Windsor-road, Denmark-hill, S.E.
Feb. 25, 1876	Ballard, Dr. W. R., jun., 26 Manchester-square, W.
Jan. 24, 1879	Barham, Geo. Titus, Danehurst, Hampstead, N.W.
July 28, 1876	Barnard, Henry.
Dec. 27, 1872	Barnard, Herbert, 33 Portland-place, W.
April 22, 1870	Barnes, Chas. Barritt, 4 Egremont-villas, White Horse-lane, South Norwood, S.E.
Aug. 28, 1874	Barnett, E. W., The Larches, Penge-lane, Sydenham, S.E.
Sept. 27, 1872	Bartlett, Edward, jun., L.D.S., M.R.C.S.E., 40 Elgin-road, St. Peter's-park, W.
Oct. 26, 1877	Basevi, Col. G. H., Elm Lodge, Prestbury, Cheltenham.
Dec. 28, 1877	Batchelor, J. A., Avenue-road, Bexley, Kent.
May 22, 1874	Bate, George Paddock, M.D., F.R.C.S.E., F.R.M.S., 412 Bethnal Green-road, E.
Mar. 27, 1874	Beach, Richard J., 36 Eden-grove, Hornsey, N.
Jan. 25, 1878	Beaman, Geo. Hulme.
May 28, 1869	Bean, Charles E., Brooklyn-house, Goldhawk-road, Shepherd's-bush, W.
Feb. 28, 1879	Bear, John.
Nov. 26, 1875	Beaulah, John, Bracken-hill, Brigg.
May 24, 1878	Beddard, Frank E., New College, Oxford.
May 26, 1871	Bedwell, Fras. Alfred, M.A. Cantab., F.R.M.S., Fort Hall, Bridlington Quay, Yorkshire.
May 28, 1880	Bennett, Lionel C., 48 Ladbroke-grove-road, Notting-hill, W.
Mar. 24, 1871	Bentley, Algernon Royds, 36 Portland-place, W.
Dec. 27, 1867	Bentley, C. S., F.R.M.S., Hazelville-villa, Sunnyside-road, Hornsey-rise, N.

Date of Election.	
May 22, 1868	Berney, John, F.R.M.S., 61 North-end, Croydon.
Oct. 23, 1868	Bevington, W. A., F.R.M.S., 80 Avondale-square, Old Kent-road, S.E.
Mar. 28, 1879	Bird, Fredk. Elliott, 42 Overton-road, Brixton, S.W.
July 28, 1871	Bishop, Wm., 549 Caledonian-road, N.
May 27, 1881	Bishopp, O. S., F.R.M.S., Oak-villa, Muswell-hill, N.
Feb. 23, 1866	Blake, T., 6 Charlotte-terrace, Brook-green, Hammersmith, W.
Mar. 19, 1869	Blankley, Frederick, F.R.M.S., Brightholm, Oakfield-road, Upper Tollington-park, N.
July 27, 1877	Blenkinsop, Benj., 176 Queen Victoria-street, E.C.
May 26, 1876	Blundell, Joseph, 24 Davies-st., Berkeley-sq., W.
Jan. 25, 1878	Bogue, David, F.R.M.S., 3 St. Martin's-place, Trafalgar-square, W.C.
Jan. 22, 1875	Bolton, Thomas, F.R.M.S., 57 Newhall-street, Birmingham.
Jan. 24, 1879	Bond, R. C. C., 36 Keppel-st, Russell-sq., W.C.
April 22, 1870	Bossy, Alfred Horsley, Walton-lodge, 118 Stoke Newington-road, N.
May 27, 1881	Botterill, C., 13 Bentley-road, Liverpool.
Oct. 27, 1865	Braithwaite, R., M.D., M.R.C.S.E., F.L.S., F.R.M.S., The Ferns, 303 Clapham-road, S.W.
May 25, 1877	Bramhall, Rev. John, R.D., Terrington St. John's, near Lynn, Norfolk.
June 28, 1878	Brewster, W., 25 Myddleton-square, E.C.
May 26, 1876	Brigstock, John Wm., 4 Comberton-road, Upper Clapton, E.
May 27, 1870	Brown, George Dransfield, M.R.C.S., Henley-villa, Uxbridge-road, Ealing, W.
Sept. 26, 1879	Brown, Wm., B. Sc., 3 Elm-cottages, Middle-lane, Hornsey, N.
May 22, 1868	Brown, W. J., 1 Lorne-villas, Stodart-road, Anerley.
May 26, 1871	Browne, George, 45 Victoria-road, Kentish-town, N.W.
May 28, 1875	Browne, J. W., Frascati, Mason's-hill, Bromley, Kent.
Feb. 27, 1872	Browne, Rev. Thomas Henry, F.R.M.S., F.G.S., M.E.S., High Wycombe, Bucks.

Date of Election.	
Jan. 23, 1880	Browne, Wm. Robert, 90 Morton-rd., Islington, N.
Jan. 26, 1877	Buffham, T. Hughes, 2 Connaught-road, Walthamstow.
Jan. 28, 1881	Burt, C. W., 5 Surrendale-place, Sutherland-gardens, W.
Aug. 22, 1879	Burton, Wm., 27 Wigmore-street, W.
Sept. 27, 1872	Bush, Wm., Hanworth-house, Hanworth.
May 23, 1879	Button, Arthur, 123 Brecknock-road, N.W
June 14, 1865	Bywater, Witham M., F.R.M.S., 5 Hanover-sq. W.
Nov. 22, 1878	Cafe, James Watt, 46 Clifton-hill, St. John's-wood, N.W.
June 25, 1880	Cambridge, John, Bury St. Edmund's, Suffolk.
Sept. 22, 1876	Canton, Fredk., L.R.C.P., M.R.C.S., &c., 17 Great Marlborough-street, Regent-street, W.
Dec. 17, 1875	Caplatzi, A., 1 North-crescent, Bedford-square, W.C.
May 23, 1879	Carpenter, H. S., F.R.M.S., Beckington-house, Weighton-road, Anerley, S.E.
July 23, 1880	Carr, Ebenezer, 9 Park-villas, Bromar-road, Denmark-hill, S.E.
May 22, 1874	Carruthers, Herbert.
Jan. 23, 1880	Cassidy, Joseph Lamont, M.D., 82 Guildford-st., Russell-square, W.C.
May 26, 1871	Catchpole, Robert, 10 The Mall, Ealing, W.
April 25, 1879	Cazaux, Denis B., F.R.M.S., 61 Finsbury-park-road, N.
April 25, 1879	Chantrell, George F. (*V.P. and late Pres. Liverpool Mic. Soc.*), 1 St. James's-mount, Liverpool.
Dec. 27, 1878	Chatto, Andrew, 214 Piccadilly, W.
Oct. 22, 1875	Cheshire, F., Avenue-house, Acton, W.
Nov. 27, 1874	Chippindale, Geo., Grape-villa, Rothschild-road, Turnham-green, W.
Mar. 24, 1876	Clarkson, A., 49 Southampton-street, Pentonville-road, N.
May 22, 1874	Clayton, James, 25 Hemingford-road, Islington, N.
Oct. 25, 1878	Clifford, Rev. H. M., M.A., 43 Onslow-gardens, S.W.
Aug. 27, 1880	Close, J. A., 449 Strand, W.C.
July 25, 1879	Cobbold, T. Spencer, M.D., F.R.S., F.L.S., 74 Portsdown-road, Maida-vale, W.

