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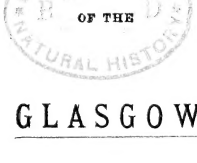

OF THE

GLASGOW

SOCIETY OF FIELD NATURALISTS.

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ESTABLISHED 1871.

SESSION 1872-73.

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THE GLASGOW SOCIETY OF FIELD NATURALISTS was established in May 1871, for the advancement and cultivation of the study of the various branches of Natural History; for furthering original biological research among its members; for the elucidation of the Natural History of Clydesdale, more especially of the obscurer branches of Botany and Zoology; and for the spreading of a love for the study of Nature among the community. The means adopted for the promotion of these objects are (1), Meetings for the Exhibition of Specimens and the Reading of Papers; (2), Excursions to places of interest in the vicinity of Glasgow; and (3), by the formation of Typical Collections of the Smaller forms of life.

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OFFICE-BEARERS, and J. HARVIE and R. M'KAY.

ANNUAL REPORT

OF THE

GLASGOW

SOCIETY OF FIELD NATURALISTS.

During the past year, the work of the Society has been carried on with vigour. The addition to the number of members has not been great; but the prosperity of such a Society is rather to be measured by the work done, than by the increase of its members.

There have been twelve excursions to places in the neighbourhood by the Society, and the results of nearly as many excursions by individual members have been recorded. The Society's excursions were to the following places:—the Shores of the Gareloch; the Banks of the Forth and Clyde Canal; Bardowie; Cadder Wilderness; Old Water Works on the Clyde; Devole's Glen, near Port-Glasgow; Possil Marsh and Bardowie; Tollcross and Kenmuir; Kilmalcolm, by Kilellan and Barochan to Houston; Calderwood Glen; Dunoon, for dredging; and Callander.

As yet the excursions have been rather desultory, the time devoted to each of them being short; but they have been useful in preparing the way for a more systematic survey of the district, a task to the performance of which the members must look forward.

The places visited by individual members (the observations made during these visits being recorded in the Society's Minute-book and Journals), were—Cumbraes, for dredging; Bute, in the neighbourhood of

Ascog; West Coast of Inverness-shire; Ben Lawers, twice visited; Arran; Sunderland; Valleys of the Tweed—Ettrick, Teviot, Esk, and Annan; Troon; and the Shore below Skelmorlie.

During the first few years of the existence of such a Society, the excursions are necessarily more for the purpose of general observation than for the purpose of making careful observations, so that at first great results are not to be looked for. The following reports of the work done during the year give a summary of the more interesting observations made.

MARINE ZOOLOGY.

MR. J. HARVIE.

Two dredging excursions took place during the season—one to Cumbrae, and one to Dunoon; there was also one, for shore-collecting, to Troon. At the excursion to Cumbrae several interesting animals were found; among others, several specimens of the Cloaklet Anemone, *Adamsia Palliata*, attached to the shell inhabited by the Hermit Crab, *Pagurus Prideauxii*. One of the largest of these was transferred to an aquarium by one of the members; and although the *Adamsia* did not long survive the confinement, the *Pagurus* seemed not at all inconvenienced by the loss of its companion. Several weeks after the death of the anemone, a very small specimen of the *Pagurus*, with a correspondingly small specimen of *Adamsia Palliata* attached, was introduced into the tank; and next morning, the small *Pagurus* was found dead, while the *Adamsia* was now seen to be attached to the large *Pagurus*. It seems generally believed, that the strange partnership which exists between these two animals is for the benefit of the anemone; but as in this case the small crab was found torn in pieces, it was inferred that it had been killed by the large one, in order to obtain possession of the anemone which was adhering to its shell.

It was observed that the shells in which the largest *Paguri*, and on which the largest *Adamsiæ* were found, were apparently deprived of a great part of their lime, and had a similar appearance to shells which had been for some time in a strong acid. At the same

excursion several magnificent specimens of the *Actinia Dianthus* were procured.

In a paper, read subsequently at one of the Society's meetings, considerable exception was taken to the statements so often made with regard to the extreme voracity of the *Actiniadæ*, the writer quoting several statements to this effect from various authors, and giving, at the same time, an account of numerous experiments which he had performed for the purpose of testing the truth of these statements,—all of which led him to believe that the *Actiniadæ* were neither so voracious nor so powerful as was generally believed. He also stated that in no instance could he discover that the *Actiniadæ* possessed that power of paralysing their prey which is so often attributed to them.

ENTOMOLOGY.

MR. P. CAMERON, JUN.

ENTOMOLOGICALLY speaking, 1872 was one of the worst seasons known to the oldest collector of insects. It commenced bad, and ended worse, and was discouraging alike to the veteran and the tyro. The spring was very cold, the summer one continued drizzle; and although the early autumn was somewhat better, yet the number of insects did not increase, and, latterly, some of our collectors became quite disheartened.

Such a season told especially upon a sun-loving order like the *Hymenoptera*, which was extremely scarce.

The Humble-Bees were rare all the season. Eight species were captured:—*Bombus lapidarius*, seen near Dumbarton; *B. pratorum*, not uncommon on the sallow catkins at Possil Marsh, in the spring, and, later, at the flowers of *Vaccinium myrtillus*, in Cadder Wilderness. Its parasite, *Apathus Barbutellus*, was even more abundant in the same localities, in the autumn. *B. terrestris*, one specimen at Tollcross; *B. lucorum*, common everywhere; *B. hortorum*, not uncommon at Carmyle, Tollcross, &c.; *B. fragrans*, two specimens taken at Possil Marsh—a female and a worker. Its nest was found there on July 3, and consisted of an egg-case and a honey-cap, covered over by a dome of dry hay. *B. senilis*, one specimen; *B. muscorum*, very abundant everywhere.

The *Andrenidæ* were very scarce, except perhaps during May, when many of the commoner species might have been observed industriously providing for their young on the Tollcross Sandhills; and I was particularly interested in watching the habits of *Specodes rufescens*, which constructs its nest in the same manner as its neighbour, *Andrena albicans;* but the genus to which it belongs had been formerly considered parasitic, through their want of pollenigerous organs.

One morning, in a place on the Sandhills where the bees' nests are very thick together, I was surprised to see a small *Andrena* going bobbing about from nest to nest as if it did not know its own; but it discovered it at last, and popped inside. The sun at the time was very bright.

The Ants did not appear to be one whit less numerous than on previous years. I was not a little surprised to discover a nest of a common species among the wet sphagnum in Possil Marsh, in a place which certainly was never dry the whole season, and must occasionally have been very wet indeed. The nest differed in nowise from those found in the fields, containing galleries as well as larvæ and pupæ; but how they managed to come to maturity, or how these usually wise insects could make their nest in such an uncongenial spot, is more than I can understand. In the nest of another species I was much pleased to find a colony of Aphides located: the Aphides belonged to a species which I have found often sucking the roots of grasses.

Wasps were not abundant. Two or three nests of *Vespa vulgaris* were noticed between Carmyle and Kenmuir. The other species found were, *V. rufa*, at Possil and Tollcross; *V. sylvestris*, near Strathblane. The Sand-wasps were nowhere.

The only representative of the Chrysidæ captured, was *Omalus cæruleus*, Dbm., which was taken near Paisley.

The *Ichneumonidæ*, *Proctotrupidæ*, and *Chalcididæ*, were very feebly represented. Regarding the transformations of the *Chalcididæ*, I have observed that they have two kinds of pupæ, which differ principally in the manner in which they are enveloped when in that condition. The one form I have only found in hard woody galls, which they do not leave until the perfect state is reached, and are invested merely in a thin transparent pellicle, which is almost invisible when cast off, like the pupæ of the *Cynipidæ;* while the other is enclosed in a thick, hard, black skin, like the obtected chrysalis of a moth, to which they have a very close resemblance indeed; and when the chalcis quits this case, it remains hard and firm, and still retaining the shape of the limbs. This

appears to be the common manner of pupation with the species which pass the period of repose in the ground unprotected.

I may also allude to a fact in the economy of a *Callimone*, which may throw a little light on its relations towards other insects. In the spring, I opened a pea-shaped gall found on the underside of an oak leaf, and found therein a large *Callimone*, not long freed from the pupal skin. Beside it was the dead pupa of one of the *Cynipidæ*, considerably crushed and flattened, evidently by its larger companion pressing it against the side of the gall, which afforded little enough room for the parasite itself. As many of the galls found on the same leaf were inhabited by two larvæ of an inquiline, it is probable that this was also the case with the gall in question, and that the *Callimone* had devoured one larva, besides killing the other in the way indicated. I have found a chalcis and an inquiline together in one gall, and reared them successfully; but in this case the parasite was smaller than the other, or at least of equal size. Another matter which interested me, and which is well worth further study, was the manner in which certain *Chalcididæ* were distributed through the gall-apples of *Teras terminalis*. Among the hosts of parasites were four of these insects, which were distributed in the galls—as might, indeed, be conjectured without actual observation—in relation to the length of their ovipositors. Thus, a species without any visible ovipositor was found to inhabit the cells at the surface, the others tenanting cells nearer the centre, according to the length of theirs, and culminating in one with an ovipositor four lines in length, or almost half the diameter of an ordinary gall.

The *Cynipidæ* occupied a good deal of my attention, but as they will be fully discussed in next year's "Transactions"—with, I hope, many additions—I need not further refer to them here. It may be mentioned, however, that twenty-five species of true gall makers were found in the district in 1872. Mr. A. Müller gave, in the *Entomologist's Annual* for 1872, thirty-two as the number known to inhabit Britain; so that our district possesses its fare share of these interesting insects. I cannot, however, pass over the extraordinary advance *Cynips lignicola* has made among us. It is now found almost everywhere, the latest locality discovered for it being the South-side Park. In 1871, when I first found it at Kenmuir Bank, many of the galls had the larvæ picked out by some bird; but, latterly, I do not remember finding any in that condition. The larvæ are said to have a bad odour (but, I must confess, I never could feel any), which may account for their preservation.

Regarding the writer's own speciality, the *Tenthredinidæ*, it is painful to speak of; a more disheartening task than hunting for saw-flies could scarcely be imagined. From early spring to the beginning of June scarcely half a dozen species were captured. On his return from a Highland tour, things began to mend a bit. *Lyda pratensis*, L., was taken in the Paisley Moss-Wood, which is unfortunately being cut down. *Tenthredo zonata*, Panz, was beaten out of an oak at Kenmuir; while Possil Marsh yielded *Tenthredo obsoleta*, Klug, which is not only new to the district, but to Britain. In all probability it will be mixed up, in collections, with the allied species, *T. viridis*, L., to which it has some resemblance. *Leptocerca Alni*, L., and *Crœsus septentrionalis*, L., were taken at Cadder Wilderness. The other species taken need scarcely be described, as they are generally distributed. *Sirex gigas*, L., was taken in a shipbuilding yard at Port-Glasgow, evidently imported in timber.

I may here mention a curious incident. One day I beat a number of *Athalia rosæ*, L., out of some bushes. On examining them at home, I was surprised to find among them some dipterous insects, which bore a remarkable resemblance to *A. rosæ*, and had, in point of fact, been bottled for that insect. The resemblance was not merely superficial; the two-winged fly had smoky wings, with black stigma, black thorax, and reddish abdomen, short black antennæ, all like the saw-fly; the tarsi were all black—not merely the half of the joints, as in *rosæ*; but, with this exception—and, of course, the difference in the number of wings—the "mimicry" was remarkably close; and it would be easy to pick out some of the *Selandrias* to which the likeness would be still closer. Further, a number of *rosæ* were given me by a collector, and among them was this Dipteron; so it is evident they have the same haunts, but whether it is a true case of mimicry or of mere resemblance, as is most likely, it is impossible to say, without some knowledge of their respective life histories.

The abundance of saw-fly larvæ during August and the rest of the autumn, made up somewhat for the paucity of the perfect insects during the earlier part of the season. About sixty different kinds were found; but as the imagos have not yet made their appearance, an account will be given of the rarer species in the next Report. One or two, however, may be mentioned. The larvæ of one of the forms of *Cimbex variabilis* of Klug occurred commonly at Kilmalcolm, on birch, in August. A *Nematus* was found inhabiting beautiful pea-shaped galls on *Salix purpurea*, at the Clyde Iron Works, and it is well worth going a journey to

see them. *Nematus Ribesii*, Stph., the gooseberry saw-fly, was commoner than was desirable on that plant in some of the gardens. A circumstance well worth further investigation happened while breeding these destructive larvæ. About the end of July, all my larvæ buried themselves in the earth. A month later, five or six of the imagos made their appearance, and along with them were two specimens of another and quite distinct species of *Nematus*, the name of which I cannot make out, and they do not agree with the descriptions of the other saw-flies, whose larvæ are known to feed on gooseberry and currant bushes. It is, therefore, evident that the two larvæ have the same dress, appearance, and habits, while the perfect insects are totally different.

The most remarkable larvæ met with, however, was a curious flat onisciform, greenish creature, found on some alders at Fruin Glen, Loch-Lomond, late in August, which, on bringing home, I found had been described first by Dohlbom, then by De Geer and Reaumur; but neither of these naturalists had been able to rear the imago, which remained unknown until Mr C. Healy traced its history, and it was described by Mr Newman as *Camponiscus Healæi*.

My experience with the *Coleoptera* consisted of such species as came across my path while searching for Hymenoptera. A single damaged specimen of *Pterostichus lepidus* was captured in its old haunts on the Tollcross Sandhills, which, unfortunately for naturalists, are being extensively dug out. *Dytiscus punctulatus* occurred at Possil Marsh; *Aphodius rufipes*, abundantly in dung below Carmyle; *Hypera pologoni*, a rare beetle in this quarter, was taken by sweeping in the Paisley Moss-wood; *Hylobius abietes*, rare on firs at Lambhill, where its days are evidently numbered; *Brachytarsus varius*, one specimen beaten out of hazel at Kenmuir. Four Longicornes occurred. *Rhagium bifasciatum* was observed flying on the Tollcross Sandhills, evidently from some of the coal pits; *Grammoptera ruficornis*, very common in May at Kenmuir Wood. Mr King found *Pachyta octomaculatus* at the Kelvin, near the old bowling-green. It has not been, I think, recorded for Scotland; but it is extremely doubtful if it is a native, and was probably introduced in some wood. *Clytus arietis* was taken, by Mr Crawford, near Hamilton. A visit was paid to Bardowie Loch, early in July, in search of *Donacia crassipes*, which was found, as usual, on *Nuphar pumila*. In the vicinity of Glasgow I have, besides this, met with only two species of that genus, *D. sericea* and *D. bidens*, and both were found at the quarry at Lambhill, which, I am sorry to say, is destroyed, and with it, I am afraid, a good many rareties.