Date of Election.	
May 22, 1868	Cocks, W. G., 36 Gayhurst-road, Dalston, E.
Sep. 22, 1876	Cole, Arthur, C., F.R.M.S., St. Domingo-house, Oxford-gardens, Notting-hill, W.
Nov. 27, 1874	Cole B. G., Laurel-cottage, King's-place, Buckhurst-hill, Essex.
April 24, 1874	Cole, Wm., M.E.S. Laurel-cottage, King's-place, Buckhurst-hill, Essex.
Jan. 25, 1867	Coles, Ferdinand, F.L.S., 18 Brooks-road, Stoke Newington-common, N.
Mar. 24, 1876	Colsell, Geo. Dannett, 5 Austin-friars, E.C.
Feb. 23, 1872	Colvin, Alexander, Beaconside, Penrith, Cumberland.
Sep. 27, 1872	Connolly, Charles, T., L.S.A., 3 Church-hill-villas, Wood-green, N.
June 14, 1865	Cooke, M. C., M.A., LL.D., A.L.S. *(Vice-President, Hon. Sec. for Foreign Correspondence)*, 146 Junction-road, Upper Holloway, N.
Feb. 22, 1867	Cooper, Frank W., L.R.C.S. Edin., Leytonstone, E.
June 27, 1873	Corbett, Alfred L., 103 Fentiman-road, Clapham-road, S.W.
May 28, 1869	Cottam, Arthur, F.R.A.S., H.M. Office of Woods, Whitehall-place, S.W.
July 26, 1872	Cowan, Thos. Wm., F.G.S., F.R.M.S., Compton Lea, Horsham, Sussex.
May 25, 1877	Coxhead, Albert C., 47 Russell-square, W.C.
Nov. 28, 1879	Crighton, Arthur J., Farncombe-villa, Godalming.
Aug. 28, 1868	Crisp, Frank, LL.B., B.A., F.L.S. *(Sec. Royal Microscopical Society)*, 5 Lansdowne road, Notting-hill, W.
Dec. 23, 1870	Crisp, John S., F.R.M.S., Ashville, Lewin-road, Streatham, S.W.
July 26, 1878	Crockford, Wm., 2 St. Peter's-road, Mile-end, E.
Feb. 23, 1877	Crofton, Edward, M.A. Oxon., F.R.M.S., 45 West Cromwell-road, South Kensington, S.W.
June 24, 1881	Crosby, Herbert T., 21 Gordon-square, W.C.
Sept. 28, 1866	Crouch, Henry, F.R.M.S., 66 Barbican, E.C.
June 22, 1877	Cunliffe, P. G., F.R.M.S., The Elms, Handforth, Manchester.

Date of Election.	
Nov. 26, 1875	Cunningham, Francis Bertram, 8 Durham-terrace, Westbourne-park, W.
June 25, 1880	Curties, Charles Lees, 244 High Holborn, W.C.
May 25, 1866	Curties, Thos., F.R.M.S., 244 High Holborn, W.C.
June 25, 1880	Curties, Walter Irvin, 244 High Holborn, W.C.
Sept. 26, 1879	Curtis, Charles, 29 Baker-street, Portman-sq., W.
Aug. 22, 1879	Cuttell, F. G., 52 New Compton-street, Soho, W.
April 22, 1881	Cutting, W. M., 1, Curtain-road, E.C.
Jan. 22, 1875	Dadswell, Edward *(Vice-President)*, 42 Barrington-road, Stockwell, S.W.
Nov. 23, 1877	Dallas, Wm. S., F.L.S., &c., The Geological Society, Burlington-house, Piccadilly, W.
May 23, 1879	Dallmeyer, Thos. R., 19 Bloomsbury-street, W.C.
Mar. 22, 1878	Darby, The Ven. Archdeacon, St. Bridget's Rectory, Chester.
Mar. 22, 1878	Darke, Edward, 2 Brecknock-crescent, Camden-road, N.W.
May 23, 1874	Davey, Robert F., War Office, Pall-mall, S.W.
Oct. 22, 1869	Davis, Henry, 19 Warwick-street, Leamington.
May 23, 1879	Dawson, Wm., 24 Abbeygate-street, Bury St. Edmunds, Suffolk.
May 28, 1875	Dean, Arthur, (*Hon. Sec. East Lond. Mic. Soc.*) 12 Vernon-road, Tredegar-road, Bow, E.
Feb. 23, 1877	Death, James, Jun., 38 Gladstone-street, St. George's-road, Southwark, S.E.
Feb. 28, 1879	Debenham, Edw. H., 9 Mincing-lane, E.C.
Jan. 24, 1879	Deby, Julien, C.E., F.R.M.S., 75 Holland-road, Kensington, W.
May 28, 1875	Defriez, Joseph George, M.R.C.S., L.S.A., 173 Bethnal-green-road, E.
Feb. 23, 1877	Delferier, Wm. Adrien, 15 Penywern-road, South Kensington, S.W.
Nov. 24, 1876	Despointes, Francis, 16 St. George's-square, Regent's-park-road, N.W.
May 23, 1879	Dixon, Wm. Fras., 18 University-street, W.C.
Nov. 24, 1865	Dobson, H. H., F.R.M.S., Holmesdale, Grange-park, Ealing, W.
Nov. 27, 1868	Douglas, Rev. R. C., Manaton-rectory, Moreton-hampstead, Exeter.

Date of Election.	
Oct. 25, 1878	Dowler, Captain F. E., Naval and Military Club, Piccadilly, W.
Jan. 23, 1880	Dowsett, Geo. Harris, 38 Egerton-road, Blackheath-road, S.E.
Nov. 22, 1878	Drayton, H. F. Ernest, Horton-house, Beckenham, Kent.
July 28, 1871	Drew, G. C., Milton-house-school, Clapton-common, S.E.
July 25, 1879	Driver, Alfred, 23 Leighan-court-road, West Streatham, S.W.
Aug. 26, 1872	Dudgeon, R. E., M.D., 53 Montague-square, W.
Oct. 25, 1872	Dunning, Charles G., 55, Camden-park-road, N.W.
Sept. 22, 1865	Durham, Arthur E., F.R.C.S., F.L.S., F.R.M.S., &c., 82 Brook-street, Grosvenor-square, W.
Jan. 24, 1879	Easty, Chas. Wm., 19 Edith-road, St. Mary's-road, Peckham, S.E.
Sept. 25, 1868	Eddy, James Ray, F.R.M.S., F.G.S., The Grange, Carleton, Skipton, Yorkshire.
June 28, 1867	Edmonds, R., 178 Burrage-road, Plumstead, S.E.
May 26, 1876	Emery, Charles (*Hon. Curator*), 6 Laburnam-cottages, Middle-lane, Crouch-end, N.
May 26, 1871	Enock, Fredk., 30 Russell-road, Seven Sister's-road, N.
Feb. 28, 1879	Epps, Hahnemann, 9 Eliot-bank, Sydenham-hill, S.E.
Dec. 27, 1878	Erlebach, H. A., Mill-hill-school, Mill-hill, N.W.
Feb. 25, 1881	Essell, G. F. S., Christ Church Vicarage, Spa-road, Bermondsey, S.E.
Dec. 17, 1875	Farries, Thomas, F.C.S.
July 25, 1873	Fase, Rev. H. J., 5 Bessborough-gardens, S.W.
June 25, 1875	Faulkner, Hy., jun., Fernwood, Roehampton-park, S.W.
Jan. 28, 1876	Faulkner, John
Feb. 27, 1880	Fieldwick, Alfred, jun., 288 Dalston-lane, Hackney, E.
July 22, 1881	Firth, W. A., Whiterock, Belfast.

Date of Election.	
July 26, 1867	Fitch, Frederick, F.R.G.S., F.R.M.S., Hadleigh-house, Highbury New-park, N.
Nov. 28, 1879	Forster, Wm., jun., Cleveland-road, Woodford, Essex.
Mar. 24, 1871	Foulerton, J., M.D., Science-club, 4 Savile-row, W.
July 26, 1878	Fowke, Francis, F.R.M.S., 40 Nottingham-place, W.
Dec. 28, 1866	Fox, C. J., F.R.M.S., 26 South Molton-street, Oxford-street, W.
Nov. 26, 1875	Freckelton, Rev. T. W., F.R.M.S., 28A Lonsdale-square, Islington, N.
Jan. 23, 1880	Freeland, Fredk. John, M.R.C.S., J.P., North-street, Chichester.
June 23, 1871	Freeman, Henry E., 1 Templeton-road, Finsbury-park, N.
May 22, 1868	Fryer, Geo. H., 107 Belsize-road, N.W.
July 23, 1880	Funston, James, 93 Finsbury-pavement, E.C.
Mar. 25, 1870	Garden, Robert Spring, 42 Carlton-hill, St. John's-Wood, N.W.
May 25, 1866	Gardiner, G., F.M.S., 23 St. Paul's-road, N.W.
Feb. 26, 1875	Gardner, Edmund, 454 Strand, W.C.
July 27, 1877	Gardner, J. H., A.K.C., 44 Berners-street, W.
April 24, 1868	Garnham, John, F.R.M.S., Hazelwood, Crescent-road, St. John's, Upper Lewisham, S.E.
April 23, 1880	Gates, G. W. H., 21 Lombard-street, E.C.
July 7, 1865	Gay, F. W., F.R.M.S. (*Hon. Treasurer*), 113 High Holborn, W.C.
Jan. 28, 1870	Gellatly, Peter, Loughton, Essex.
June 25, 1880	George, C. F., M.R.C.S., Kirton-in-Lindsey, Lincolnshire.
July 26, 1867	George, Edward, F.R.M.S., 12 Derby-villas, Forest-hill, S.E.
April 26, 1878	Gibbins, G. W., 44 Parkfield-street, Islington, N.
July 22, 1870	Gibson, Joseph F., F.R.M.S., 20 Aldermanbury, E.C.
June 14, 1865	Gibson, W., 3 Bridge-street, Westminster, S.W.
April 27, 1877	Gilbertson, Henry, Mangrove-house, Hertford.
June 24, 1881	Gilburt, Henry, 63 Rectory-road, Stoke Newington, N.

Date of Election.	
Oct. 27, 1876	Gilburt, W. H., F.R.M.S., 48 Wetherell-road, South Hackney, E.
Feb. 25, 1881	Glaisher, James, F.R.S., F.R.A.S., F.R.M.S., &c., 1 Dartmouth-place, Blackheath, S.E.
June 27, 1873	Glasspoole, Hampden G., 15 Mall-road, Hammersmith, W.
Feb. 25, 1876	Godwin, John, 219 Brompton-road, S.W.
Nov. 28, 1879	Goodinge, Alfred Charles, 18 Aldersgate-st., E.C.
April 26, 1872	Goodinge, James Wallinger, F.R.G.S., F.R.M.S., 119 High Holborn, W.C.
Nov. 23, 1877	Goodwin, Wm., 162 Elthorne-road, Hornsey-rise, N.
Mar. 27, 1866	Gray, S. Octavus, Bank of England, E.C.
Nov. 27, 1874	Grayling, J. F., Sittingbourne, Kent.
May 22, 1874	Green, G., 6 Helmet-row, St. Luke's, E.C.
April 22, 1881	Green, J. R., 46 Chetwynd-road, Dartmouth-park, N.W.
Aug. 22, 1879	Greenhough, D. W., F.R.M.S., South-bank, Breakspeare-road, Lewisham-high-road, S.E.
Oct. 23, 1868	Greenish, T., F.R.M.S., 20 New-street, Dorset-square, N.W.
Oct. 23, 1868	Gregory, Henry R., 1 Wellington-square, King's road, Chelsea, S.W.
May 22, 1874	Grey, Ernest, 290 Essex-road, Islington, N.
July 24, 1868	Groves, James William, F.R.M.S. (*Vice-President*), 15 Carlyle-square, Chelsea, S.W., and Physiological Laboratory, King's College, W.C.
May 28, 1880	Groves, William, 28 Manor-park, Lee, S.E.
July 24, 1868	Grubbe, E. W., C.E., 73 Redcliffe-gardens, S.W.
Jan. 27, 1871	Guimaraens, Augustus de Souza, F.R.M.S., 50 Lowden-road, Herne-hill, S.E.
Aug. 24, 1877	Habirshaw, Fredk., F.R.M.S., 6 West 48th-street, New York, U.S.A.
Aug. 24, 1877	Habirshaw, John, M.D., F.R.M.S., 6 West 48th street, New York, U.S.A.
Jan. 23, 1874	Hadland, J. H., 11 King William-street, E.C.
Sept. 28, 1877	Hagger, John, Repton-school, Burton-on-Trent.
Feb. 25, 1881	Haigh, William, Tempsford-villa, Uxbridge-road, Ealing, W.

Date of Election.	
June 14, 1865	Hailes, Henry F., 4 Westfield-road, Hornsey, N.
Aug. 26, 1870	Hailstone, Robert H., 91 Adelaide-road, N.W.
Feb. 23, 1867	Hainworth, W., jun., Clare-villa, Cricketfield-road, Lower Clapton, E.
July 28, 1876	Halford, Edwd., 18 Leinster-square, Bayswater, W.
Dec. 28, 1866	Hallett, R. J., 123 Seymour-st., Euston-sq., N.W.
Feb. 22, 1869	Hammond, A., F.L.S., 13 Rock's-mount-road, Central-hill, Norwood, S.E.
June 25, 1880	Hancock, H. S. H., 93 Aden-grove, Stoke Newington, N.
Jan. 24, 1879	Harding, Burcham, 128 Adelaide-road, N.W.
July 23, 1880	Hardingham, Arthur Shortridge, 3 Serjeant's-inn, Chancery-lane, E.C.
July 25, 1879	Hardingham, George Gatton, F.R.M.S., 33 St. George's-square, S.W.
Jan. 23, 1874	Hardy, James Daniel, 73 Clarence-road, Clapton, E.
Sept. 28, 1866	Harkness, W., F.R.M.S., Laboratory, Somerset-house, W.C.
June 23, 1871	Harris, Edward, F.R.M.S., Rydal-villa, Longton-grove, Upper Sydenham, S.E.
Jan. 25, 1878	Harrison, D. H., Argyll-villas, Mattock-lane, Ealing, W.
June 24, 1881	Harrison, Fredk. Wm., 69 Sewardstone-road, Victoria-park, E.
April 23, 1875	Harrison, James, 150 Akerman-road, North Brixton, S.W.
July 26, 1872	Harrod, John, Mark-lane-square, E.C.
Mar. 28, 1879	Hawkins, C. E., H.M. Geological Survey, Jermyn-street, S.W.
June 24, 1870	Hawkins, S. J.
June 28, 1867	Hawksley, Thos. P., 97 Adelaide-road, N.W.
Sept. 28, 1877	Headley, Robt., F.R.G.S., 44 Walham-grove, Walham-green, S.W.
Aug. 23, 1872	Hembry, F. W., F.R.M.S., 150 Stockwell-park-road, Brixton, S.W.
June 26, 1868	Henry, A. H., 73 Redcliffe-gardens, S.W.
June 26, 1874	Hewitt, W. W., F.R.M.S., 5 Torriano-gardens, Camden-road, N.W.
May 22, 1868	Hicks, J. J., 8 Hatton-garden, E.C.

Date of Election.	
June 22, 1877	Hill, R. W., 41 Lothbury, E.C.
Sept. 24, 1869	Hilton, T. D., M.D., Upper Deal, Deal, Kent.
Sept. 28, 1866	Hind, F. H. P., Bartholomew-house, Bartholomew-lane, E.C.
May 22, 1874	Hind, George, 244 High Holborn, W.C.
July 26, 1872	Hinton, Ernest.
Aug. 26, 1870	Hirst, John, F.R.M.S., Ladcastle, Dobcross, Manchester.
Sept. 26, 1879	Hobden, Horace, St. Bartholomew's-hospital, E.C.
Feb. 26, 1875	Holford, Chr., Bounty-office, Dean's-yard, Westminster, S.W.
Jan. 23, 1880	Holland, Chas. Fredk., 14 Wayland-avenue, Sandringham-road, Hackney, E.
April 26, 1867	Hooton, Charles, Sunningdale-house, Bickerton-road, Upper Holloway, N.
Nov. 26, 1880	Hopkins, Robert, 53 Pall-mall, S.W.
April 28, 1876	Horn, Wm. E., A.I.C.E., 10 Vincent-square, Westminster, S.W.
Oct. 26, 1866	Horncastle, H., Whitemoor-house, Ollerton, Notts.
June 25, 1869	Houghton, W., Hoe-street, Walthamstow, E.
May 22, 1874	Hovenden, C. W., F.R.M.S., 95 City-road, E.C.
April 26, 1867	Hovenden, F., F.R.M.S., Glenlea, Thurlow-park-road, Dulwich, S.E.
June 23, 1876	How, Wm. Samuel, 75 Great Portland-street, W.
Oct. 27, 1876	Howard, D., 60 Belsize-park, N.W.
Oct. 25, 1878	Howling, W. E., Crowley's Brewery, Alton, Hants.
Feb. 25, 1870	Hudleston, W. H., J.P., F.G.S., 23 Cheyne-walk, S.W.
Feb. 28, 1879	Hudson, C. T., M.A., LL.D. Cantab., V.P.R.M.S., Manilla-hall, Clifton, Bristol.
Jan. 26, 1872	Hudson, Robert, F.R.S., F.L.S., F.R.M.S., &c., Clapham-common, S.W.
Nov. 28, 1879	Hughes, R. J., L.R.C.P., L.R.C.S., L.M., 15 Queen's-road, Finsbury-park, N.
Jan. 23, 1880	Hunt, Fredk., York-lodge, Stamford-hill, N.
Dec. 28, 1866	Hunt, W. H. B., F.R.M.S., 160 Camden-rd., N.W.
Dec. 22, 1876	Hunter, J. J., 20 Cranbourne-street, W.C.
July 25, 1873	Hurst, John Thomas, Royal Engineer Office, Portsmouth.