A visit to Irvine and Troon, on the Queen's Birthday, in company with Mr Dunsmore, yielded some good beetles, but no Hymenoptera. *Dyschirius impunctipennis* and *Bembidium pallidipenne* were found most abundantly on the moist sand near the sea; *Broscus cephalotes*, of course everywhere; *Onthophagus nuchicornis*, rare in dung; *Ægialia arenaria*, very common; *Phyllopertha horticola*, rare; *Helioparthes gibbus*, very common in the pits.

Mr James King has furnished me with the following list of his best captures among the Lepidoptera:—

Eupithecia Indigator, at Possil; *Ypsipetes ruberata*, Eaglesham, but getting exterminated; * *Cidaria populata*, Cadder Wilderness; *Miana arenosa*, common on banks of Canal at Maryhill; *Scoparia muralis*, Possil Marsh; *Perenia schalleriana*, St. Germans Loch; *Retinia pinivorana*, Possil; *Dicrorampha Herbosana*, Possil; *Cochylis Smeathmanniana*, Possil; *Argyresthia Gœdertalla*, Possil and Kelvin; *A. Brocheella*, Possil; *Gracilaria smederella*, Possil; *Pterophori bipunctidactylus*, Possil Marsh.

Speaking generally, most of the other orders appeared in diminished numbers, and this seemed to be more particularly the case with the *Diptera*, except one blood-thirsty species which tormented my existence in Cadder Wood.

Among the *Neuroptera*, the occurrence of *Œschna varia*, which was captured, far from its native element, in Buchanan Street, must not be passed over.

Both *Sialis lutaria* and *S. fuliginosa* occur in the district.

While out in Bardowie Loch, in July, searching the water-lilies for *D. crassipes*, I was covered with multitudes of a small pure white species of *Ephemera*, or May-fly, which rose out of the water in shoals, and fell on me like flakes of snow, while others alighted on the plants, stones, &c., on the side of the water, where they cast off their skins. This was about five o'clock.

I do not recollect seeing any grasshoppers other than *Tettix bipunctata*, which was taken abundantly on the Gareloch, at the beginning of April, and, in July, near Milngavie.

* It is to be hoped, not by collectors.—P.C.

BOTANY.

MESSRS R. M'KAY AND G. HORNE.

In the Botanical section, owing to the previous industry of many well-known local botanists, little has been done by way of adding to the flora of the district. Indeed, from the alterations taking place by the extension of the city and other necessary causes, many of our favourite stations are fast disappearing. Kelvin woods, Possil and Stonelaw quarries, are among these. We are sorry at being able to add that other localities have in recent years been closed against us, without, so far as we can judge, any visible cause. During the past year, Bardowie Loch has thus been closed.

Of native species not previously recorded, the following have been authenticated:—*Avena pratensis*, L., found at Whiting and Machrie Bays, Arran; *Carex watsoni*, Syme, near Hamilton and Kenmuir bank; *Mentha viridis*, L., abundant near Hamilton; *Claytonia alsinoides*, naturalized near Cloch; *Astrantia major*, L., naturalized on Possil Road; *Hypochoeris glabra*, L., Whiting Bay, Arran; and *Elymus arenarius*, Invercloy, Arran. The two last found by Dr Syme.

New localities are recorded for the following:—*Viola odorata*, L., Bothwell Bridge; *Lepidium smithii*, Hook., Baldernock; *Geum intermedium*, Ehr., Carmyle and Bothwell Bridge; *Agrimonia Eupatorium*, L., near Hamilton; *Arum maculatum*, L., Calderwood Glen; *Sedum villosum*, L., Loch Cochno, Kilpatrick Hills; *Carex laevigata*, Sm., near Shandon, Gareloch; *Carex pendula*, Huds., Banks of Clyde, opposite Kenmuir, and near Cloch; *Isoëtes lacustris*, L., Loch Cochno, Kilpatrick Hills.

As many plants appear occasionally on rubbish-heaps and other doubtful situations, it is thought it might be useful to keep a record of these appearances, that the history of any which might afterwards become naturalized could be ascertained. The following is given as a contribution to such a record:—*Reseda lutea*, L., Great Western Road, at Hillhead; *Helleborus viridis*, L., Bothwell Woods; *Lepidium Draba*, L., near Renfrew; *Erysimum orientale*, Br., near Clyde Ironworks, Possil Park, Possil Marsh, and Carmunnock Road; *Saponaria Vaccaria*, L., near Clyde Ironworks, and opposite Dalbeth; *Geranium nodosum*, L., Bothwell Woods; *Medicago falcata*, L., near Renfrew, opposite Dalbeth,

and Possil Marsh; *Medicago denticulata*, Willd., Lochburnie, Possil Park, Great Western Road; *Medicago apiculata*, Willd., Possil Park and Great Western Road; *Melilotus parviflora*, Lam., Firhill, Possil Park, Great Western Road; *Melilotus arvensis*, Wallr., Inchinnan; *Trifolium resupinatum*, L., Possil Park; *Vicia lutea*, L., near Renfrew; *Potentilla intermedia*, Bothwell Woods; *Centaurea solstitialis*, L., Lochburnie; *Doronicum plantagineum*, L., Bothwell Woods; *Xanthium spinosum*, L., Helensburgh; *Campanula rapunculoides*, L., near Langside; *Mimulus luteus*, L., Cathkin; *Echinospermum Lappula*, Lehm., near Renfrew; *Echinospermum deflexum*, Lehm., Possil Marsh; *Setaria viridis*, Beauv., near Renfrew. *Setaria glauca*, Beauv.; *Polypogon monspeliensis*, Desf.; *Apera Spica-venti*, Beauv.; *Alopecurus agrestis*, L.; and *Phalaris paradoxa*, L.,—Great Western Road.

The formation of the Typical Collections mentioned in the following report by the Curator, will not only be the means of gathering together the results of the observations made into a more permanent form, but will also tend to make them more accurate, thus adding greatly to their value.

CURATOR'S REPORT.

The Council, taking into consideration the great disadvantage under which Entomologists and other workers at the smaller forms of life lie in Glasgow, through the want of typical collections, and seeing no prospect of this desideratum being otherwise supplied, resolved to undertake this work. As the undertaking was only agreed upon a few weeks ago, it is now only just begun. But the Curator has much pleasure in reporting that, even as they are, the collections are of considerable value. It is to be hoped that the members will further the scheme as much as possible, and that in the course of time these collections will be extensive enough to obviate the necessity of beginners sending their specimens to England for names.

Through the generous and spontaneous gift from Mr John Dunsmore, the well-known Paisley Entomologist, of 200 species of Tortrices, the Lepidoptera is well begun. The Curator has presented between 500 and 600 Coleoptera, and an Herbarium of Cryptogamic plants is in course of formation. In addition to this, the Botanical members of the Society

have undertaken to present to the Kelvingrove Museum a collection of the flowering plants of Clydesdale, and last season they were enabled to hand over a large number of specimens.

The papers read during the year have been varied and interesting. Although the work of the Summer Session chiefly consisted of the exhibition of specimens and reports of excursions, yet time was found for the reading of short papers on the following subjects:—"The Order Decapoda of the British Stalk-eyed Crustaceans," "How to begin a Salt-water Aquarium," "Explanation of the Principles of the Construction of the Microscope," "The Eye and its Modifications in Insects," and "When are Plants entitled to be called Indigenous?"

The reading of papers being the object to which the meetings of the Winter Session are principally devoted, at the beginning of the Session a syllabus was prepared, and from the success with which the arrangements were carried out, evidence was given of the benefit arising from having the subjects of the papers previously fixed.

During the Winter Session, papers were read on the following subjects:—"On the Present Tendencies of Science;" "On the Distribution of Plants;" "A Life History of Nematus Gallicola, with some Account of its Parasites;" "On Spiders;" "On Zoophytes;" "On the Exotic Plants of Clydesdale;" "On the Definition of Species;" "Notes of Observations in Marine Zoology;" "Notes of Observations with the Microscope;" "Botanical Gleanings from the Rubbish-heaps of the City;" and "On the Cynipidæ of the Glasgow District."

In addition to the above, a paper by Dr. Stirton was brought under the notice of the Society, which the Council resolved on publishing, as it contains an account of a number of lichens found in New Zealand not hitherto described.

ADDITIONS TO THE LICHEN FLORA OF NEW ZEALAND.

DR. J. STIRTON.

THE following are descriptions of lichens picked out of several bundles sent to me by Mr John Buchanan, of the Colonial Museum, Wellington, New Zealand, to whose assiduity and enthusiasm I can bear ample testimony.

There is every probability of my being able to supplement what is now given, as Mr Buchanan is diligently prosecuting his researches towards the interior of the country, where the chances of success are greater, and where, too, disturbing causes are less at work.

Towards their determination and identification, I have had access to various works, and, of these, Nylander's *Synopsis* has proved most useful, so far as it goes; but as the literature of the subject is scattered and imperfect, I have been thrown pretty much on my own resources, aided, of course, by an herbarium, which, although not very extensive, is yet adequate enough to enable me to arrive at tolerably definite conclusions, at least on the crustaceous lichens. It ought to be stated, also, that two or three of the most characteristic species are in small quantity, as they have, in fact, been detected on barks, &c., containing other lichens, for which they were more immediately sent, and, as a consequence, are confined to a few apothecia.

The botany of Australasia has peculiar attractions for a student in the northern hemisphere, inasmuch as it may be said to belong to a preceding geological epoch; and it is curious to notice, that while the phanerogamic part of it diverges widely from that of countries in a corresponding northern European latitude, its cryptogamic part shows closer analogies, and the more so as we approach the lichens, whose powers of resisting atmospheric changes and conditions are becoming a subject of closer study, in proportion as our knowledge of their structure and internal organization advances. If we are ever to arrive at anything like a general comprehension of the spread and distribution of vegetation over the surface of the earth, I have little doubt that a thorough appreciation of climacteric changes on the lower organisms will serve to indicate the movements of the larger waves, so to speak; and as these are the first to reveal themselves, I hold that this part of the scale ought to have more attention paid to it than has hitherto been the case.

The present attempt will have served its purpose, if it merely provokes discussion of this difficult, yet interesting, section of Botany.

It will be seen that no specified order of classification has been followed; it is merely that of detection and discrimination.

Lecidea campylospora (Sp. Nova).—Thallus, in one specimen, white or greyish white, thin, continuous, almost papery (K— C—); in another, of a darker dingier colour, rimulose areolate, areolæ flat or convex, and somewhat granulate. Apothecia elevato-sessile; concave and contracted, in a young state, afterwards expanded and flat, or even somewhat convex; caesio-pruinose, border thick, rounded and inflexed.

Spores four, six, or eight, colourless, very large, bent at middle, one septate, with, in many instances, nuclei in the loculi, epispore crenulate; paraphyses dense, capillary; hypothecium pale yellow, grumous, subtended by the dense black receptacle.—This is evidently allied to *Lecidea marginiflexa* (Taylor), although quite distinct. On trees at an elevation of 1000 feet.

Lecidea fuscolutea (Dicks.).—The chemical reactions are identical, viz., K. thallus, yellow; apothecia, crimson. The hypothecium is darker than specimens from Ben Lawers.—On trees, 1000 to 1500 feet.

Lecanora chrysosticta (Taylor) is mentioned for the purpose of recording the fact of its growing along with the preceding on the bark of the same tree. As regards their internal organization, the two lichens are identical, and it is only when the thallus and thalline margin of the latter are considered, that the question of generic difference is forced upon the attention. The chemical reactions are also identical, and, as showing still further the close organic affinity between the two, there are seen, scattered on the thallus of the former, spermogones without the thalline margin, while on the latter are seen the same, with an elevated thalline margin. I may have another opportunity of returning to this subject, which is beginning to interest me, inasmuch as I can point to other instances having a similar association.

Bœmyces pertenuis (Sp. Nova).—Thallus scarcely discernible. Apothecia pale buff, concave with a paler border, attached by a central axis; spores eight, exceedingly minute, elongato-elliptical, apparently simple, although there are occasional indications of a septum which a $\frac{1}{8}$ objective cannot distinctly resolve, in nearly single file in asci, which scarcely differ in size or thickness from the ordinary paraphyses. A section presents the characteristic appearance of lichens of this genus. In such an extreme case as this, it is necessary to remark that I have carefully discriminated between the oil globules that are seen in the paraphyses of one or two of the species of this genus and these minute spores, which still preserve their outline when free of the asci, and which, by the aid of a better objective, I find now are nearly constantly three septate.—On trunks of trees, apparently those of some species of tree fern.

Squamaria thaumasta (Sp. Nova).—Thallus greyish white, tesselato-areolate, consisting of roundish *umbonate* particles, closely set together, and yet quite distinct; cephalodia large, reddish brown, cracked in a radiating manner, and roundly lobed at the circumference; apothecia small, elevato-sessile, concave, reddish brown, rugose, with an elevated, smooth, inflexed border; spores eight, colourless, broadly elliptical,

uniserial, one septate.—A beautiful lichen, and one that might constitute the type of a new genus. On stones in dry creeks, 200 feet.

Lecidea Otagensis ? (Nyl.).—Thallus greyish white, smooth, thin and nearly continuous; apothecia black, sessile, slightly concave, margined, afterwards slightly convex and immarginate, and somewhat rugose; spores eight, irregularly fusiform, thicker at one end, and shaped like an italian *f;* septa varying from two to six; hypothecium pale; paraphyses not distinct, their apices black and closely matted together, as in many others of the New Zealand lichens.

The shape of the spores as indicated above is constant throughout several specimens examined, and it is noticeable that the curve at the thicker end is invariably that of a shorter radius vector.

Until I saw Dr Lauder Lindsay's paper, in the *Edinburgh Philosophical Transactions*, On Lichens and Fungi of New Zealand, I felt satisfied in identifying this lichen with *L. Otagensis*, from Dr. Nylander's description; but the shape of the spores, as figured by Dr. Lindsay, is quite at variance with what I have seen and described. The whole of a thin section has a dingy aspect, and the hypothecium is not dingier than the rest, perhaps more pellucid.—On trees, 1000 to 1500 feet.

Lecidea insidens (Sp. Nova).—Thallus white, smooth, investing the leaves of *Dicranum Menziesii* with a continuous layer, to which, also, the apothecia are attached by a central point; apothecia reddish brown, rugose, plane, surrounded by a smooth prominent border of the same colour; hypothecium pale red, grumous; spores eight, colourless, sphaerical, muralilocular; paraphyses discrete.

The spores are muralilocular, and not merely coarsely granular, while their outline, when free, is, in the great majority of cases, circular, although a few are to be seen somewhat oblong. The paraphyses are thickened at their apices, where they are of a brown colour, and matted together.

Lecidea kelica (Sp. Nova).—Thallus greyish white, thin, minutely rimuloso-areolate; areolæ smooth, flat, or somewhat convex (K— C—); apothecia bright yellow (K, red), convex, immarginate, generally clustered and then deformed; hypothecium pale; spores eight, straight or curved, colourlesss, elongato-elliptical, almost sub-cylindrical, one septate; paraphyses indistinct, with reddish brown apices.

This lichen is peculiar in having attached to the hypothecium, or indeed forming part of it, little cushions composed of green granular matter, not gonidiac cells, but rather as if their granular contents were set free—granula gonima, in fact; so that a microscopic preparation

capable of showing the asci and spores, has, to the naked eye, a bright lemon colour throughout. I cannot see the slightest trace of a margin even in very young apothecia, and, as the reaction is always as indicated above, I have no doubt this lichen is distinct, although it has certain affinities to *L. Ehrhartiana* (Ach.). On trees.

Lecidea amphorodes (Sp. Nova).—Thallus dark ashy grey, rimulose, thin. Apothecia small, black, prominent, flat in a young state, and smooth, with a slight border; convex, immarginate and rugose, when mature. Section of apothecium pale throughout, seated on a brownish grumous stratum; paraphyses scattered, distinct, colourless, filiform, densely matted together at their thickened apices; asci pyriform, lower extremity attenuated and easily detached, walls composed of a double hyaline membrane, with a broad intervening space resembling, in this respect, the epispore in *Lecidea sanguinaria;* spores large, four, six or eight, in asci oblong-cylindrical, multiseptate, with longitudinal septa.

A remarkable phenomenon is seen in a microscopical preparation of this lichen, of some months' standing, viz., filaments are seen arising from many detached spores—*first*, from the extremities; *second*, from the septa, or in a line with them. Whether this is the result of germination or not, I cannot determine, as I have very few apothecia left, and do not care to destroy more until I see whether it is possible to secure other specimens. —A very distinct and curious lichen. On trees.

Lecidea maculosa (Sp. Nova).—Thallus whitish, thin, determinate, continuous or slightly rimulose, somewhat rugulose (K y C y); hypothallus black; apothecia black, sessile, flat, moderate, separate or conjoined, with a prominent black margin; spores eight, colourless, the great majority curved, ellipsoid, one septate ·016 × ·007 m m.; paraphyses slender, distinct, with black very much enlarged, club-shaped extremities, which are matted together; thalamium pellucid; hypothecium a beautiful reddish brown, subtended by a pale stratum, which rests on the black entire exciple.—On bark, Wellington.

On the same piece of bark were detected a few apothecia of *Lecidea melanotropa* (Nyl.), having their characteristic appearance. In all specimens of the latter lichen that I have seen, the epithecium alone turns livid, while the smooth margin retains its pale colour.

Lecidea implicata (Sp. Nova).—Thallus white, smooth, thin, glaucous, rimulose (K— C—); apothecia large, sessile, flat or somewhat convex, pale buff colour, pruinose, rugose, border smooth, somewhat inflexed; paraphyses distinct, filiform, densely matted together, and giving off lateral filaments; hypothecium yellowish brown; spores eight, colourless,

elliptical, large, simple, coarsely granular. Disk of apothecia rendered slightly darker by K, but not red.

This lichen has a proper margin, and as the apothecium is attached by a broad central basis, the thalline receptacle is seen covering it and the unattached portion, but ceases considerably below the proper margin. Spores, ·043×·021 m m.—On trees, 1000 to 1500 feet.

Verrucaria Wellingtonii (Sp. Nova).—Thallus a dirty brownish cream colour, thick, continuous, smooth; apothecia large, immersed; perithecium entire, globose; epithecium depressed, dark brown, poriform; spores eight, colourless, very large, oblong, fusiform, acutely pointed, muralireticulate, enveloped in a double hyaline membrane which is most perceptible in a young state, when, also, the contents are coarsely granular; paraphyses distinct, filiform, numerous.—A very remarkable lichen. On trees.

Astrothelium prostratum (Sp. Nova).—Thallus well developed, continuous or rimulose, thin, yellowish white, merging into grey or cinereous; apothecia compound; receptacle black, large, broad (·02 to ·07 in.), shallow, scarcely raised above the general surface; perithecia entire, irregular in outline, and all apparently opening into one ostiole which shows on the surface; spores eight, uniserial, colourless at first, when the contents are coarsely granular, becoming brown when mature, with six cross bars, which assume the appearance of oval coloured cells; paraphyses plentiful, filiform, simple.—On bark.

Squamaria gelida (L.).—The apothecium of this lichen is differently constituted from that in this country, inasmuch as the thalline exciple resembles the cup of the acorn, while there is a proper border, smooth and prominent, surrounding the epithecium, which is itself white, pruinose and rugose. I can see, however, little difference otherwise to warrant a separation.

Parmelia implexa (Sp. Nova).—Thallus yellowish brown, smooth above, closely adherent, intricately divided into small lobes which are roundly laciniated; under surface white, tomentose (much more so than usual), attached to the bark by a dense mass of coarse, stiff, black, branching rhizinæ, which extend considerably beyond the thallus; apothecia moderate, brown, surrounded by a deeply incised lobular inflexed thalline margin, which, in a young state, almost conceals the disk; spores eight, simple, elliptical, moderate; paraphyses not discrete, agglutinate at their apices; hypothecium yellowish brown, grumous.

I have given a rather minute description of a lichen which has puzzled me considerably, mainly for the purpose of calling attention to it, as I

cannot pretend to an intimate knowledge of this intricate and perplexing genus. The chemical reactions of K and C on the upper surface and medulla are (K— C—).

Thelotrema obovatum (Sp. Nova).—The spores of this lichen differ in shape from those of *Th. lepadinum*, and have altogether an appearance so peculiar, that I have been tempted to elevate it into the rank of a species under the name given above. Thallus yellow, rimulose, uneven, slightly nodulated; apothecia hemispherical, crowded in some parts; ostiolum rounded, open, margin even; disk urceolate, scutelliform, dark brown, proper margin inflexed; spores eight, colourless, obovate, sharp pointed at one end, rounded at the other, divided internally by numerous cross bars which do not reach the margin; epispore beautifully crenulated.

These characteristics are constant, at least in every specimen examined. I have not seen *T. subtile*, but, judging from the description of it by Leighton, in his *Lichen Flora*, I cannot reconcile myself to identifying the present plant even with it.

Psoroma athroophyllum (Sp. Nova).—Thallus greyish brown, thick, continuous, brownish black, and rough on the under surface, multifido-laciniate above; laciniae closely imbricated, ascending, broad, margins roundly crenate, their under surface somewhat paler; apothecia large, rufous, rugose, margin elevated, granuloso-concrete; spores eight, colourless, sphaerical, crenulate, in nearly single file in asci; paraphyses indistinct.

This may be *Psoroma euphyllum* (Nyl.), of which no description is given in the "Flora of New Zealand," nor in any of the later papers to which I have had access.

Lecidea contigua (Fr.).—A curious form growing on earth. The apothecia are sessile, and arranged in beautiful concentric rings; the border sharply defined and flat, being set at an angle to the surface, a disposition seen in a certain proportion of New Zealand crustaceous lichens. The internal organization resembles exactly that so characteristic of this lichen.

Lecidea enteroleuca (Ach.).—On earth. In this instance, also, there are no elements of distinction of sufficient importance to warrant a separation.

Platysma dermatoides (Sp. Nova).—Thallus firm, large, from six to eight inches in diameter, roundish, thick (·3 mm.), brownish yellow or buff colour, under side concolorous, closely and roundly lobate; laciniae sinuato-pinnatifid, apices rounded and recurved, often subimbricate, and

the whole surface much and irregularly corrugated; apothecia reddish brown, turning brownish black, margin inflexed, deeply crenate; spores eight, colourless, elliptical, beautifully crenulate, simple, moderate; medulla white (K— C—), as well as upper surface.

A curious and somewhat anomalous lichen: the upper surface, under a lens, is seen to be minutely rugose and almost farinose, while the under presents a fibrous appearance, the fibres arranged nearly parallel, and closely appressed; spermogonia minute, papilliform, reddish, turning bluish black, situate near the margins of the lobules. On trees, Wellington.

Lecidea rivulosa (Ach.).—So far as I know, this is the first notice of this common lichen having been found in New Zealand. It differs in no essential from specimens found in Britain.

Trypethelium connivens (Nyl.).—The spores of the specimens sent, instead of remaining colourless, as Nylander states, turn ultimately to a brownish black, and the ostiolum shows a beautiful orange instead of being nigrescent; differences which, although worthy of remark, scarcely constitute a specific distinction.—On bark, Wellington.

Verrucaria cyrtospora (Sp. Nova).—Thallus white, smooth, glabrous; apothecia black, prominent, subglobose; perithecium entire; spores eight, narrowly fusiform, curved, brown, with four to eight rectangular nuclei (·03 × ·004 m m.); paraphyses long, filiform, occasionally branched.—On bark, with *Ver. glabrata*.

Lecidea amaura (Sp. Nova).—Thallus cinereo-virescent, thin, scattered, leprose or evanescent; apothecia small, scattered or conglomerate, subglobose, immarginate, obscure within; spores eight, colourless, fusiform, apices obtuse, mostly curved, one to three septate, ·009 — ·016 × ·003 m m.; paraphyses indistinct; hypothecium nearly colourless.—On palings, Wellington. Allied to *L. denigrata* (Nyl.).

Pannaria crustata (Sp. Nova).—Thallus dark greenish olive, squamuloso-crustaceous, areolato-diffract; squamules largish, rugose, round with crenulate upturned margins; hypothallus black, evident; apothecia reddish brown, moderate, flat, or somewhat convex when matured, with a proper margin of same colour, and an elevated crenated thallodal margin, which is often separated from the former by a chink, pale within; hypothecium pale brown; epithecium brownish; paraphyses matted together at apices; spores eight, simple, ellipsoid—or, more frequently, one or other, or both apices, acute—margins distinctly crenulate, moderate (·014 × ·008 m m).—On stones, Wellington.

Sticta hirta (Sp. Nova).—Notwithstanding the varied forms assumed by *Sticta Urvillei*, I am tempted to elevate into the rank of a species one of the several specimens sent.

Thallus widely expanded, reticulato-foveolate, broadly and roundly lobed, covered in many places with dense clusters of yellow isidiose efflorescence, under surface dark brown, densely tomentose; apothecia reddish brown, merging into black, margin composed of a mass of radiating isidiose excrescence, which, in many instances, almost covers the disk; spores as in the variety *Colensoi*.

NOTE.

Since the Report was arranged, Dr. Stirton exhibited two lichens from Ben Lawers, collected by him in June 1871, each somewhat anomalous in the section to which it belongs.

1st. *Solorina bispora*, Nyl. (Syn., p. 331).—The spores, in size and shape, are characteristic, as well as the peculiar granular or isidiose appearance of the thallus in the neighbourhood of the apothecia. This lichen is more allied to *S. limbata* than to *S. Saccata*. This is the first intimation of its existence in any other locality than that on the Pyrenees.

2nd. *Lecidea didymospora* (Sp. Nova).—Nearly allied to *L. sanguinaria*, but differing in having two spores in each ascus, which are, besides, only half the size of those of the latter, and oval in shape instead of oblong. A section of an apothecium shows, also, a perfectly pellucid appearance, instead of the greenish tinge which pervades the hymenium of *L. sanguinaria*, and the thallus is more continuous. The chemical reactions of the hymenium, epispore, and thallus, are identical in both. The discoverer remarked, besides, that this lichen is as much entitled to a specific place as *Lecidea geminata*.

TRANSACTIONS

OF THE

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OF

FIELD NATURALISTS.

ESTABLISHED 1871.

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Session 1873-74.

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1874.

TRANSACTIONS

OF THE

GLASGOW SOCIETY OF FIELD NATURALISTS.

SECOND ANNUAL MEETING.

187 George Street, 18*th March*, 1873.

The Annual Meeting of the Society was held here this evening—Mr. James Allan, Vice-President, in the chair.

The following office-bearers were elected for the ensuing year:—James Stirton, M.D., *President;* James Allan and George Horn, *Vice-Presidents;* David Gregorson, *Secretary;* George Barlas, *Treasurer;* Peter Cameron, Jun., *Curator;* Richard M'Kay and John Harvie, *Members of Council.*

Mr. Walter Galt was elected a resident member of the Society.

SPECIMENS EXHIBITED.

Mr. G. Horn exhibited a specimen of *Saxifraga rivularis*, one of the smaller saxifrages, from Lochnagar.

1st April, 1873.

The first meeting of the summer session was held this evening—Dr. J. Stirton, President, in the chair.

Mr. P. Cameron laid before the members a beautiful typical collection of *Micro-Lepidoptera*, numbering about 200 species, which had been sent as a donation to the Society by Mr. John Dunsmore, Paisley. The collection was much admired by the members, and the Secretary was instructed to convey the thanks of the Society to Mr. Dunsmore for his valuable gift.

SPECIMENS EXHIBITED.

Mr. Cameron exhibited two pine-feeding saw-flies, *Lyda erythrocephala*, L., a rare and beautiful species from Rannoch; *Lyda nemoralis*, L., from Paisley.

Mr. A. Watt exhibited a specimen of *Pogonatum nanum*, var. *longisetum*, gathered at Old Meldrum.

15TH APRIL, 1873.

Dr. J. Stirton, President, in the chair.

SPECIMENS EXHIBITED.

Mr. P. Cameron exhibited a number of *Chalcididæ* bred from the galls of *Teras terminalis*, and made some remarks on their habits and distribution through the galls; some Lepidopterous pupæ (those of *Ypsipetes ruberata*) which had been devoured by larvæ of Chalcididæ, between thirty and forty having been bred from a single pupa; and some dissected specimens of the common Oil-beetle (*Melöe proscarabaeus*) and of the Humble-bee (*Bombus lucorum*), illustrating their internal anatomy.

PAPER READ.

Mr. D. Gregorson read a paper, in which he gave an outline of the method that should be pursued by the student of Natural History in investigating any branch of the science, taking for his type *Ranunculus ficaria*, of which fresh specimens were exhibited. He pointed out the importance of studying the life history of particular plants or animals, and how very profitable this would be, not only to the individual student, but to science. In the conversation that followed it was stated that plants having reservoirs of starch in tubers were particularly adapted for growing under water, the extra quantity of starch affording an extra amount of heat.