Date of Election.	
Nov. 25, 1870	Hutton, Rev. Wyndham M., Hungarton Vicarage, Leicester.
June 28, 1878	Huxley, Prof. T. H., F.R.S., &c., Science Schools, South Kensington, S.W.
May 24, 1867	Ingpen, J. E., F.R.M.S. (*Hon. Secretary*), 7 The Hill, Putney, S.W.
Aug. 22, 1873	Israel, S., 18 Stepney-green, Mile-end-road, E.
Dec. 17, 1869	Jackson, B. D. (*Sec. Linnean Society*), F.R.M.S., 30 Stockwell-road, S.W.
Dec. 17, 1875	Jackson, C. L., F.L.S., F.Z.S., F.R.M.S. (*President of the Bolton Microscopical Society*), Hill Fold, Sharples, Bolton.
July 24, 1868	Jackson, F. R., Culver-cottage, Slindon, Arundel, Sussex.
June 25, 1880	Jacques, Walter, 2 Fenchurch-buildings, E.C.
June 14, 1865	Jaques, Edward, B.A., F.R.M.S., H.M. Office of Woods, Whitehall-place, S.W.
Feb. 28, 1873	Jenkins, J. W., 3 Harcourt-road, Wallington.
July 24, 1868	Jennings, Rev. Nathaniel, M.A., F.R.A.S., 1 Grove-terrace, Highgate-road, N.W.
Jan. 25, 1867	Johnson, John A., 15 Wellington-road, Stoke Newington, N.
Feb. 24, 1871	Johnson, M. Hawkins, F.R.M.S., F.G.S., 379 Euston-road, N.W.
June 23, 1876	Johnson, Tom Richard.
Feb. 23, 1877	Johnston, J. M. C., 161 Grove-lane, Camberwell-S.E.
Mar. 24, 1871	Johnstone, James, Stanhope-lodge, Bideford.
Oct. 25, 1872	Jones, E. W., F.R.A.S., F.R.M.S., 53 Cowley-road, North Brixton, S.W.
Feb. 28, 1873	Jones, Geo. J., 38 St. Thomas'-street, Lymington, Hants.
June 25, 1875	Jones, J. Birdsall, F.R.M.S., The Athenæum, Liverpool.
Nov. 25, 1870	Jones, Lieut.-Col. Lewis, St. Bernard's, Maple-road, Surbiton.

Date of Election.	
May 23, 1873	Jones, Captain Loftus F., United Service Club, Pall Mall, S.W.
June 23, 1876	Jones, Thomas E., 46 Park-street, Stoke Newington, N.
May 23, 1873	Karop, Geo. C., M.R.C.S., &c., 198 Holland-road, Kensington, W.
Aug. 23, 1867	Kiddle, Edward, The War Office, Pall Mall, S.W.
Mar. 19, 1869	Kilsby, Thomas W., 4 Brompton-villas, Edmonton.
April 22, 1881	King, H. W., The Cedars, Upper Park-road, New Southgate, N.
Dec. 23, 1870	King, Robert, F.R.M.S., Fern-house, Upper Clapton, E.
May 24, 1878	King, Wm. Talbot, M.D., M.R.C.S., 74 Victoria-park-road, South Hackney, E.
Nov. 26, 1880	Kingsett, Chas. T., F.C.S., F.I.C., 12 Auriol-road, West Kensington, W.
April 26, 1867	Kirk, Joseph, 11 Blossom-st., Norton Folgate, E.
Nov. 27, 1874	Kirkman, Rev. Joshua, Thurlow-road, South Hampstead, N.W.
Feb. 28, 1873	Kitsell, Francis J., 41 Latymer-road, W.
Mar. 23, 1877	Kluht, H. J., 42 Westbourne-grove, Bayswater, W.
Oct. 24, 1873	Knight, John Mackenzie, 50 Bow-road, E.
Nov. 25, 1870	Ladd, Wm., F.R.A.S., F.R.M.S., 12 Beak-street, Regent-street, W,
Nov. 23, 1866	Lambert, W., 1 New Broad-street, E.C.
Jan. 24, 1879	Lancaster, Arthur H., 7 Campden-hill-gardens, Kensington, W.
Mar. 22, 1867	Lancaster, Thos., Bownham-house, Stroud, Gloucestershire.
May 25, 1877	Lane-Fox, Hon. Sackville F. H.
Jan. 28, 1881	Lankester, H. H., 4 Claverton-street, S.W., and Medical School, St. Thomas'-hospital.
May 28, 1875	Larkin, John, 24 Charterhouse-square, E.C.
Nov. 26, 1880	Larkings, Richd., jun., 98 Clarence-road, Lower Clapton, E.
May 28, 1875	Laws, Joseph C., 41 St. John's-park, Upper Holloway, N.

Date of Election,	
June 25, 1869	Layton, Charles E., 12 Upper Hornsey-rise, N.
Aug. 28, 1868	Leaf, C. J., F.L.S., F.R.M.S., &c. (*President of the Old Change Microscopical Society*), Old Change, E.C.
Mar. 19, 1869	Lee, Henry, F.L.S., F.R.M.S., &c., Ethelbert-house, Margate.
May 27, 1874	Leefe, Frederick Ewbank, 289 Goswell-road, E.C.
June 23, 1876	Leeson, Herbert Seymour, 4 Old-buildings, Lincoln's-inn, W.C.
Feb. 25, 1881	Leicester, Alfred, 13 Adelaide-terrace, Waterloo, Liverpool.
Oct. 25, 1867	Leifchild, J. R., M.A., 6 St. Lawrence-road, Notting-hill, W.
Sept. 22, 1865	Leighton, W. H., 2 Merton-place, Chiswick, W.
July 25, 1873	Le Pelley, C., 84 St. Thomas'-road, Seven Sisters-road, N.
April 27, 1866	Lewis, R. T., F.R.M.S. (*Hon. Reporter*), 1 Lowndes-terrace, Knightsbridge, S.W.
June 26, 1868	Lindley, W. H., jun., 29 Blittersdorffs-platz, Frankfort-on-Maine.
May 26, 1871	Locke, John, 16 Georgiana-street, Camden-town, N.W.
April 23, 1869	Long, Henry, 90 High-street, Croydon.
Nov. 24, 1866	Lovibond, J. W., F.R.M.S., St. Anne-street, Salisbury.
Sept. 22, 1866	Lovick, T., 53 Queen's-crescent, Haverstock-hill, N.W.
Dec. 18, 1868	Lowne, B. Thompson, F.R.C.S., F.L.S., F.Z.S., 65 Cambridge-gardens, Bayswater, W.
April 27, 1866	Loy, W. T., F.R.M.S., Garrick-chambers, 11 Garrick-street, W.C.
Nov. 23, 1866	McIntire, S. J., F.R.M.S., 14 Hettley-road, Uxbridge-road, Shepherd's-bush, W.
Jan. 28, 1881	McKenzie, John A., Forestone-lodge, Hornsey, N.
Jan. 26, 1872	Mackechnie, J. Hamilton, M.D., 60 Wimpole-street, Cavendish-square, W.
Jan. 23, 1880	Mackenzie, James, Warden-villa, Uxbridge-road, Ealing, W.

Date of Election.	
June 28, 1878	Magor, John Bernard, L.D.S., 24 Chapel-street, Penzance.
July 26, 1874	Magor, Thomas, M.D., Eagle-cottage, Hornsey, N.
Feb. 28, 1879	Mann, James H.
Sept. 27, 1872	Manning, H.E. the Cardinal Archbishop, Archbishop's-house, Westminster, S.W.
Jan. 23, 1880	Martin, Francis, R.N., H.M.S. "Hydra," Sheerness.
Sept. 22, 1876	Martin, W. H., 11 Markham-square, Chelsea, S.W.
Dec. 27, 1867	Martinelli, A., 106 Albany-street, N.W.
Dec. 27, 1878	Martiney, M. G., 11 Castlenau-gardens West, Barnes, S.W.
April 26, 1867	Matthews, G. K., St. John's-lodge, Beckenham, Kent.
Oct. 26, 1866	Matthews, John, M.D., F.R.M.S., 30 Colebrooke-row, Islington, N.
Jan. 26, 1877	Matthews, Wavell, 12 Wigmore-street, W.
May 26, 1871	May, John William, F.R.M.S., Arundel-house, Percy-cross, Fulham, S.W.
Feb. 27, 1874	May, Lewis J., 371 Holloway-road, N.
Dec. 17, 1875	May, Thomas.
Feb. 25, 1876	May, W. R., 69 St. Mark's-square, Dalston, E.
Mar. 22, 1867	Meacher, John W., 10 Hillmarten-road, Camden-road, N.
Feb. 28, 1879	Menzies, James, 13 Leighton-grove, N.W.
May 22, 1874	Messenger, G. A., 21 Glengall-grove, Old Kent-road, S.E.
Dec. 18, 1868	Mestayer, Richard, F.L.S., F.R.M.S., 7 Buckland-crescent, Belsize-park, N.W.
July 27, 1877	Michael, Albert D., F.L.S., F.R.M.S., 3 & 4 Great Winchester-street, E.C.
May 28, 1880	Miles, Andrew, 185 Camden-grove, Peckham, S.E.
Feb. 25, 1881	Millar, John, L.R.C.P., F.L.S., F.R.M.S., Bethnal-house, Cambridge-road, E.
July 7, 1865	Millett, F. W., F.R.M.S., 13 Milner-square, Islington, N.
Oct. 22, 1880	Milner, W. E., 47 Park-road, Haverstock-hill, N.W.
May 25, 1866	Moginie, W., F.R.M.S., 26 Lichfield-grove, Finchley, N.
Jan. 23, 1874	Moreland, Richard, jun., M.I.C.E., F.R.M.S., 4 The Quadrant, Highbury, N.