29TH APRIL, 1873.

Mr. J. Allan, Vice-President, in the chair.

The following gentlemen were elected resident members:—Messrs. Æneas M'Master, David Pearson, Richard K. Howie, W. J. Milligan, and J. M'Murtrie.

SPECIMENS EXHIBITED.

Mr. J. Harvie exhibited, under the microscope, a number of Diatoms collected at the last two excursions.

Mr. P. Cameron exhibited specimens of the following:—*Lestes sponsa*, a dragon-fly taken at Possil Marsh; the somewhat rare bee, *Bombus scrimsheranus*, from the same locality; a saw-fly, *Allantus costalis;* and a curiously-coloured specimen of *Chrysis ignita*.

Mr. A. Watt exhibited specimens of dried grasses, with beetles fastened to them, among which were the common British species, *Gasterophysa raphani* and *Cetonia aurata*, the majority, however, being foreign Buprestidae. These were procured from a milliner's stock, and are specimens of what is at present fashionable for ladies' head-dresses.

Mr. G. Horn exhibited *Ophioglossum lusitanicum* from Jersey; and Mr. R. M'Kay, *Geum urbanum* in full flower, collected in the neighbourhood on the 26th April, being a month earlier than its usual time of flowering.

EXCURSIONS.

Whangie.—Mr. R. M'Kay, conductor, stated that an unsuccessful search had been made for *Cryptogramme crispa*, which at one time grew on the Drymen Road. The two somewhat rare mosses, *Glyphomitrium Daviesii* and *Grimmia Doniana*, were found at the Whangie. *Isoëtes lacustris* was found abundantly in Cochno Loch.

Tollcross and Kenmuir.—Mr. P. Cameron, conductor, gave an account of the excursion. The spring bees (*Andrenidae*), usually abundant on the sand hills at this season of the year, were found to be very scarce, owing to the prevalence of the east wind. The common Oil-beetle (*Melöe proscarabaeus*) was seen in greater numbers and earlier than usual. Two other Coleopterous insects, *Amara fulva* and *Pteristichus lepidus*, were also collected. Through changes in the locality, the latter is being gradually exterminated. The habits of a spider (*Lycosa picta*), which forms tunnels lined with a web in the loose sand, were also noticed. At Kenmuir, the galls of *Andricus noduli* were observed to be very abundant on a small oak tree. This gall-fly has not previously been reported for Scotland. The fresh-water mussel, *Unio margaritifer*, was found to have disappeared from most of its old stations.

13TH MAY, 1873.

Mr. J. Allan, Vice-President, in the chair.

SPECIMENS EXHIBITED.

The Chairman showed to the members a collection of flowering plants from the neighbourhood of Louisville, Kentucky, illustrating the general character of its botany, and which had been forwarded by Mr. John Williamson, corresponding member.

Mr. Cameron exhibited the larvæ, pupæ, and imagos of the Gooseberry Saw-fly, *Nematus ribesii*, and gave some account of its transformations and habits, mentioning some of the most effectual methods of destroying it. He also exhibited one of its parasites in the larval condition. He then made some remarks on the parasites of bees, noticing particularly the habits of the mites (Acari), the Oil-beetle, Apathus, and Nomada.

Dr. Stirton exhibited two lichens new to Britain, *Solorina bispora*, Nyl., and *Lecidea didymospora*, Stirton.

EXCURSION.

Cambuslang.—Mr. Allan M'Aulay gave an account of this excursion. In the course of his remarks, he said that plants which formerly were abundant on the Kenmuir side of the river, but were now getting scarce, are still found in abundance on the south bank. For example, *Trollius europaeus* and *Cardamine amara.*

PAPER READ.

Notes on Plant Names.—The Chairman then read a paper on plant names, in which the etymology of some of the commoner and more favourite plants was traced, and some of the superstitions and folk lore surrounding them were detailed. Among these were the rose, lily, elder, skellochs, agrimony, ash, beech, and the banes and worts. Some interesting facts were pointed out in the names derived from Gaelic.

27TH MAY, 1873.

The President in the chair.

Mr. Malcolm Black, jun., was elected a resident member.

SPECIMENS EXHIBITED.

Mr. Cameron exhibited a large number of Ichneumonidae taken in the district last season. There were about 200 species. He

made some remarks on their usefulness in destroying the caterpillars injurious to vegetation.

Mr. A. Watt exhibited *Primula scotica* from Stromness; *Gymnostomum tenue* from Stonelaw; and *Equisetum hyemale* from Cartland Crags.

Mr. G. Barlas exhibited a fine specimen of the hedgehog from Dumbarton, and made some remarks on its habits in confinement.

EXCURSION.

Campsie Glen.—The President remarked, that in addition to a number of the more common mosses, the following were found:—*Zygodon Stirtoni*, Schimper, being only the second or third time this moss has been found in fruit; *Anomodon viticulosus*, found in fruit in two different parts of the glen; *Tortula convoluta*, var. *sardoa*, this variety being comparatively rare, and differing so much from *T. convoluta* that it might almost be reckoned a distinct species. *Gymnostomum rupestre* was also found in fruit; and the Chairman stated that he had formerly found in the glen *Bartramia Halleriana* and *B. calcarea*. The lichens noticed were *Lecidea cupularis* and *Peltigera canina*. Specimens of the beautiful little shell, *Clausilia rugosa*, were collected from a wall on the road leading up to the glen.

10TH JUNE, 1873.

Mr. J. Allan, Vice-President, in the Chair.

EXHIBITION OF SPECIMENS.

Mr. R. M'Kay exhibited *Barbarea stricta*, Fries., collected near Balmore. He stated that from its abundance in that locality, and the situation in which it was growing, he believed it to be established there, if not indigenous. It is not mentioned in the floras as being found in Scotland.

Mr. J. Allan exhibited a large collection of mosses, and made some remarks regarding his method of mounting them.

Mr. J. Harvie exhibited specimens of the large Anemone, *Bunodes crassicornes*, and of the Nudibranchiate Mollusk, *Doris tuberculata*. He made some remarks on their structure, and on the power of the Anemone to retain objects in its grasp. He also showed by experiment that even a large Anemone like the one

exhibited had not any power to paralyze even a soft-skinned animal like the *Doris*. Three times he placed the Doris among the tentacles of the Anemone, and although it was grasped firmly and held for a short time, yet on each occasion it succeeded in making its escape without any apparent injury.

EXCURSION.

Wemyss Bay.—Mr. J. Harvie, in the course of his remarks, mentioned that on the arrival of the excursion party at the seaside, the weather was found too rough for dredging operations to be carried on with safety. The members then separated into two divisions, one taking the shore and giving their attention to marine zoology, the other attending to the botany of the district. Mr. A. Watt found *Equisetum telmateia*. Specimens of *Asplenium marinum* were also found; and a search was made for *Osmunda regalis*, which formerly grew near Skelmorlie, but it was found to be rooted out.

PAPER READ.

Mr. S. Macdonald read a paper on "Home Entomology," illustrated by drawings. He attempted to show that numerous objects for microscopic study were to be found in our rooms and cellars, and in the gardens and outhouses attached to our dwellings. The drawings were principally in illustration of the parts of the common house-fly. After the reading of the paper, the history of this insect gave rise to a lengthened discussion.

24TH JUNE, 1873.

Mr. J. Allan, Vice-President, in the chair.

William Dickson, Esq., Underwood, Dunoon, was elected a resident member.

A copy of the "Transactions of the Berwickshire Naturalists' Club" was presented to the Society by Mr. Dickson.

EXHIBITION OF SPECIMENS.

By Mr. J. Allan.—A number of mosses collected in Glen Clova, among which was the rare and beautiful *Tetraplodon angustatus*, found growing in dense tufts alone, or intermingled with *T. mnioides*.

By Mr. A. Watt.—A number of plants collected near Largs, including the mosses *Hypnum Schreberi*, *Mnium serratum*, and *Bryum Zierii*, all in fruit; also the rare grass *Avena pubescens*.

By Mr. P. Cameron.—*Hemichroa luridiventris*, Fallén, a rare saw-fly, captured in the larva state at Loch-Lomond, and bred last month. This is the larvæ mentioned in last year's "Transactions," p. 11, under the name of *Camponiscus Healaei*, Newman. He also gave an account of an entomological tour to Rannoch this month. Whilst there, the weather was on the whole favourable, but unfortunately insects of all orders were very scarce, and he had not been able to make many additions to his collection. In particular, he was disappointed in procuring only five specimens of Pine Saw-flies (namely, three of *Lophyrus pini*, L., and one each of *L. pallipes*, Fall., and *L. virens*, Klug), after exploring nearly the whole of the Black Wood specially for them. Two saw-flies new to Britain were captured (probably more, as the whole of the captures had not yet been examined). These are:—*Poecilosoma pulverata*, Retz, one of the finest species of the genus, having the feet pale red, with the abdominal segments faintly banded with white; and *Taxonus coxalis*, Klug, which has segments six to eight of the abdomen red. The only other noteworthy saw-fly as yet named is *Crœsus varus*, Vill., which is, rightly or wrongly, described by Stephens ("Ill. Brit. Ent.," vii., 39), but is omitted by Mr. F. Smith in his "Nomenclature of British Hymenoptera." The discovery of the species at Rannoch places the fact of its British nativity beyond dispute.

On the male catkins of the oak were found, at Dall and Kinloch-Rannoch, the galls of *Andricus quadrilineatus*, Hartig, and *A. amenti*, Gir., neither of which have been recorded as British.

He also exhibited the galls and insects of *Andricus ramuli*, L., which are known as the "cotton gall of the oak," so called from the long white fibres which are attached to the gall proper, giving it the appearance of tufts of cotton. Another gall, also new to the British list, had been found sticking out of the leaf buds, but as only inquilines had been reared the species could not be properly identified.

EXCURSION.

Gourock and Cloch.—Mr. Gregorson reported that the excursionists had a pleasant ramble in the glens and on the hill-sides,

noticing most of the plants for which the locality has long been famed; but nothing was found of sufficient importance to merit special remark, excepting that *Claytonia alsinoides* continues to spread in its station there.

PAPER READ.

Dr. Stirton read a paper on "Lichens, the Peculiarities of their Structure and Development." He traced their affinities on the one hand to Algae and on the other to Fungi, and showed by a series of specimens that although they constituted on the whole a well-defined section of cryptogamic botany, yet on the extremes they merged insensibly into the other two great divisions, more especially the Fungi, several genera in each being up to the present time subjects of dispute among authorities in cryptogamy. As an instance of the enduring nature of some lichens, he mentioned that one had been observed for nearly one hundred years, with little apparent change. They do not thrive in the vicinity of Glasgow, owing to the acids contained in the air. The various parts of their structure were minutely described, thus giving a good introduction to the study of this interesting part of the vegetable kingdom. In illustration of the different parts of the paper, many specimens were exhibited from several parts of the world, especially Western Africa.

8TH JULY, 1873.

Mr. J. Allan, Vice-President, in the chair.

It was announced by the Secretary that he had received from the Berwickshire Naturalists' Club a copy of their "Transactions" for the year 1872.

EXHIBITION OF SPECIMENS.

By Mr. P. Cameron.—*Cœnoneura Dahlbomi*, a highly interesting addition to the British list of Tenthredinidae, taken at Cadder Wilderness last week, on birch. The genus consists of only one species, which was described for the first time by Professor Thomson, the Swedish entomologist, three years ago. The genus comes between *Fenella* and *Fenusa*, from which it is distinguished by the seven or eight-jointed antennae and by the two marginal and four submarginal cells in anterior wings. It is noteworthy

that the Cadder specimen is the variety described by Thomson, and has the antennae seven-jointed, while the type has them eight-jointed.

Phyllotoma nemorata, Fall., and *P. microcephala*, Klug, taken along with the above.

A number of *Cimbices*. He remarked on the extreme variation occurring in this group of saw-flies, and from his observations he was led to the belief that the food-plant had a considerable influence in causing this variation, as conjectured long ago by Dahlbom.

And he also exhibited the larva of a saw-fly in the act of casting its skin, which it was prevented from accomplishing from the want of a suitable surface to rest upon, thus showing the necessity of breeding them in vessels with rough surfaces. He also mentioned that he had found the galls of *Andricus quadrilineatus* at Cadder Wilderness.

By Mr. A. Watt—A specimen of *Linnæa borealis* collected by himself in Aberdeenshire.

EXCURSION.

Wemyss Bay.—Mr. J. Harvie reported, that from the very unfavourable weather nothing could be done in dredging. He stated that near Toward he had dredged a fine specimen of the Sun-star, *Solaster papposa;* the Spider-crab, *Hyas araneus*, Leach; and the Hermit-crab, *Pagurus Prideauxii*, associated with the Anemone *Adamsia palliata.*

PAPER READ.

Mr. R. M'Kay read a paper on the willows of the district. He described their structure, and gave a minute description of the characters by which they are separated into species and varieties; also mentioning the difficulties to be overcome in the study of them. He exhibited a collection of those he had gathered, including, besides those already recorded, *Salix acuminata*, *S. laurina*, *S. nigricans*, *S. phyllicifolia*, and *S. triandra.* He also exhibited a branch of *S. aurita*, bearing both male and female catkins, and a catkin with both male and female flowers. In the conversation which followed, some remarks were made on the facilities offered in this genus for cross fertilisation, and the difficulty of getting perfectly distinct species.

29TH JULY, 1873.

Mr. James Allan, Vice-President, in the chair.

Dr. George Watt, Lecturer on Botany, Calcutta, was elected a corresponding member.

SPECIMENS EXHIBITED.

By Dr. Stirton.—A peculiar form of *Dicranum glaciale*, Berge, in fine fruit, from the summit of Lochnagar, collected this month, by Mrs. W. R. Watson. This moss, in the few localities in which it has been met with, is nearly always barren; but from the present specimen it is now seen that the fruit is deeply sulcate instead of smooth, and that the stems are characterised by a degree of radiculosity which has not hitherto been described.

By Mr. G. Harper.—A growing specimen of a dichotomous variety of *Asplenium filix-foemina* found near Stewarton. This variety has the fronds much branched, and differs much in appearance from the usual form.

By Mr. A. Watt.—A specimen of *Utricularia vulgaris* collected in Aberdeenshire.

By Mr. G. Horn.—*Allium scorodoprasum*, L., collected near Bothwell.

By Mr. D. Gregorson.—A living specimen of *Zootoca vivipara*, found at the foot of Ben Voirlich.