Date of Election.	
July 26, 1878	Morland, Henry, Cranford, near Hounslow.
Oct. 27, 1866	Morrieson, Colonel R., F.R.M.S., Oriental-club, Hanover square, W.
Dec. 27, 1876	Morris, J. Griffith, M.R.C.S., 135 St. Owen-street, Hereford.
Oct. 27, 1876	Morris, W. G., L.D.S., The Lodge, Sansome-walk, Worcester.
Nov. 23, 1877	Morten, T. S., 42 Haverstock-hill, N.W.
April 22, 1881	Moss, J. M., 313 High Holborn, W.C.
Jan. 24, 1879	Murray, James, Osborne-house, 50 Percy-road, Shepherd's-bush, W.
Jan. 25, 1867	Murray, R. C., 69 Jermyn-st., St. James's, S.W.
Mar. 23, 1866	Nation, W. J., 30 King-square, Goswell-road, E.C.
Feb. 22, 1878	Needham, S. H., F.R.G.S., F.G.S., 5 Mecklenburg-street, Mecklenburg-square, W.C.
Mar. 24, 1876	Nelson, Edward M., 9 Marlborough-hill, N.W.
Mar. 24, 1871	Nelson, James, 3 Oakden-street, Kennington-road, S.E.
Feb. 28, 1879	Nesbitt, Henry, F.R.G.S., F.R.M.S., 12 Victoria-villas, Kilburn, N.W.
May 23, 1879	Newcombe, Prout, Northcote, East Croydon.
Nov. 23, 1877	Newth, A. H., M.D., Science-club, 4 Savile-row, W.
Jan. 26, 1872	Newton, Edwin Tulley, F.G.S., Geological-museum, Jermyn-street, S.W.
Feb. 27, 1880	Niven, George, 41 Albert-road, Finsbury-park, N.
May 22, 1874	Nixon, Philip Charles, Oporto.
Mar. 25, 1881	Norman, Edwin, 178 City-road, E.C.
Aug. 26, 1881	Northey, M. D., 4 South Brighton-terrace, Surbiton.
Aug. 24, 1877	Oates, Parkinson, M.D., L.S.A., M.R.C.S., 48 Lupus-street, S.W.
Jan. 24, 1879	Offord, John Milton, 31 Hereford-square, S.W.
Dec. 22, 1876	Ogilvy, C. P., F.L.S., Sizewell-house, Leiston, near Saxmundham, Suffolk.
May 24, 1878	O'Hara, Lt.-Col. Richard, F.R.M.S. (late Royal Artillery), West-lodge, Galway.
June 22, 1877	Oswin, Frederick, F.S.A., 10 Gower-street, W.C.
Dec. 27, 1867	Oxley, Frederick, F.R.M.S., 8 Crosby-square, Bishopsgate-street, E.C.

Date of Election.	
July 25, 1879	Palmer, Greville H., 95 Cornwall-gardens, S.W.
May 22, 1874	Palmer, Thomas, B.Sc., F.R.M.S., Holme Lee, Lower Camden, Chislehurst, Kent.
Oct. 27, 1871	Parsons, Fred. A., 90 Leadenhall-street, E.C.
Dec. 28, 1877	Partridge, Thos., M.D., Stroud, Gloucestershire.
April 23, 1875	Peal, C. N., Fernhurst, Mattock-lane, Ealing, W.
May 22, 1874	Pearce, George Alonzo Creech, B.A., M.B., B.C.N., 26 Gracechurch-street, E.C.
May 24, 1867	Pearce, George, Villa Helvetia, Tufnell-park, N.
Feb. 23, 1872	Pearce, W. E. Grindley, L.R.C.P., 24 Bessborough-gardens, S.W.
April 27, 1877	Pearcy, Alfred Copley, 20 Castlewood-road, Craven-park, Stamford-hill, N.
May 24, 1867	Pearson, John, 212 Edgware-road, W.
July, 22, 1881	Perigal, Henry, F.R.A.S., F.R.M.S., 9 North-crescent, Bedford-square, W.C.
Oct. 27, 1865	Pickard, J. F., 195 Great Portland-street, W.
May 23, 1879	Pilcher, Wm. John, F.R.C.S., &c., Boston, Lincolnshire.
June 24, 1881	Pilley, John James, 8 Ellesmere-rd.-north, Bow, E.
Jan. 22, 1869	Pillischer, M., F.R.M.S., 88 New Bond-street, W.
Nov. 24, 1871	Pitts, Frederick, Harvard-house, St. John's-hill, Clapham, S.W.
Sep. 27, 1878	Plomer, Geo. Danl., F.R.M.S., 48 Springfield-road, St. John's-wood, N.W.
Sep. 28, 1877	Pocklington, Henry, F.R.M.S., 20 Park-road, Leeds.
Nov. 23, 1866	Potter, George, F.R.M.S., 42 Grove-road, Holloway, N.
Jan. 25, 1878	Potts, R. A., 26 South Audley-street, W.
June 24, 1881	Potts, William, Hillside-avenue, Beckenham, Kent.
June 22, 1866	Powe, I., 71 George-street, Richmond, Surrey.
May 25, 1866	Powell, Hugh, F.R.M.S., 170 Euston-road, N.W.
April 25, 1879	Powell, Hugh Peter, The Butts, Brentford.
May 26, 1876	Powell, J. T., 32 Dunlace-road, Lower Clapton, E.
July 7, 1865	Powell, Thomas, F.R.M.S., 18 Doughty-street, Mecklenburg-square, W.C.
July 24, 1874	Powell, Thomas Henry, 116 Denmark-hill, S.E.
Jan. 22, 1875	Power, H. D'Arcy, F.L.S.
April 25, 1879	Preedy, Wm. Halcomb, 41 Oseney-crescent, Camden-road, N.W.

Date of Election.	
June 27, 1873	Priest, B. W., 22 Parliament-street, S.W.
May 23, 1879	Pritchard, J. D., Crymlyn Burrows, near Swansea.
July 26, 1867	Pritchett, Francis, 137 Fenchurch-street, E.C.
Feb. 25, 1881	Probyn, Clifford, 55 Grosvenor-street, W.
April 23, 1868	Quekett, Alfred J. S., 51, Warwick-road, Maida-hill, W.
April 23, 1868	Quekett, Arthur Edwin, 51 Warwick-road, Maida-hill, W.
April 23, 1868	Quekett, Rev. William, The Rectory, Warrington.
Feb. 23, 1866	Quick, George E., 74 Long-lane, Bermondsey, S.E.
Oct. 26, 1866	Rabbits, W. T., Highfield, Dartmouth-park, Forest-hill, S.E.
Sept. 24, 1869	Radcliffe, J. D.
Oct. 22, 1880	Radcliffe William, 43 Queens-road, Brownswood-park, N.
June 25, 1875	Radford, W. S., M.D., F.R.M.S., Sidmouth.
Oct. 26, 1866	Ramsden, Hildebrand, M.A.Cant., F.L.S., F.R.M.S., 26 Upper Bedford-place, Russell-square, W.C.
Aug. 28, 1868	Rance, T. G., Elmside, Bickley, Kent.
June 24, 1881	Ransom, F., Fairfield, Hitchin.
May 22, 1868	Rawles, W., 64 Kentish-town-road, N.W.
July 23, 1880	Read, Rev. Wm., M.A., F.R.A.S., F.R.M.S., &c., Worthing, Sussex.
June 27, 1879	Readaway, Wm., 39 Robert-street, Hampstead-road, N.W.
Dec. 27, 1878	Reed, John Murray, Sidmouth-house, South-park, Ilford, E.
June 22, 1877	Reed, John W., F.R.G.S., F.R.M.S., 27 Clarence-street, Islington, N.
June 27, 1873	Reeve, Fredk., 37 Fentiman-road, Clapham-road, S.W.
July 7, 1865	Reeves, W. W., F.R.M.S., 30 Ashburnham-grove, Greenwich, S.E.
May 22, 1874	Reid, Wm. Wardlaw, Corra Lynn, Selhurst-park, South Norwood, S.E.
Mar. 25, 1870	Richardson, Thomas Hyde
May 23, 1879	Rideout, Wm., F.R.M.S. (*Hon. Sec. Bolton Microscopical Club*), Hulliwell, Bolton.