EXCURSION.

Ben Voirlich, Loch Lomond.—Dr. Stirton gave an account of this excursion. He mentioned that at the top of the mountain the aneroid barometer indicated an altitude of 3,100 feet. The following plants were found:—Thalictrum alpinum, Sibbaldia procumbens, Epilobium alpinum, Gnaphalium supinum, Vaccinium uliginosum, Juncus trifidus, Bartramia halleriana, B. calcarea, Diphyscium foliosum, Dicranum circinatum, Physiotium cochleariforme, and Adelanthus Carringtonii.

12TH AUGUST, 1873.

Mr. J. Allan, Vice-President, in the chair.

Mr. James R. Watson and Mr. Francis G. Binnie were elected resident members.

It was reported that the lizard exhibited at the last meeting had since then given birth to four young ones, which seemed to be born perfect, and to be quite independent of their parent.

SPECIMENS EXHIBITED.

The Chairman exhibited the mosses collected at the excursion to Ben Voirlich—about sixty different species, mounted and named.

Mr. Cameron exhibited the galls of *Cynips ferruginea*, Htg., which are somewhat spindle-shaped and covered with brownish hair. They were found on oak-buds at Kenmuir, and had not been previously recorded as British.

EXCURSION.

Ben Lawers.—Dr. Stirton, conductor. It was reported that at this excursion the following rare flowering plants and mosses were found:—Gentiana nivalis, Saxifraga cernua, Draba rupestris, Sesleria cœrulea, Poa glauca, Carex atrata, Juncus biglumis, Tortula fragilis, Timmia Norvegica, Weissia compacta, Anacalypta latifolia, and Habrodon Notarisii.

PAPER READ.

Mr. Cameron read a paper on "Saw-fly Larvæ." He pointed out their distinctive characters, and showed by what means they could be known from the larvæ of the Lepidoptera, and mentioned their relationship towards these, as well as to the larvæ of the Trichoptera. He alluded to their habits, all being plant-eaters; some living solitary, others gregarious, as many as a dozen or more on a single leaf. Others inhabit galls on willow-leaves or in swellings on the petioles; while others live beneath the epidermis, or in leaves whose edges are folded down by the larvæ themselves. He stated that those larvæ which feed in an open and conspicuous manner, had either an obnoxious smell, peculiar glands on the under side of the abdomen, or had the power of ejecting, often to a considerable distance, a fluid of a somewhat acid nature. Many were injurious to the gardener and farmer; of which the best known are the larvæ of *Nematus ribesii*, on the gooseberry; *Athalia spinarum*, commonly known as the Black-jack or Nigger, on the turnip; *Blennocampa aethops*, on the plum; and various species of *Cephus* on the wheat; whilst the pine has a genus (*Lophyrus*) attached exclusively to it. He remarked that these were not

regular in their depredations, but would appear in enormous numbers some years, whilst the next year scarcely a single specimen would be seen. And in the conclusion of the paper the subject of their parasites was touched upon; and it was shown how very useful they were in keeping down their numbers, *Lophyrus pini*, which on the Continent frequently did great damage to the pine-trees, having upwards of forty attached to it.

26TH AUGUST, 1873.

Mr. James Allan, Vice-President, in the chair.

SPECIMENS EXHIBITED.

By Mr. J. Allan.—A number of mosses collected during the excursion to Ben Lawers.

By Mr. P. Cameron.—A number of insect remains dug out of a peat-bog at Possil, from a depth of 10 feet. They consisted chiefly of wing-cases and feet of beetles, but they were not sufficiently complete to enable the species to be identified satisfactorily. Most of them belonged to a species of *Donacia*, probably *aquatica*, an insect which frequents such situations; and it was noticeable that the colour varied from green to blue, as in the perfect specimens. For the examination of these he was indebted to Mr. Thomas Naismith.

Also an acorn-gall found in the district. As the insect reared from this was an inquiline, it could not be named with certainty; but it was probably the gall of *Andricus glandium*, Gir., which had not been recorded as British.

EXCURSION.

Hills behind Greenock.—Mr. D. Gregorson gave an account of this excursion, and stated that no rare plants had been found. Mr. F. G. Binnie reported finding nine different species of shells, among which was *Zonites radiatulus*, which he had not before seen in this district.

9TH SEPTEMBER, 1873.

Mr. James Allan, Vice-President, in the chair.

SPECIMENS EXHIBITED.

By Mr. A. Watt.—*Suaeda fruticosa, Senebiera coronopus, Senebiera didyma*, and *Carduus tenuifolia*. By Mr. R. M'Kay.—

Mercurialis annua and *Brassica Monensis*. All from Troon, and, with the exception of *Carduus tenuifolia*, which is native, were all found on the ballast heap.

EXCURSIONS.

Troon and Cloch.—Bowling was the locality entered in the syllabus for the excursion on the 6th September; but as it was feared that at this season few objects of interest would be found there, it was determined to substitute two excursions—one to Troon and the other to Cloch.

At Troon, in addition to the specimens above mentioned, an abundant supply of the common shore animals was found.

Mr. F. G. Binnie reported finding at Cloch fifteen different species of land shells and one species of fresh-water shell, among which were *Zonites purus*, var. *margaritacea*, *Pupa Anglica*, and the variety *pallida*, and *Helix fusca*. *Campanula hederacea* and *Aspidium angulare* were also found at this excursion. Mr. Cameron mentioned having found the larvæ of *Hemichroa luridiventris* at the Cloch.

PAPER READ.

Gasteropoda.—Mr. John Harvie read a paper on this class of the Mollusca, in which he said that their present classification was merely provisional, until their physiology and development had been more thoroughly examined. He confined his remarks principally to experiments and observations of his own on this class, few of which demonstrated anything new; but he had made them for the purpose of satisfying himself that many of the statements made with regard to the habits of the Gasteropoda were correct. He described the structure of their shells, and exhibited prepared specimens in illustration of his remarks.

23RD SEPTEMBER, 1873.

Mr. Allan, Vice-President, in the chair.

By Dr. Stirton.—A lichen found on Ben Voirlich in July, during the Society's excursion, which he had submitted to Dr. Nylander, of Paris, who pronounced it new, and named it *Lecidea botryiza*. It is distinguished by the clustering of the apothecia, the dark hypothecium, and the conglutinate paraphyses with

colourless apices, and small unilocular spores. Also, from the same locality, a specimen of *Verrucaria theleodes*, another rare lichen, hitherto found in this country only on Ben Lawers; the only other known locality being the Dovrefield Mountains in Norway.

Mr. Cameron exhibited the living larvæ of *Croesus septentrionalis*, pointing out the glands on the under side of the abdomen, and the peculiar habit it has of protruding and retracting the glands, and of throwing the body about, so as to deter the ichneumons from attacking it. Also the larvæ of *Hemichroa luridiventris*, found at St. German's Loch on alders. At the same time the imagines and larvæ of *Nematus virescens*, found common at Possil Marsh, and widely distributed throughout Scotland. He gave some details of their life-history, and mentioned that sometimes they are so abundant on a bush that they will strip it of its leaves.

By Mr. Binnie.—A number of shells, among which were *Helix fusca*, mentioned in former lists as rare in the district, *Helix hispida*, and *Zonites nitidulus;* all found at Kenmuir.

By Mr. Horn.—*Lathyrus hirsutus*, *Erysimum cheiranthoides*, and *Linaria elatine*, all found at Troon, and supposed to be introduced by ballast; *Tulipa sylvestris*, from Bothwell Woods; and a new juncus (*Juncus pygmaeus*), sent him from the south of England.

7th October, 1873.

Mr. P. Cameron in the chair.

Messrs. Alexander Hill, Robert Brown, and Walter Smith Middleton, were elected ordinary members.

Mr. D. Gregorson exhibited the leaves of the Prickly Comfrey (*Symphytum asperrimum*), and stated that a gentleman in the neighbourhood of the city was making an experiment in cultivating it as a forage plant. It is easily cultivated, yields a large crop, affords three cuttings during one season, and remains some years in the soil.

PAPER READ.

Mr. W. D. Benson gave an account of a long series of interesting experiments he had made during the summer months with infusions of different vegetable substances, in order to make observations on the development of Infusoria. The infusions were kept in test-tubes, some hermetically sealed, others open; some kept in the

dark, and others in different degrees of light. Life began to appear in the open tubes exposed to the light in thirty-six to forty hours. The development of life was slower and not so abundant in those tubes kept in the dark; and in those hermetically sealed no signs of life were seen till after six or seven days. The first forms of life that began to appear were Bacteria and Vibriones, then a little later Paramecia were seen. In making some of his experiments in a room where some water containing Rotifers was standing, he found Rotifers in great abundance in all his open tubes, but none in those that were closed, so that it seemed that the germs of the Rotifers had access to the open tubes through the air. He also found that in open tubes connected by a thread with the vessel containing the Rotifers, the diffusion took place more rapidly than through the air. Tubes with the same infusions, and placed in the same circumstances, were found to contain quite different forms of life. Mr. Benson also described the Sun Animalcule (*Actinophrys sol*), and its manner of feeding.

24th October, 1873.

Mr. J. Allan, Vice-President, in the chair.

SPECIMENS EXHIBITED.

Mr. Cameron exhibited two saw-flies new to Britain—*Tenthredo moniliata*, Kl., taken at Rannoch in June; and *Nematus quercus*, Htg., of which several specimens have been taken at Cadder Wilderness during the summer; also *Lophyrus pallipes*, a very rare saw-fly, the male of which is remarkable for its beautiful pectinated antennae.

PAPER READ.

The Chairman read a paper on the study of Natural History, in which he insisted on the benefits to be derived from it in training the mind to observe carefully, and classify accurately, and in fostering a love of Nature which at once purifies and enlarges the mind. The rest of the paper was taken up in discussing how Natural History should be studied. Referring to Cuvier's letters to Pfaff on this subject, in one of which he says, "I think we ought carefully to seek out the relation of all existences with the rest of Nature, and to show their part in the economy of the great

All," the essayist thought the work of the man of science or observer was hardly begun, and when the storehouse of facts was filled, the work of the philosopher would begin. He concluded by adverting to the great advantages the naturalist received from some attention to drawing and languages, and the necessity for some enthusiasm in the work.

7TH NOVEMBER, 1873.

Mr. J. Allan, Vice-President, in the chair.

PAPER READ.

Mr. D. Gregorson read a paper on "The Development of Life." In his introductory remarks he stated, that although the principal work of a naturalist should consist in conducting experiments and making observations, yet it was often necessary that he should quit the solid ground of facts, and attempt to penetrate into the distant past or future, deducing his conclusion as far as possible from the state of Nature as we find her at present; and the usefulness of the procedure was, in his opinion, borne out by the great impulse the Darwinian hypothesis had given to the study of biology. He then gave a sketch of the nebular hypothesis of Laplace, the growth of inorganic matter being necessary before organic life could flourish; then gave a resumé of the various speculations of scientific men regarding the origin of life upon the globe, mentioning the recent controversies upon the spontaneous generation of life; and finally gave an outline of the various phases and forms by which life is represented.

21ST NOVEMBER, 1873.

Mr. Allan, Vice-President, in the chair.

The Chairman announced that the Secretary had given in his resignation of the office on account of his leaving the city; and moved that the thanks of the Society be given to Mr. Gregorson for his services during the time he held that office. Mr. John Harvie was afterwards elected his successor.

SPECIMENS EXHIBITED.

Mr. Cameron exhibited an undescribed saw-fly, which he proposes to name *Nematus graminis*, the larvæ of which feeds on

short grasses at Tollcross. Also a specimen of *Nematus Wttewaalli*, Voll., a saw-fly not hitherto mentioned as a native of Britain. It had been bred from larvæ found not uncommon at Cadder Wilderness, feeding on willows; they emit a very offensive odour.

Mr. Middleton exhibited some beautiful small shells from the West Indies.

Mr. Pearson exhibited a living specimen of the apple snail (*Helix pomatia*), which he had brought from Germany, making some remarks on its manner of feeding, and its habits while in a state of confinement.

PAPER READ.

By Mr. F. G. Binnie.—"On the Study of Land and Fresh-Water Mollusks." In introducing his subject, the author defined the work and scope of all true scientific study to be a strict investigation—exhaustive in its character—of the particular objects chosen by the student, having for its ultimate end the deduction of broad generalisations from these data, and the acquisition of accurate views of the origin, plan, and laws of nature. After describing the zoological position of the group now under consideration, and its leading divisions, the author proceeded to the more special consideration of its study, and stated that of the three great aspects into which all zoological study divides itself—Morphology, Physiology, and Distribution—the first-named was that most investigated in the group, and in the Mollusca generally; Distribution coming next in order, Physiology being least studied. Glancing at a few of the more salient features in the development, habits, and distribution of Mollusks, he indicated the directions in which investigation, by observation and by experiment, might be made—dwelling chiefly on the egg; the more or less complex metamorphosis gone through after leaving it; the growth of the animal and its shell; maturity, its signs, and their value; the senses of sight, hearing, etc.—specially-directed experiments being here greatly needed; food, hibernation, and æstivation; enemies, with the means of defence and protection adopted; concluding with some observations on distribution, mentioning the paucity and incompleteness of our knowledge as to the influence of soil, climate, moisture, &c., with relation to individual habit, and the several stages of development, in facilitating or retarding growth and numerical increase; also the various facilities and means of

migration from one place to another; in all of which a thorough investigation of our own inland molluscan fauna—the details and limits of whose distribution even is by no means complete—will undoubtedly give valuable results.

5TH DECEMBER, 1873.

Mr. J. Allan, Vice-President, in the chair.

EXHIBITION OF SPECIMENS.

Mr. Binnie exhibited a specimen of *Helix pygmæa*, found near Loch Lomond, which has not been recorded for the district.

PAPER READ.

The Chairman read a paper on "Centres of Creation," in which he defined the idea implied in this phrase, and objected to the phrase as hardly correct, although it has obtained a footing from its being concise. Centres of Distribution is probably more correct. He also considered it in connection with Darwin's theories. He thought it impossible to mark the centre of creation for any species, the original being planted apparently all round the world within a certain zone. He also thought that there was a great want of a natural history census, both of distribution and proportion. The "Cybele Britannica" supplied this want to some extent in Botany, but it was only a census of distribution. There are, however, wide areas in which the fauna and flora are quite distinct, as Madagascar, Brazil, Australia, where the term seems tolerably accurate. The plants and animals are so distinct, that there seems to have been a separate creation for each area. The subject, which was treated at considerable length, was pointed out as rather an important one in the great Darwinian dispute.

19TH DECEMBER, 1873.

Mr. J. Allan, Vice-President, in the chair.

EXHIBITION OF SPECIMENS.

Mr. Cameron exhibited specimens of *Apanteles placidus*, Hal., one of the parasitic Hymenoptera, which he had bred from spiders'

eggs, upon which they had lived in the larval condition. The spider's egg-bag in which they were found must have contained upwards of a hundred eggs, yet not one egg had escaped destruction.

He also read some notes on the transformations of *Hypera plantaginis*. This weevil in the larval condition feeds on grasses, and is found at Possil Marsh and Kenmuir during June and July. The larvæ is a stout, green, somewhat hairy grub, with a fuscous head, and a white sub-dorsal stripe; and spins an oval, white, semi-transparent cocoon attached to the flower-heads of grasses.

PAPER READ.

Mr. S. M'Donald read a paper on "The habits of the Formicidæ," giving an account of a day spent at Tighnabruaich in examining the nests and observing the habits of different species of these insects. The paper was illustrated by coloured drawings.

9TH JANUARY, 1874.

Mr. P. Cameron, jun., in the chair.

EXHIBITION OF SPECIMENS.

The Chairman exhibited four saw-flies which had not been recorded as British:—*Nematus pallipes*, Fall., which had been taken by him on a mountain at Rannoch in Perthshire, at an elevation of 3000 feet, and near the spot where they were captured some cocoons were found, evidently belonging to this species; and as the only vegetation near consisted of moss and grass, the larvæ no doubt fed on the latter; *Nematus mollis*, Kl., taken by Dr. Buchanan White at Braemar, and by himself at Rannoch; *Nematus obductus*, Kl., taken by sweeping grass in Possil district; *Nematus croceus*, Fall., taken at Cadder Wilderness by beating willows, upon which the larvæ feed.

Mr. Binnie exhibited living specimens of a rare shell, *Zonites glaber*, taken by him in Yorkshire.

The remainder of the evening was taken up examining a large and interesting collection of microscopic objects, and a collection of enlarged drawings of some of the more remarkable forms of the Diatomaceae, such as *Toxonidea gregoriana*, *Pinnularia major*, *Triceratium striolatum*, &c., exhibited by Mr. Barlas.

6th February, 1874.

Mr. James Allan, Vice-President, in the chair.

SPECIMENS EXHIBITED.

By Mr. J. Harvie.—A nest, apparently that of a robin or a creeper, found imbedded in the centre of a tree from Ireland. As the hole from which it was taken had no external aperture, and as there were about six inches of wood on the side nearest the surface, it was evidently of considerable age.

By Mr. Cameron—A large collection of Hymenoptera in illustration of his paper.

PAPER READ.

"Contributions to a Knowledge of the Scotch Cynipidæ." By P. Cameron, jun.

During the last two years I have paid considerable attention to Scotch Cynipidæ, especially to the gall-makers and inquilines; and having been able to identify as natives the greater part of the recorded British species, it has occurred to me that it might be useful to give, in a connected form, an account of our present knowledge of the subject. With the exception of Mr. Traill's descriptions of galls in the "Scottish Naturalist," nothing has been written upon the Scotch species; nor indeed can our knowledge of those of Britain be regarded in any other light than as a beginning. The number of true gall-makers reported for Britain is thirty-six; in this paper thirty are noted as natives of Scotland, besides one doubtful species; but this is not by any means the real number, for I possess many other galls and insects that cannot in the meantime be identified.

My knowledge of their distribution is at present so scanty, that I have omitted in most cases special reference to it; but to assist the local student, I have given localities for those found within five miles around Glasgow. As excellent descriptions of the galls have appeared within the last few years, it is needless for me to allude to them here, but I have added a few notes upon the habits of the insects.

The study of galls and gall-insects is one of the most interesting branches of Natural History, and is alike worthy of the attention of the entomologist and botanist. The former will find that the habits of the flies, their inquilines and parasites, will afford ample opportunity for using his powers of observation, his ingenuity,

and patience, while the latter will see how a tiny insect, by a puncture, can give origin to forms so strange and anomalous that he will hesitate to refer them to any of the plant organs. Yet it is probable that, after all, these objects, which to our eyes may seem so unnatural, are simply monstrous or aborted developments of the ordinary organs. The long, white fibres of the cotton gall of the oak, for instance, is no doubt a monstrous development of the pubescence of the leaf. The entire absence of males among the larger species, and in America the phenomenon of Dimorphism, will give the philosophic student of biology food for speculation.

As many naturalists are prevented from working at little studied branches of Entomology, like the *Cynipidæ*, from want of instructions about the proper method of collecting, setting, books, etc., it may be useful to give a few hints about these matters. But before doing so it may be as well to state that all the *Cynipidæ* are not gall-makers. Speaking generally, the family is divided into three divisions, each section having different habits. The first section consists of the true gall-makers; the second of inquilines, species closely allied to the gall-makers, and which deposit their eggs, cuckoo fashion, in the galls while they are soft, and, by monopolising the food and space, destroy the young of the maker. The third division is composed of true parasites, which do good work in destroying the plant lice, and, as if it were to counterbalance this useful service, other species are parasitic upon the enemies of the plant lice—the larvæ of the *Syrphidæ*. Of this section I may mention that I have taken at Kenmuir Bank, in May, *Allotria halterata*, Thoms, a minute species with abbreviated wings. Some of the first branch are, however, inquilines—*e. g.*, *Neuroterus parasiticus;* and the genus *Aulax* forms a transition between the two groups.

As regards breeding: this is in most cases easy enough, provided the galls are not plucked too soon, for the larvæ feed not on solid matter, but on the juices that the gall contains when it is young; and when pulled in this condition, it is liable to dry up before the creature inside has had time to become full fed. They are most conveniently kept in glass bottles, tightly corked; but care must be taken with the spring galls (those of Sp. baccarum, catkin galls, etc.), that they do not become mouldy. The peculiar development of the galls of *Neuroterus* requires that they should be always kept moist. If we examine, for example, the "oak

spangles," in summer, we will see that they are perfectly flat and dry, without a vestige of the larvæ discernible inside, and in this condition they remain till February or March, when the galls swell up to double their previous size, and the insects pass very rapidly through their transformations. (May not this be a provision of nature to protect the larvæ from the attacks of inquilines and parasites? a supposition that seems to be justified by their comparative immunity from enemies. Out of several hundred flies that I have reared from the spangles, not one was a parasite or inquiline, and I may say also, not one a male.) With these I place the galls in a bottle, tie a piece of muslin over its mouth, and then stick the bottle, mouth downwards, in a flower-pot full of soil, and put the whole outside. Of course different galls must be kept separate.

The dried galls I gum upon stiff card-board, and the flies must also be set upon cards, and it is always as well to have a few upside down.

The student must not, however, expect to be always successful in rearing the makers out of all his galls; flies in abundance he will in most cases breed, but the chances are that they will be *Synergi* and *Chalcididæ;* but do not let him throw these away as useless, but rather set them out, and carefully note from what galls they were reared; for although he may not care about investigating them himself, still they might be extremely useful to some specialist, and they will be doubly valuable if the latter hint be followed.

The British galls are, as a rule, easily identified, but the insects, from the unsatisfactory nature of the descriptions, are involved in considerable perplexity; and a proper monograph is much needed. The inquilines cannot be identified at all from Hartig's descriptions, and that author, by treating the group in the way he did, has probably done more harm than good. The following are the works and papers that the student will find of most use:—Marshall, Entomologist's Monthly Magazine, vol. iv. (good descriptions of most of the British insects); Müller, Entomologists' Annual for 1872; Traill, "Scottish Naturalist," vols. i. and ii. Continental Works, are:—Hartig, Ueber die Familie der Gallwespen in "Germar's Zeitschrift für die Entomologie," vol. ii., pp. 176-209; vol. iii., pp. 322-358, and iv., pp. 395-422; Taschenberg, "Hymenopteren Deutschlands," pp. 116-144 (an excellent and cheap work),

and Mayr on the "Mitteleuropäischen Eichengallen" (Vienna), in which work figures of the galls are given.

Dryophanta folii, L.—Seems to be local, but widely distributed throughout Scotland. I found it not uncommon in Perthshire.

D. longiventris, Hart.—I possess Scotch specimens of this insect, but without note of the locality where they were taken. Galls agreeing with the descriptions of those of this species are not uncommon at St. German's Loch and Cadder Wilderness.

D. divisa, Hart.—Abundant all over Scotland. Local stations are:—Kenmuir Bank, Cadder Wilderness, St. German's Loch, Langside Wood, etc. The galls appear in July, and the flies enter the perfect state in August, and remain in the galls during the autumn and winter. The ovaries, as I have observed by dissection, do not become developed till the time of oviposition is at hand. In order to see the proportion of galls infested by inquilines, etc., I set aside thirty galls, and out of the lot only seven gall-makers came out, the remainder being inhabited by inquilines or *Chalcididæ*. A variety of the gall is found; it differs in being entirely white, without the usual red, the skin not smooth, but very rugged, and beset with tubercles, which are often brownish.

Aphilothrix fecundatrix, Hart.—A common species met with in most localities, Kenmuir, Cadder, St. German's. The galls are easily recognised from their resemblance to a miniature artichoke. At Kenmuir I have found larvæ living in leaf-buds which were not perceptibly enlarged or aborted, nor could a vestige of the acorn be observed.

A. radicis, Fab.—This species does not seem to be common; the galls are found on the roots of oaks at Cadder and Kenmuir. I have captured the flies in January. At Kenmuir Bank, I discovered a gall with every cell, and they amounted to between two and three hundred, occupied by a *Synergus*.

A. ferruginea, Hart (*solitaria*, Forsc?).—This is a very rare species, and has, as yet, been only reported from this locality, where I took it for the first time at Cadder Wilderness, and between Carmyle and Kenmuir. The spindle-shaped, wool-covered galls stick out of the leaf buds.

Cynips lignicola, Hart.—Although so recently introduced into Scotland, this is now one of our commonest gall-insects, and in all probability it will, in a short time, be abundant all over Scotland. Cadder, Kenmuir, Langside, St. German's, are

a few of its local habitats. At present there does not appear to be any material check upon its increase, for although birds at first destroy the larvæ, yet, in course of time, leave them alone, not finding them suitable food. Nevertheless I have reared from one of the galls a large *Synergus*, evidently the same species that was bred from the gall of *A. radicis* (*vide suprà*), and no doubt, as other inquilines and parasites will become aware of its presence, their number will be kept within due limits. They show a partiality for small shrubby oaks, but I have also noticed the galls upon the topmost twigs of a tree about thirty feet high.

Biorhiza aptera, Fab.—For a gall of this species I am indebted to Mr. Barlas, who picked it up at Dalreoch. It was of an oval form, dark-coloured, and rough outside, white and smooth within; a thin partition in the centre divided it into two cells, in each of which was a specimen of the apterous maker. Usually the galls are monothalamous, *i.e.*, one-celled.

B. renum, Hart.—The minute, reniform, pale-green galls are situated in clusters on the veins on the underside of oak leaves; and late in autumn swell up to more than double their previous size, and fall to the ground. The galls are common in the autumn in Cadder and Kenmuir woods.

Neuroterus numismatis, Oliv.—The maker of the well-known "silky button galls," which occur on the underside of oak leaves nearly everywhere.

N. lenticularis, Oliv.—The equally well-known "oak spangle" galls of this species are even commoner than the "button" galls, and are frequently found on the same leaf with them. Kenmuir, Cadder, Langside, etc., are good stations for both.

N. fumipennis, Hart (?).—Mr. Traill describes the supposed galls of *N. fumipennis* (Scot. Nat., ii., 127), and similar galls I have noticed at Cadder and Kenmuir. The insects reared therefrom (which I have received from Mr. Traill), however, appear to be only *N. lenticularis;* at least I cannot distinguish any difference between the two; and the Rev. T. A. Marshall also thinks that they are the latter species. The galls certainly differ both in habit and form from the common spangles.

N. ostreus, Hart.—The galls are not unfrequent at Kenmuir and Cadder during August and September.

Andricus curvator, Hart.—The galls are found in abundance at Cadder, Langside, Kenmuir, etc., and are generally distributed

over Scotland. The leafy outer covering of the gall appears to be merely protective, for it affords no sustenance to the larvæ. It does not, however, give entire protection, as both inquilines and parasites are often bred from the galls; and a *Chalcis* that I observed filled, when a larva, the inner-gall so exactly, that it is a wonder how it contrived to change.

A. inflator, Hart.—A much scarcer species than the last. I have only found it at Cadder Wilderness.

A. noduli, Hart.—The larvæ live in swollen twigs of young oaks, between twenty and forty inhabiting a small twig, each larva residing in a separate cell. One small tree at Kenmuir (now cut down) must have contained hundreds; it is also found at Cadder Wilderness.

A. ramuli, L.—Seems to be distributed all over Scotland. I noticed the galls—which are easily recognised from the wool that envelops them—very abundant at Blair-Athole; and on one bunch a *Tortrix* larva was feeding; in the pill-box it spun a web, and was about to change into a chrysalis; but on looking at it next day, it was *non est*, and instead, there remained a neat little cocoon of an ichneumon.

A. quadrilineatus, Hart.—The galls of this species were very common on the male catkins of the oak at Dall, Rannoch, in June; and I have taken specimens of the leaf galls at Cadder Wilderness.

A. amenti, Gir.—This species was also found at Rannoch, with the last insect; the galls are on the catkins as well, but far less frequent. From one of its galls was reared an *Andricus*, which I have doubtfully named *A. albipes*, Hart (Germ. Zeit., ii., p. 192). Among the Rannoch catkin-galls were examples of what probably pertained to another species, which was bred, but cannot be identified.

Dryoteras terminale, Fab.—Undoubtedly our commonest gall-insect. The galls appear very early in the season; are at first white, with red cheeks, but soon change to a brown colour. They are much frequented by all sorts of insects—beetles, moths, Diptera as inquilines, and *Chalcididæ* as parasites—about which I may have something to say on another occasion. Local stations are:—Carmyle, Kenmuir, Kelvinside, Langside. I have found them in Skye.

Spathogaster baccarum, L.—The upheaver of the familiar "currant" galls of the oak, which are found both on the male catkins

and on the young leaves. It is distributed all over Scotland, and is exceedingly abundant in Cadder Wilderness. The flies emerge in June and July. A *Synergus* tenants the galls to a great extent, as well as numerous handsome *Chalcididæ*.