Date of Election.	
June 25, 1869	Roberts, John H., F.R.C.S., 82 Finchley-road, St. John's-wood, N.W.
April 26, 1872	Roberts, S. Hackett, F.R.M.S., 22 Moorgate-station-buildings, Finsbury-pavement, E.C.
May 22, 1868	Rogers, John, F.R.M.S., 4 Tennyson-street, Nottingham.
Oct. 26, 1866	Rogers, Thomas, F.L.S., F.R.M.S., Selmeston-house, Thurlow-park-road, West Dulwich.
Mar. 22, 1872	Rolfe, Charles Spencer, 5 Westminster-chambers, S.W.
May 22, 1868	Roper, Freeman C. S., F.L.S., F.G.S., F.R.M.S., Palgrave-house, Eastbourne, Sussex.
June 23, 1876	Roper Henry John, F.R.M.S., 5 Lausanne-road, Peckham, S.E.
Oct. 27, 1876	Roper, Robert, 29 Hampton-road, Upton, Essex.
July 24, 1868	Rowe, James, jun., M.R.C.V.S., 65 High-street, Marylebone, W.
May 23, 1879	Rowe, Thos. Smith, M.D., Cecil-square, Margate.
Oct. 26, 1866	Rowlett, John, 92 Enville-road, Walworth, S.E.
Aug. 26, 1881	Roy, Eugene L., B.A., 1 Lady Margaret's-road, Kentish-town, N.W.
Sep. 24, 1880	Rudkin, F.D., 80 Moray-road, Tollington-park, N.
July 24, 1874	Rushton, William, 61 Tufnell-park-road, Holloway, N.
Oct. 27, 1865	Russell, James, 10 High-street, Shoreditch, E.
May 22, 1868	Russell, Thomas D., 21 Park-road, West Dulwich, S.E.
Feb. 22, 1867	Rutter, H. Lee, 1 St. Barnabas-villas, Lansdowne-circus, South Lambeth, S.W.
Feb. 27, 1880	Ryley, Thomas, Lee Park-house, Blackheath, S.E.
Nov. 22, 1878	Sabel, Ernest E., 6 Grove-road, Clapham-park, S.W.
May 23, 1873	Salkeld, Lt.-Colonel J. C., F.R.M.S., 29 St. James's-street, S.W.
Dec. 27, 1878	Salmon, C. W., 7 Manor-park-villas, Manor-road, Stoke Newington, N.
Dec. 17, 1869	Salmon, John, 24 Seymour-street, Euston-square, N.W.

Date of Election.	
Dec. 28, 1877	Sands, Chas., 5 Woburn-place, Russell-sq., W.C.
May 28, 1875	Saul, Geo. William.
June 27, 1879	Sawyer, Geo. D., F.R.M.S., 55 Buckingham-place, Brighton.
Feb. 27, 1880	Schulze, Adolf, 1 St. James's-street, Hillhead, Glasgow.
Feb. 26, 1875	Scofield, W. J., M.R.C.S., F.L.S., 13 South Hill Park-gardens, Hampstead, N.W.
May 24, 1872	Sequeira, H. L., M.R.C.S., 1 Jewry-street, Aldgate, E.C.
July 27, 1868	Sewell, Richard, Ashmore-house, Keston, Kent.
July 23, 1880	Shaw, Henry Vincent, Fir Croft, Keymer, Hurstpierpoint, Sussex.
Oct. 22, 1869	Shaw, Wm. Forster, Mosshall-grove, Finchley, N.
May 26, 1876	Shepheard, Thomas, F.R.M.S., Kingsley-lodge, Chester.
May 26, 1871	Sigsworth, J. C., F.R.M.S., 18 Chaucer-road, Herne-hill, S.E.
June 27, 1873	Simmonds, Joseph E., Royal Exotic Nursery, Kings-road, Chelsea, S.W.
Aug. 23, 1867	Simmons, James J., L.D.S., 18 Burton-crescent, Euston-road, N.W.
May 26, 1876	Simpson, Edwd., 24 Grummant-road, Peckham-road, S.E.
Nov. 23, 1877	Simpson, Thomas, Fennymere, Castlebar, Ealing, W.
Mar. 27, 1868	Simson, Thos.
May 28, 1869	Sketchley, H. G., 75 Bailgate, Lincoln.
Dec. 28, 1866	Slade, J., Fern-villa, Lion-rd., Bexley-heath, Kent.
Oct. 23, 1868	Smart, William, 27 Aldgate, E.
May 25, 1866	Smith, Alpheus (*Hon. Librarian*), 42 Choumert-road, Rye-lane, Peckham, S.E.
April 23, 1880	Smith, Archd. S., Silvermere, Cobham, Surrey.
Oct. 26, 1877	Smith, Bernard E., Aucklands, Wandsworth-common, S.W.
July 25, 1879	Smith, Charles Vance, 5 Parade, Carmarthen.
Feb. 25, 1876	Smith, Edward, F.S.S., St. Mildred's-house, Poultry, E.C.
Mar. 25, 1870	Smith, Francis Lys, 3 Grecian-cottages, Crown-hill, Norwood, S.E.

Date of Election.	
June 27, 1873	Smith, G. J., F.R.M.S., 73 Farringdon-street, E.C.
Oct. 26, 1866	Smith, H. Ambrose, Claremont, Loughton-grove, Sydenham, S.E.
June 26, 1868	Smith, James, F.L.S., F.R.M.S., 233 Dalston-lane, Hackney, E.
Dec. 23, 1870	Smith, Joseph A., Granville-lodge, Croydon-road, Anerley, S.E.
Oct. 26, 1877	Smith, Samuel, 331 Hackney-road, E.
Aug. 23, 1872	Smith, W. Stuart, 30 Loraine-road, Holloway, N.
April 24, 1868	Snellgrove, W., 58 Cranfield-road, Wickham-park, S.E.
Aug. 22, 1879	Soames, Rev. H. Aldwin, B.A., Rochester.
May 24, 1878	Southey, A., 145 Fenchurch-street, E.C.
Sept. 22, 1865	Southwell, C., 44 Princes-street, Soho, W.
May 26, 1876	Southwell, Chas. Wm., 35 Douglas-road, Canonbury, N.
May 22, 1874	Spencer, James, F.R.M.S., 50 South-street, Greenwich, S.E.
June 26, 1876	Spencer, John, Brook's Bank, 81 Lombard-st., E.C.
Nov. 22, 1872	Spencer, Thomas, F.C.S., F.R.M.S., 32 Euston-square, N.W.
Mar. 24, 1866	Starling, Benjamin, 9 Gray's-inn-square, W.C.
Aug. 23, 1878	Steel, John Henry, M.R.C.V.S., F.Z.S., The Royal Veterinary-college, Camden-town, N.W.
Feb. 23, 1872	Stevens, C. R., 7 Ashby-road, Canonbury, N.
Aug. 24, 1866	Steward, J. H., F.R.M.S., 406 Strand, W.C.
June 22, 1877	Stewart, Charles, M.R.C.S., F.L.S., *Sec. R.M.S.*, &c. (*Vice-President*), St. Thomas'-hospital and 42 Sinclair-road, Kensington, W.
April 23, 1880	Stewart, Fredk., 25 Lime-villas, Foxberry-road, Brockley, S.E.
Sept. 22, 1876	Stiles, M. H.
May 23, 1879	Stocken, James, 40 Euston-square, N.W.
Jan. 23, 1880	Stœssiger, Fredk. Aug., 70 Windsor-road, Holloway, N.
June 24, 1881	Stokes, A. W., F.C.S., Laboratory, Vestry-hall, Paddington, W.
July 25, 1879	Stone, Edwd. Mulready, Hill-side, West-hill, Sydenham.