S. tricolor, Hart.—I have bred this species from galls, which at the time I took for those of *S. baccarum*, and considered the insect to be an inquiline. Continental authors, however, give it as a true gall-maker, although their descriptions of the galls are nearly applicable to those of *baccarum*. The fly came out in July, and does not seem to be common.

S. vesicatrix, Sch.—(Traill., Ent. Mon. Mag., x., p. 85.) The galls have been found near Aberdeen by Mr. Traill.

Diastrophus rubi, Hart.—Forms galls on the stems of *Rubus cæsius*, and according to Mr. A. Müller on the tops of *Pteris*. At Cadder and Kenmuir the flies are found during May.

Rhodites rosæ, L.—The maker of the Bedeguar of the rose; it is distributed all over Scotland, and is very common at Lambhill, and along the banks of the Forth and Clyde canal.

R. eglanteriæ, Hart. — Evidently common throughout the country; at Lambhill, abundant. The green monothalamous galls are found on *Rosa canina*.

R. spinosissimæ, Gir.—The bright red galls are found on *Rosa spinosissima* wherever that plant occurs. On *Rosa canina* are found galls which differ from these in being larger, and the colour pale green; never red. They are clearly the same that Hartig (Germ. Zeit., ii., 196) describes as those of *Aulax caninæ;* but Taschenberg (Hymen, Deutsch., p. 135) refers them to *spinosissimæ*, *A. caninæ* residing in the galls as an inquiline. I have collected the galls at Lambhill for four years, and have never been able to breed a *Rhodites* from them, but plenty of parasites have come forth. At Lambhill, one evening at the beginning of August, I was fortunate enough to witness an inquiline oviposit its eggs in a gall. It held on to the side of the gall by its feet, and deposited an egg at that point, then shifted its position to the other side, and laid another, or perhaps more than one. On the same leaf was another gall, which, on taking home and examining, I found to be very soft and succulent, with the cells not properly formed, and the progeny of the maker still in the egg state.

Trigonaspis megaptera, Panz. — Evidently a common early summer species. The galls are very pretty objects of a shining

white colour, with reddish cheeks, and are situated on the trunks of oaks at a distance of three or four feet from the ground, or on very young shoots. I possess one shoot, three inches long, with eight galls on it. They are not uncommon at Cadder and Kenmuir during May and June, and I noticed that they were very abundant in Glen Lyon, Perthshire. The flies emerge in June.

Aulax sabaudi, Hart.—A local, but not uncommon, species. The galls are found on the stems of *Hieracium boreale.*

A. glechomæ, Hart.—The galls occur on the leaves of *Nepeta glechoma*, and have been found in Perthshire. (Traill, Scot. Nat., ii., 253.)

A. rhœadis, Kl., Hart.—The larvæ live in inflated capsules on *Papaver rhœas* and *dubium.* (Hardy, Transactions Berwickshire Naturalists' Club, 1871, p. 263.) From the distribution of the food plants the species is not likely to be met with in the West. Hartig describes another species (*Aulax minor*) that should occur in Scotland; it also affects *P. rhœas.*

24TH FEBRUARY, 1874.

Mr. James Allan, Vice-President, in the chair.

This meeting was entirely occupied examining microscopic objects exhibited by Mr. G. Barlas, Mr. W. D. Benson, and Mr. J. Harvie; also some micro-photographs exhibited by Mr. Barlas.

6TH MARCH, 1874.

Mr. James Allan, Vice-President, in the chair.

SPECIMENS EXHIBITED.

By the Chairman.—A number of shells collected from gum imported from Barbary. Mr. Binnie distinguished *Helix lactea*, and two other species of that genus.

Mr. Cameron mentioned that on the 26th February he had, in the Possil Road, discovered a nest of *Formica nigra*, in which not only were the workers in a state of activity, but also a colony of *Aphis radicis;* and the ants, on the nest being disturbed, had taken the plant-lice carefully in their jaws, and carried them down into the inner recesses of their habitation.

NOTES OF AN EXCURSION TO BEN LAWERS.

(By Mr. James Allan.)

The 9th August was put down in our syllabus for the Ben Lawers excursion, and at seven o'clock on the morning of that day the members intending to go met at the Buchanan Street Station of the Caledonian Railway. They were five in number, the President being the conductor of the excursion. As this was a two days' excursion, more elaborate preparations than usual were apparent. Each excursionist carried the inevitable vasculum, a small bag with some change of raiment, a good stout walking-stick, a flask, and a good supply of sandwiches. All took the precaution of having a top-coat, which should never be neglected in mountain climbing. In due time the train started, and the beauty of the morning raised the spirits of the party considerably, in the expectation of a pleasant trip. On to Stirling and Callander we were whirled, over ground well known to almost every one; but after passing Callander the attention is rivetted on the surrounding scenery, which is perhaps amongst the finest yet penetrated by the railway. The Pass of Leny, the Braes of Balquhidder, Loch Lubnaig, Loch Earn, and the sides of Ben An and Ben Ledi present to the traveller scenes of beauty and grandeur rarely to be seen. On arriving at Killin Station a change was made to the coach, making a pleasant variety. The distance from Killin Station to Killin Village is four miles. The drive is all downhill, and the peeps at Ben Lawers, Ben More, and Loch Tay give interest to every turn of the road. Arrived at Killin Hotel, a delay of greater length than was at all necessary took place, which was occupied primarily in obtaining some refreshments, and then in a little desultory botanising. Within ten minutes' walk of Killin Hotel the extremely rare moss, Habrodon Notarisii, is to be found; and learning that there was plenty of time, the members visited the spot, which is extremely easily found, as all those in the secret know, and were successful in obtaining specimens. This moss was first discovered on the same tree by Sir Wm. Hooker in 1830.

At Killin Hotel, by the way, a letter was received from Mr. Anderson, the landlord of the Ben Lawers Inn, with the welcome intelligence that he could put us up. This set our minds at ease, as it is, even for the strongest, no joke to find at the end of a day's

climbing that one must move on some twelve miles for a bed, or sleep on the heather.

The drive from Killin to Ben Lawers is beautiful and varied—first the woods surrounding the Lochy, then the sides of Loch Tay, and the jagged slopes of the mountains. Craig Cailleach was passed in a pour of rain, and things atmospherically began to look bad. Still we were all well clothed, and never for a moment dreamed of giving up our object. Craig Cailleach, as all botanists know, is even a richer field than Ben Lawers, and not quite so much hunted, and we hope it will long continue so; but our short two days were promised to Ben Lawers, and we had to leave Craig Cailleach for another year. We were very fortunate in finding one of the servants of the Ben Lawers Inn on the top of the coach; so, consigning our impedimenta to her care, we came off the coach about three miles on this side of the inn, and commenced the ascent. The first half-hour was through marshy, sour-looking ground, at first flat and then gently-sloping, the weather having cleared up beautifully. But with the first stiff climb came a driving shower, and we were glad to push on for shelter, although some good finds might have been got here. However, after a little we were successful in finding a few mosses, at about a thousand feet, where first the climber meets Alchemilla alpina. Among these were Polytrichum strictum, Oligotrichum hercynicum, Racomitrium sudeticum, ericoides, etc. However, we could not waste much time on the low parts, and pushed on for the valley or gully to the Craig Cailleach side of the top of Ben Lawers, and, arrived there, we found ourselves in a very garden of mosses. Every step brought us to something rare, beautiful, and interesting. This small spot, probably about a mile long, must be surely the richest in Scotland. The following is a list of the rarest:—

Bryum nutans, cirrhatum, Zierii; Hypnum atrovirens, rivulare, glareosum, denticulatum, umbratum, Starkii; Blindia acuta; Weissia crispula; Dicranum palustre, longifolium; Grimmia patens, Tortula fragilis, Myurella julacea, Campylopus compactus, Distichium capillaceum, Timmia norvegica, Pterogonium filiforme, Meesia uliginosa, Leptostomum flexicaule, etc.

The little rare and beautiful flower, Gentiana nivalis, is found on the rocks just at the saddle at the top of this valley, and some went now to look for it, and the President to search another place

for mosses. Arrived at the rocks, the weather became simply disgusting. Over the top of the saddle, and round the face of the cliffs, the mist or clouds rolled in thick masses, cold as ice, and every now and again discharging a drenching rain; the wind blew with a fury that rendered it necessary to hold on by the hands at times. And yet when we got a glimpse of Loch Tay, and the valley, 3,000 feet below us, the sun was shining, and it was a fine autumn day apparently. We had simply got amongst the clouds, which are always whirling "through other." Two of the members, despite the weather, determined to go to the top, which was still nearly 1000 feet above us, and climbed up through a gap in the rocks. After getting up a bit, coming back was almost impossible, from the mist and the steepness, and perforce they had to go on. After a long and dreary search, at last the gentian was found; a gem which well repaid us. We counted seven plants only, and refrained from taking more than three. This we were entitled to, although it grieved us to make this plant, now very rare, still rarer. However, as we afterwards found it in comparative plenty, we all managed to get a specimen or two, and still leave some for our successors. It was curious, in this desolate and bleak region, to observe a mouse run from one hole to another, as frightened as if it had seen an excursion of cats. The cold was now extreme, we could not put our hands in our pockets, our whisky was about finished, and the cold, pelting rain was pouring, so we began to consider the expediency of making for the inn, where tea would be waiting us. Five minutes behind a large stone, a shelter in a weary land, for a smoke, and then we set out for the inn. It took us about an hour and a half, and on arriving at the foot the evening was calm and beautiful, but round the top we still saw the clouds swirling as before. The mist appeared to be resting on the top, but our now experienced eyes saw what was still going on. At the inn we met our friends who had gone to the top, running races to see if they were still fresh. A thorough wash and change of clothing made us comfortable, and we sat down about nine o'clock to the finest tea, thanks to our hunger, we had ever had. Tea over, the inevitable smoke and chat over the incidents of the day pleasantly occupied half an hour, and after a hot tumbler of toddy, to counteract the effects of the mist, we retired to rest, the moon shining beautifully on the mountain and the loch.

The following day we got up at six, so as to make an early

start, our first day being only half a one (we were not off the coach till two o'clock). This morning promised well; the top standing out clear against the blue sky, and in the soft morning light looking beautiful. Not a cloud was in the sky, and we were eager to be off. But it was first necessary to breakfast, and to breakfast well, for except a slice of bread and cheese we should get nothing till eight or nine o'clock at night. And we did breakfast well, as might be expected. Another important matter had to be attended to, filling our flasks, and then, after a preliminary nip, although it *was* rather early for that sort of thing, we set off, pipes all going briskly, for the same scene visited already. The first stiff climb began to display the stiffness of limb brought on by our previous exertion, and it was not till after a couple of hours' climbing that we began to feel fresh again. The first half of the day was spent at the scene of the previous day's labours, and we were successful in getting some good mosses, but not any very rare ones. Then to the top, the climb being very steep, amongst large boulders, which hid all view, save of the opposite hill. From the cairn at the top a magnificent view is obtained of the surrounding country for a great distance. To the north and west a splendid bird's-eye view of the various passes and glens — Glen Lyon, &c., with the lochs and mountains in the distance, Ben Wyvis in Ross-shire being quite discernible. At our feet, halfway up the mountain, lay the little loch, "Loch-na-Cat," and beyond it lay mountains piled on one another with infinite grandeur. At the foot of the mountain, to the south-east, Loch Tay was shining in the sun, and beyond it we were told we could even see Edinburgh with a glass. At the head of Loch Tay Killin could be discerned amidst the woods, with Ben Vorlich and Ben More to form a background. Altogether the view is nearly unequalled in Scotland, which is saying a great deal. Although the day was clear and beautiful, still it was cold and blowy, and we descended about a hundred yards to the Sappers' gully, known to every botanist as the only spot in this country for the Saxifraga cernua.

Here we lunched, but our more eager botanists soon commenced a search for the Saxifraga, and before long the cry, "Here it is!" broke up our pic-nic, and a minute search was instituted over the rocks. Although by no means plentiful, yet it was satisfactory to see that there is no chance of its being exterminated for a year or two yet. As every botanist who visits Ben Lawers must needs

take one or two specimens, and as the total number of plants is probably under a hundred, it is not unlikely that in a few years it may be quite extinct. This Saxifraga is propagated by bulbs, which lie in the axils of the leaves, and from their number and colour make this plant when growing an object of great beauty. In the dried state, in which condition most botanists have seen it, it is far from beautiful. Here also was found the rare Draba rupestris, in tolerable plenty.

From here we descended to the shores of "Loch-na-Cat," probably 1,500 feet, down the almost precipitous sides. Around its shores grow some rare plants, and we scattered all about to look for them. This loch may be about a mile and a half in circumference, and is surrounded on three sides by Ben Lawers. At the lower end it is drained by the Lawers Burn. It is a scene of considerable beauty, and well worth a visit. Among the boulders at the head of the loch, the Polystichum lonchitis is found in great abundance. It would be almost impossible to eradicate it, as every hole and dark corner round the boulders seems to grow one or more specimens. It is, in my opinion, the most beautiful of the ferns, and grows well in a case. The Polypodium alpestre is also common. The still rarer Woodsia grows in one or two spots upon the rocks at the head of the loch, but is getting very difficult to find. Here also were found Draba incana, Juncus biglumis, and male and female plants of Carex dioica.

From the lower end of the loch there is a good road, although somewhat of the steepest, and although not the most direct we now took it, and in about two hours arrived at the inn, where the same profusion awaited us, who were equally ready. On the whole our second day was the most enjoyable, as the weather allowed us to enjoy the view, but the first day was probably the most successful. The second day also was so long, that we were more fagged, having been upwards of twelve hours up the hill. We did not get down till after nine o'clock, and as we had to retire early, did not spend much time in examining our spoils, but as speedily as possible retired to rest. Next morning we were up by four o'clock, and drove down the sides of Loch Tay to Killin, which looked even more lovely in the morning mist than in the noon-day sun. From Killin up to Killin station, where we got the train at seven, and arrived in Glasgow at half-past ten, having enjoyed this excursion extremely, and determined to return at some time to repeat our adventures.

TRANSACTIONS

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OF

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TRANSACTIONS

OF THE

GLASGOW SOCIETY OF FIELD NATURALISTS.

THIRD ANNUAL MEETING.

187 George Street, 20*th March*, 1874.

The Annual Meeting of the Society was held here this evening—Mr. James Allan, Vice-President, in the chair.

The following office-bearers were elected for the ensuing year:—James Stirton, M.D., *President;* Richard M'Kay and Peter Cameron, jun., *Vice-Presidents;* John Harvie and F. G. Binnie, *Secretaries;* George Barlas, *Treasurer;* Alex. Watt, *Curator;* James Allan and W. D. Benson, *Members of Council.*

SPECIMENS EXHIBITED.