Date of Election.	
May 23, 1879	Stubbins, John, F.G.S., F.R.M.S., Chester-cottage, Old-lane, Halifax.
May 23, 1879	Sturt, Clifton, King's-college, W.C., and The University, Melbourne, Australia.
July 7, 1865	Suffolk, W. T., F.R.M.S., Stettin-lodge, St. Faith's-road, Lower Norwood, S.E.
June 27, 1873	Suter, Edward D., Kent-lodge, Douglas-road-north, Canonbury, N.
June 24, 1870	Swain, Ernest, 34 Elsham-road, Kensington, W.
Nov. 22, 1867	Swainston, J. T., 3 St. Mark's-square, Regent's-park, N.W.
Nov. 24, 1866	Swansborough, E., 20 John-st., Bedford-row, W.C.
Dec. 18, 1868	Swift, James, F.R.M.S., 81 Tottenham-court-road, W.C.
Dec. 17, 1875	Swift, Mansell J., 81 Tottenham-court-road, W.C.
Jan. 23, 1880	Symons, Wm. Hy., F.C.S., F.R.M.S., 2 Queen's-terrace, St. John's-wood, N.W.
July 27, 1877	Tanqueray, A. C., Reid's Brewery, Theobald's-road, E.C.
Sept. 28, 1877	Tarrant, Kenneth J., Litchford-house, Hatch-end, Pinner.
Nov. 28, 1879	Tasker, J. G., 18 Junction-rd., Upper Holloway, N.
Aug. 22, 1879	Tate, J. W., 6 Clarendon-terrace, Brentford-road, Turnham-green, W.
May 22, 1868	Tatem, J. G., Russell-street, Reading.
Feb. 25, 1881	Taylor, Thos., M.R.C.S., L.A.C., Bocking, near Braintree, Essex.
Aug. 23, 1878	Teasdale, Washington, F.R.M.S., Rosehurst, Headingley, Leeds.
Dec. 22, 1865	Terry, J., 109 Borough-road, S.E.
Aug. 23, 1872	Terry, Thomas, 5 Austin-friars, E.C.
May 23, 1879	Thompson, Isaac Cooke, F.R.M.S. (*Hon. Sec. Liverpool Microscopical Soc.*), Woodstock, Waverley-road, Liverpool.
May 28, 1875	Thompson, John Reid, 14 Alexandra-villas, Finsbury-park, N.
Feb. 24, 1871	Thornthwaite, W. H., 416 Strand, W.C.
April 27, 1877	Thorpe, George, 20 Eastcheap, E.C.

Date of Election.	
Jan. 22, 1875	Tinney, William A., 1 Clifford's-inn, Fleet-st., E.C.
Nov. 27, 1867	Tomkins, Samuel Leith, Apsley, East Grinstead.
June 23, 1871	Topping, Amos, 28 Charlotte-street, Caledonian-road, N.
July 26, 1872	Townsend, John Sumsion, F.R.M.S., Stamford-lodge, St. John's, Sevenoaks.
July 24, 1868	Tulk, John A., M.D., F.R.M.S., Burton-lodge, Staines-road, Twickenham.
July 26, 1867	Turnbull, Joseph, Laurel-house, North-hill, Highgate, N.
Aug. 24, 1877	Turner, Ernest Blaker, 1 Clifton-villas, Amberley-road, Lea-bridge-road, N.E.
June 25, 1869	Turner, R. D., Roughway, near Tonbridge.
June 25, 1875	Turner, Sydney, A.R.I.B.A., 7 Mark-lane, E.C.
Feb. 25, 1881	Tyler, Chas., F.L.S., F.G.S., F.R.M.S., 317 Holloway-road, Holloway, N.
May 25, 1877	Veasey, Robt. Geo., Ashchurch-lodge, Ashchurch-road, Shepherd's-bush, W.
July 27, 1866	Veitch, Harry, F.H.S., The Royal Exotic Nursery, King's-road, Chelsea, S.W.
Feb. 28, 1879	Venables, W., 253 Camden-road, N.W.
Feb. 27, 1880	Vereker, The Hon. J. G. P., 1 Portman-sq., W.
Feb. 25, 1881	Vereker-Bindon, Wm. J., M.D., F.R.C.S.E., 2 Elgin-villas, Willesden-lane, Kilburn, N.W.
May 23, 1879	Vezey, John Jewel, F.R.M.S., 12 Sandbourne-road, Brockley-rise, S.E.
June 25, 1880	Waddington, Henry J., 253 Evering-road, Upper Clapton, N.
Feb. 27, 1874	Walker, John C., Highfield, Avenue-road, Crouch-end, N.
July 25, 1873	Walker, John Stringer, Warwick-road, Upper Clapton, E.
June 26, 1868	Walker, J. W., Melrose-villa, Watford.
May 22, 1868	Waller, J. G., 68 Bolsover-street, Portland-road, W.
Jan. 23, 1880	Wallis, Whitworth, 4 The Residences, South Kensington, S.W.
Aug. 26, 1870	Warburton, Samuel, Merton-villa, New-road, Lower Tooting, S.W.

Date of Election.	
Nov. 22, 1867	Ward, F. H., M.R.C.S., F.R.M.S., Springfield-house, near Tooting, S.W.
Feb. 25, 1881	Ward, James Duff, Northwood-lodge, Cowes, Isle of Wight.
June 28, 1878	Ward, Richard John, Silver-street, Lincoln.
Dec. 18, 1868	Warner, Alfred, care of Mr. W. F. Stanley, 13 Railway-approach, London-bridge, S.E.
May 25, 1866	Warrington, H. R., 7 Royal Exchange, Cornhill, E.C.
July 25, 1879	Waterman, Thos. L., 103 Antill-road, Bow, E.
Oct. 27, 1865	Watkins, C. A., 10 Greek-street, Soho, W.
Oct. 25, 1872	Watkins, J., L.C.P., 24 Lime-grove, Lewisham, S.E.
Aug. 23, 1878	Watson, Geo. F., 313 High Holborn, W.C.
Nov. 28, 1879	Watson, Robert Walker, 22 Highbury-new-park, N.
Sept. 28, 1877	Watson, Thos. P., F.R.M.S., 313 High Holborn, W.C.
Dec. 28, 1877	Watson, Thos. W., 4 Pall-mall, S.W.
May 23, 1879	Watts, The Rev. G. E., M.A., F.R.M.S., Kensworth-vicarage, Dunstable, Herts.
Dec. 28, 1866	Way, T. E., 65 Wigmore-street, W.
Oct. 26, 1877	Weatherley, Capt. H. C. S., 64 Cheapside, E.C.
July 24, 1874	Webb, C. E., Wildwood-lodge, North-end, Hampstead, N.W.
April 25, 1879	Webster, Hy. Wm., M.D., St. George's Infirmary, Fulham-road, West Brompton, S.W.
May 24, 1867	Weeks, A. W. G., 36 Gunter-grove, West Brompton, S.W.
Sept. 27, 1878	West, Robt. G., 39 Lombard-street, E.C.
Feb. 25, 1876	Wheeler, George, 27 Theberton-street, N.
May 23, 1879	Wheldon, John, F.R.M.S., 58 Great Queen-street, Lincoln's-inn-fields, W.C.
April 23, 1869	White, Charles Frederick, F.R.M.S., 42 Windsor-road, Ealing, W.
May 22, 1868	WHITE, T. CHARTERS, M.R.C.S., L.D.S., F.L.S., F.R.M.S. (*President*), 32 Belgrave-road, S.W.
July 25, 1873	White, Walter, Litcham, Norfolk.
Aug. 22, 1879	Whittell, Horatio T., M.D., F.R.M.S., Adelaide, South Australia.

Date of Election.	
June 25, 1880	Wickes, Wm. Dickerson, 3 Cottage-grove, Bow-road, E.
Mar. 25, 1881	Wildy, Arthur, 48 Albion-road, South Hampstead, N.W.
April 23, 1880	Williams, Arthur, 48 Osnaburg-street, Regent's-park, N.W.
Mar. 24, 1871	Williams, George, F.R.M.S., 1 Devonport-road, Shepherd's-bush, W.
Nov. 23, 1877	Williams, Geo. Sawyer, 10 Clifton-villas, Maida-hill, W.
May 28, 1880	Williams, J. Michael, The Hawthorns, Bootle, Liverpool.
June 27, 1879	Willson, James, 2 Oval-road, Regent's-park, N.W.
Mar. 24, 1876	Wilson, Chas. Joseph, 14 Highbury-crescent, N.
Feb. 22, 1867	Wilson, Frank, 110 Long-acre, W.C.
Jan. 24, 1879	Wilson, S. K., F.R.G.S., F.R.M.S., M.R.I., 3 Portland-terrace, Regent's-park, N.W.
April 23, 1880	Winney, Hy. John, 1 Shorters-court, Throgmorton-street, E.C.
June 27, 1879	Wood, Francis, 63 Mayfield-road, Dalston, E.
Aug. 27, 1869	Woods, W. Fell, 1 Park-hill, Forest-hill, S.E.
Jan. 28, 1876	Woollett, John, 58 Cloudesley-road, Islington, N.
Oct. 25, 1867	Worthington, Richard, Champion-park, Denmark-hill, S.E.
June 27, 1873	Wrey, George E. B., Addington-house, Addington-road, Reading.
Aug. 22, 1879	Wright, Bryce McMurdo, 54 Guildford-street, Russell-square, W.C.
Nov. 26, 1880	Wright, J. H., jun., Merston-house, Ealing, W.
May 25, 1877	Yates, Francis, Rockwood, Surbiton-hill.
Jan. 25, 1878	Yates, Robert, 64 Park-street, Southwark, S.E.
Oct. 26, 1866	Yeats, Christopher, Mortlake, Surrey, S.W.

NOTICE.

Members are requested to give the Hon. Secretary early information of any change of Residence, so as to prevent miscarriage of Journals and circulars.

RULES.

I.—That the Quekett Microscopical Club hold its meetings at University College, Gower Street, on the fourth Friday Evening in every month, at Eight o'clock precisely, or at such other time or place as the Committee may appoint.

II.—That the business of the Club be conducted by a Committee, consisting of a President, four Vice-Presidents, an Honorary Treasurer, one or more Honorary Secretaries, an Honorary Secretary for Foreign Correspondence, an Honorary Reporter, an Honorary Librarian, an Honorary Curator, and twelve other members,—six to form a quorum. That the President, Vice-Presidents, Treasurer, Secretaries, Reporter, Librarian, Curator, and the four senior members of the Committee (by election) retire annually, but be eligible for re-election. That the Committee may appoint a stipendiary Assistant Secretary, who shall be subject to its direction.

III.—That at the ordinary Meeting in June, nominations be made of Candidates to fill the offices of President, Vice-Presidents, Treasurer, Secretaries, Reporter, Librarian, Curator, and vacancies on the Committee. That such nominations be made by resolutions duly moved and seconded, no Member being entitled to propose more than one Candidate. That the President, Vice-Presidents, Treasurer, Secretaries, Reporter, Librarian, and Curator, be nominated by the Committee. That a list of all nominations made as above be printed upon the ballot paper; the nominations for vacancies upon the Committee being arranged in such order as shall be determined by lot, as drawn by the President and Secretary. That at the Annual General Meeting in July all the above officers be elected by ballot from the candidates named in the lists, but any member is at liberty to substitute on his ballot-paper any other name or names in lieu of those nominated for the offices of President, Vice-Presidents, Treasurer, Secretaries, Reporter, Librarian, and Curator.

IV.—That in the absence of the President and Vice-Presidents the Members present at any ordinary Meeting of the Club elect a Chairman for that evening.

V.—That every Candidate for Membership be proposed by two or more Members, who shall sign a certificate (see Appendix) in recommendation of him—one of the proposers from personal knowledge. The certificate shall be read from the chair, and the Candidate therein recommended balloted for at the following Meeting. Three black balls to exclude.

VI.—That the Club include not more than twenty Honorary Members, elected by the Members by ballot upon the recommendation of the Committee.

VII.—That the Annual Subscription be Ten Shillings, payable in advance on the 1st of July, but that any Member elected in May or June be exempt from subscription until the following July. That any Member desirous of compounding for his future subscription may do so at any time by payment of the sum of Ten Pounds; all such sums to be duly invested in such manner as the Committee shall think fit. That no person be entitled to the full privileges of the Club until his subscription shall have been paid; and that any Member omitting to pay his subscription six months after the same shall have become due (two applications in writing having been made by the Treasurer) shall cease to be a Member of the Club.

VIII.—That the accounts of the Club be audited by two Members, to be appointed at the ordinary Meeting in June.

IX.—That the Annual General meeting be held on the fourth Friday in July, at which the Report of the Committee on the affairs of the Club, and the Balance Sheet duly signed by the Auditors shall be read. Printed lists of Members nominated for election as President, Vice-Presidents, Treasurer, Secretaries, Reporter, Librarian, Curator, and Members of the Committee having been distributed, and the Chairman having appointed two or more Members to act as Scrutineers, the Meeting shall then proceed to ballot. If from any cause these elections, or any of them, do not take place at this Meeting, they shall be made at the next ordinary Meeting of the Club.

X.—That at the ordinary Meetings the following business be transacted:—The minutes of the last Meeting shall be read and confirmed; donations to the Club since the last Meeting announced and exhibited; ballots for new Members taken; papers read and discussed; and certificates for new Members read; after which the Meeting shall resolve itself into a Conversazione.

XI.—That any Member may introduce a Visitor at any ordinary Meeting, who shall enter his name with that of the Member by whom he is introduced in a book to be kept for the purpose.

XII.—That no alteration be made in these Laws, except at an Annual General Meeting, or a Special General Meeting called for that purpose; and that notice in writing of any proposed alteration be given to the Committee, and read at the ordinary Meeting at least a month previous to the Annual or Special Meeting at which the subject of such alteration is to be considered.

APPENDIX.

Form of Proposal for Membership.

Quekett Microscopical Club.

Mr.

of

being desirous of becoming a Member of this Club, we beg to recommend him for election.

(*on my personal knowledge*).

This Certificate was read 18

The Ballot will take place 18

MEETINGS

OF THE

QUEKETT MICROSCOPICAL CLUB,

AT

UNIVERSITY COLLEGE, GOWER STREET, LONDON.

1881.—August	12	....	26
September	9	....	23
October	14	....	28
November	11	....	25
December	9	....	23
1882.—January	13	....	27
February	10	....	24
March	10	....	24
April	14	....	28
May	12	....	26
June	9	....	23
July	14	....	28

The Ordinary Meetings are held on the *fourth* Friday in each month :—business commences at 8 o'clock p.m.

The Meetings on the *second* Friday in the month are for Conversation and Exhibition of Objects; from 7 to 9.30 p.m.

The Annual General Meeting will be held on July 28th, 1882, at 8 o'clock, for Election of Officers and other Business.

EXCURSIONS, 1881.

MAR. 26th.	HIGHGATE. To meet at Broad Street Station.
APRIL 9th.	WANDSWORTH COMMON. To meet at Clapham Junction at 3 p.m.
APRIL 23rd.	SNARESBROOK. To meet at Fenchurch Street Station at 2 p.m.
MAY 7th.	ASCOT. To meet at Waterloo Station, Loop Line.
MAY 21st.	MERSTHAM. To join the Croydon Club. To meet at Cannon Street Station.
JUNE 4th.	NORTHFLEET, for SWANSCOMBE. To meet at Cannon Street Station.
JUNE 18th.	BROXBOURNE, for HERTFORD HEATH. To meet at Liverpool Street Station (2 p.m. train).
JUNE 23rd.	EXCURSIONISTS' ANNUAL DINNER. Arrangements will be duly announced.
JULY 2nd.	HAMPTON COURT. To meet at Waterloo, Suburban Station, Main Line.
JULY 9th.	DAY EXCURSION, GREAT MARLOW. To meet at Paddington Station (Excursion Train, at or about 11 a.m.).
JULY 16th.	WOKING, returning by Weybridge. To meet at Waterloo, Suburban Station, Main Line.
JULY 30th.	SLOUGH, for BURNHAM BEECHES. To meet at Paddington Station.
SEPT. 3rd.	TAPLOW. To meet at Paddington Station (Excursion Train, at or about 2.30 p.m.).
SEPT. 17th.	BROMLEY, for KESTON. To meet at Holborn Viaduct Station.
OCT. 1st.	BARNES. To meet at Waterloo Station, Loop Line.

The time of departure from Town, unless otherwise specified, will be THE FIRST TRAIN AFTER TWO O'CLOCK.

E. DADSWELL,
F. W. GAY,
F. OXLEY,
W. W. REEVES,
T. ROGERS,
J. SPENCER,
} Excursion Committee.

GENERAL INDEX

TO THE

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OF THE

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1882.

INDEX.

NOTE.—In the JOURNAL, Vol. II, pp. 285—287 are in error printed as 215—217.