By Mr. Peter Cameron, jun.—Two saw-flies, new to Britain, *Blennocampa aterrima*, Klug., a species distinguished from the rest of the genus by its entirely deep black colour, and by the long pilose antennæ. *Hoplocampa pectoralis*, Thomson, the only recorded locality for which is Gothland; its nearest British ally is *H. crataegi*. The first of these was taken by Dr. Buchanan White at Braemar, and the latter by the Rev. T. A. Marshall at St. Albans. Also two new saw-flies described by him in the "Entomologists' Monthly Magazine": *Taxonus glottianus*, of which a single specimen was taken at Kenmuir Bank; and *Nematus graminis*, a not uncommon species in the district, the larva of which feeds on grasses.

Mr. James Allan communicated an extract from a letter which he had received from Mr. Williamson, corresponding member, mentioning the occurrence of *Trichomanes radicans*, near Louisville, Kentucky.

7th April, 1874.

The first meeting of the summer session was held this evening—Mr. Peter Cameron, jun., Vice-President, in the chair.

SPECIMENS EXHIBITED.

By Mr. David Pearson.—Living specimens of several species of *Helices*, imported into this country amongst Esparto grass.

By Mr. Alex. Watt.—Several mosses collected at the Society's excursion to Corrie Glen. Amongst others, *Orthotrichum rupestre*, *Tortula ruralis*, and *Dicranum heteromallum*.

By Mr. F. G. Binnie.—Living specimens of *Limax brunneus* and other land molluscs, collected at the same excursion. He also stated that he had found *L. brunneus* last month at Robroyston, which, taken in connection with its occurrence near Possil Marsh, would indicate that though local, it is generally distributed throughout the Glasgow district, and that probably further research would find it so throughout Clydesdale. It is probably only a persistent variety of the abundant *L. agrestis*, characterised by its smaller size, uniform brown colour, and limpid mucus, and differing slightly in habit, being seemingly restricted more to moist situations than the type.

By Mr. Peter Cameron, jun.—Two saw-flies not hitherto reported as having been found in Britain:—*Strongylogaster mixtus*, Klug., taken in the neighbourhood of Paisley; *Pœcilosoma obtusa* from Rannoch. He remarked that it was doubtful if the Scottish specimens of the latter insect were the same as the *P. obtusa* of Klug. which was found in Hungary, but they were undoubtedly identical with those described under that name by Thomsom from Sweden. It was quite possible that the species was a variable one. Also *Phyllotoma tenella*, Zaddach, in its various stages of larva, pupa, and imago. He said that the eggs were laid on the leaves of the birch, and that the larva bores its way between the folds of the epidermis, and by its continual feeding makes the leaf a mere bladder, inside of which the larva can be easily observed by holding the leaf between the observer and the light. The larvæ open the sides of the leaf to expel the frass. Two broods occur, the first in the early summer, the second in the autumn. The larvæ of the second brood remain unchanged till the following spring, passing the winter in a cocoon of very thin silk, which is

spun between the epidermal folds of the leaf. Generally only one larva inhabits each leaf, but sometimes two or three do so.

EXCURSION.

Kilsyth and Corrie Glen.—An account was given of this excursion. Several of the spring plants were noticed in flower, and some of the more frequent mosses of the district were collected. A single plant of *Cardamine pratensis* was noticed in flower. This was early, as it does not usually flower till May. *Sisymbrium thalianum* was also found. A number of species of land molluscs were observed, including *Limax brunneus*, of which a single individual was found on the Castle Hill. It was also observed to be rather numerous at the Corrie on a limited piece of ground on the margin of the burn. The early date, undoubtedly, prevented much of unusual interest being found, but the excursion was intended principally for the purpose of examining the character of the district. All who were at the excursion were of the opinion that the district promised to be well worthy of careful investigation farther on in the year.

21st April, 1874.

Mr. Peter Cameron, Vice-President, in the chair.

Mr. Alexander Macindoe, Kelvinbank Terrace, Maryhill, was elected a resident member.

SPECIMENS EXHIBITED.

By Mr. Alexander Watt.—Growing specimens of *Chara flexilis* and *C. fragilis*, from Possil Marsh. He stated that he had found three species in the district—the two exhibited, and *C. vulgaris*. The last was found at Millport, and seemed to be chiefly found near the coast. *C. flexilis* is the commonest species in the district.

By Mr. Alex. Macindoe.—Very luxuriant specimens of *Asplenium ruta-muraria* from a wall near the Maryhill Road.

By Mr. Thomas King.—A case of insects from Chili, belonging chiefly to the orders *Coleoptera*, *Hymenoptera*, *Lepidoptera*, *Diptera*, and *Hemiptera*. Among them was *Ophion luteus*, an ichneumon very common in Britain.

By Mr. J. R. Watson.—A living female of *Vespa sylvestris* captured on the Drymen Road, about nine miles from Glasgow.

By Mr. Peter Cameron, jun.—A collection of the social wasps found within ten miles round Glasgow. They are:—*Vespa vulgaris*, the commonest species in the district, found nearly everywhere; *Vespa rufa*, common at Carmyle and Possil; *V. Germanica* from Possil, not so common as the previous species; *V. sylvestris*, a tree wasp from Milngavie, rare; *V. Norwegica* from Paisley Moss Wood. The only other British wasps are *V. arborea* and *V. Crabro*. The former has been recorded from Scotland, but not the latter.

He also exhibited *Allotria halterata*, Thomson, the smallest species of the *Cynipidæ*, from Kenmuir Bank; also the dried body of an *Aphis*, the interior of which had been devoured by an *Allotria*, or by some species of an allied genus.

EXCURSIONS.

Fintry.—Mr. Richard M'Kay gave an account of this excursion. He said the district between Fintry and Killearn was likely to repay more searching investigation than the present excursion permitted, both as regards its Fauna and Flora. Mr. Peter Cameron, jun., reported finding the following *Cynipidæ* in the neighbourhood of Fintry:—*Cynips lignicola*, very abundant in all the woods; *Dryophanta divisa*, *Dryophanta fecundatrix*, *Dryoteras terminale*, *Neuroterus numismatis*, *N. lenticularis*, *Rhodites rosæ*, all common; *Andricus noduli*, apparently rare. He also found a small *Aphilothrix* which is apparently new to the British list, as it cannot be satisfactorily identified with any of those already described.

Possil Marsh.—Mr. Alex. Watt gave an account of this excursion. Many of the more frequent species of the aquatic fauna were collected, including *Coleoptera* and *Hemiptera* of several species, also the larvæ of several species of *Coleoptera*, *Neuroptera*, *Trichoptera*, and *Diptera*, among which was the very interesting larva of a small gnat, *Corethra plumicornis*, often termed the glass or phantom larva, on account of its extreme transparency, which permits of a clear view of the internal organs and their action. Amongst the Mollusca *Lymnæa stagnalis* was found. This species was introduced into the marsh some years ago. Numbers of empty shells of *Dreissena polymorpha* were noticed amongst the mud and debris thrown out of the adjoining canal.

5th May, 1874.

Mr. Peter Cameron, jun., Vice-President, in the chair. Mr. Thomas King, 110 Hill Street, was elected a resident member.

SPECIMENS EXHIBITED.

By Mr. Richd. M'Kay.—Fertile stems of *Equisetum umbrosum.*

By Mr. Peter Cameron, jun.—Two species of saw-flies, taken at the excursion to Cambuslang and the south bank of the Clyde, *Dolerus vestigalis* and *Nematus Kirbyi.*

By Mr. F. G. Binnie.—Three species of caddis-flies, taken at the same excursion, *Brachycentrus subnubilis, Rhyacophila dorsalis,* and *Glossosoma Boltoni.*

By Mr. W. D. Benson.—Specimens of *Unio margaritifer,* and a collection of pearls secreted by this mollusc.

EXCURSION.

Cambuslang and the South Bank of the Clyde.—Mr. Richard M'Kay gave an account of this excursion. The more characteristic plants of the district were found in their usual haunts; the *Equisetum umbrosum* was observed still growing at the locality where it was found at the Society's excursion last year. It was rather stunted, and did not fruit so readily, as only one fertile plant was found. With regard to this station for it Mr. M'Kay, in allusion to some newspaper correspondence, said it was found by Mr. George Ross, a former member of the Society, and himself, in 1872, but had been omitted to be reported at the time. *Anacharis alsinastrum* grows abundantly in a pool in a disused quarry. A search was made for the Pearl Mussel (*Unio margaritifer*), which was found still living in some numbers in the bed of the Clyde opposite Carmyle and Kenmuir Bank. The other Mollusca noticed in the Clyde were *Lymnæa peregra* and *Ancylus fluviatilis.*

Two species of humble-bees were observed—*Bombus lucorum* and *B. terrestris.* *Andrena albicans* was also captured.

PAPER READ.

By Mr. Malcolm Black, on the Anatomy of the Haddock, illustrated by dissected specimens. He described the internal

anatomy very minutely, and showed its relationship with that of other members of the class.

The attention of the Society was called to a communication from Mr. Darwin, which appeared in a recent number of "Nature," in which he writes that near Beckenham, Kent, he had observed, for above twenty years, that every spring the flowers of the primrose, and sometimes also of allied species, were cut off and strewn about—presumably by birds—and that this year the destruction has been greater than ever. He asks whether this fact has been noticed in other parts of Britain, as having a bearing on the question of its being a new habit or instinct of birds. Several letters, chiefly affirmative, appeared in "Nature."

Mr. Thomas King stated that he had observed it, for the first time, this spring at Innellan, with respect to both primroses and cowslips—the former in the woods and in the garden, the latter in the garden only. In most instances he did not observe the cut-off portions; they had either been eaten or carried away. He never saw the birds at work, and could not therefore say what species committed the depredations.

Mr. Allan M'Aulay said he had been informed that bullfinches destroyed the blossom of the peach for the sake of the nectar.

19TH MAY, 1874.

Mr. Peter Cameron, jun., Vice-President, in the chair.

SPECIMENS EXHIBITED.

By Mr. George Horn.—Two rare plants; *Euonymus Europæus* from Bothwell woods, and *Paris quadrifolia* from Kilsyth.

By Mr. Alexander Watt.—The following mosses from the Whangie:—*Blindia acuta*, *Rhabdoweissia denticulata*, and *Hypnum denticulatum*; *Aspidium filix-mas*, var. *paleacea*, from the neighbourhood of the Whangie; and *Peplis portula* from Craigton Dam and the reservoir in the Kilpatrick Hills.

By Mr. J. R. Watson.—Specimens of the Parsley Fern (*Cryptogramme crispa*), from a new locality in the Kilpatrick Hills, where it occurs in some abundance, and very luxuriant in growth.

By Mr. James Allan—(For Mr. Turner of Stirling). The very curious eggs of the earth-worm (*Lumbricus terrestris*). Each

egg is seated on a pedicel, and has at the top a peculiar valvular opening to facilitate the egress of the mature embryo.

By Mr. F. G. Binnie.—Specimens of *Balia perversa* from Campsie Glen.

By Mr. Peter Cameron, jun.—*Nematus histrio*, LePel = *rufescens*, Hartig, a saw-fly new to the British list. It was bred from larvæ found on the west coast of Inverness-shire. The larva, which fed on *Salix aurita*, was of a pale green colour, dotted over with small black points, and with a dark green stripe bordered on each side with a narrower white one; the cocoon was long, scarcely cylindrical, composed of a brown-coloured silk. He also exhibited the saw-fly described by De Geer as *Tenthredo salicis*, Linn, which is, however, quite different from the true *Nematus salicis* of Linn (of which specimens were exhibited), which is a much larger insect, and instead of having the head and thorax black, as in De Geer's species, has only a square black spot on the top of the head and another on the mesonotum and breast.

EXCURSION.

Calderwood Glen.—Mr. Richard M'Kay gave an account of this excursion. There was a good turn-out of members. Numerous objects of interest were seen, but the only things worthy of special mention were the three uncommon mosses—*Tortula insulana*, *Gymnostomum rupestre*, var. *stelligerum*, and *Bryum pallescens*—collected by Mr. Alexander Watt.

2ND JUNE, 1874.

Mr. Peter Cameron, jun., Vice-President, in the chair.

Mr. James Kirkland was elected a resident member.

SPECIMENS EXHIBITED.

By Mr. Richard M'Kay.—*Arabis hirsuta*, *Cnicus heterophyllus*, and *Asplenium viride*, all from the neighbourhood of Kilsyth.

By Mr. Peter Cameron, jun.—A saw-fly, *Selandria grandis*, Zaddach=*S. interstitialis*, Thomson, similar in coloration to the common *S. serva*, but is much larger, and the second recurrent nervure is received into the second submarginal nervure, which is not the case with *S. serva*. This species was also taken in the district.

By Dr. James Stirton.—A number of cryptogamic plants, chiefly

lichens, from the "Challenger" expedition, and made some remarks on their distribution. Especially noteworthy among them, from its bearing on questions of plant-distribution, was a moss, *Myurium Hebridarum*, from Furnas in the Azores. This species was known only from some of the Western Isles of Scotland until found by the present expedition in the Canaries and the Azores; at the latter station a specimen with seta attached was found, showing that it had fruited. Among the lichens from Furnas, one *Sticta Damæcornis*, var. *Canariensis*, occurs also in Skye. The Azores being true oceanic islands, renders the question of the connection between these isolated stations one of extreme difficulty; but the materials now being collected by the expedition respecting the vegetation of such islands may throw some light upon it, as may, perhaps, the fact that the Azores are culminating points of a submarine ridge, the southward extension into the basin of the North Atlantic of the plateau from which rise the Hebrides along with the Färoe and other islands.

EXCURSION.

Strathblane.—Mr. F. G. Binnie gave an account of this excursion. *Viola flavicornis* was found generally distributed along the hill slopes there; and the *Arum maculatum* was observed (evidently a garden escape) in the grounds of Carbeth Guthrie, adjoining the Colt's Lane.

The larvæ of *Eupithecia sobrinata* were taken on a juniper near the Deil's Craig Dam, and were exhibited at the present meeting chiefly to show the protective coloration of the insect at this stage of its existence.

PAPER READ.

Dr. Stirton read a paper in continuation of a former one on the peculiarities and organization of Lichens. On the present occasion he dwelt chiefly upon the more recent contributions to our knowledge of the physiology and reproduction of this class, and discussed, in the light of these fresh facts, the theories which had been advanced to explain certain functions and products that are still veiled in some obscurity. The paper was illustrated by diagrams.

In connection with remarks made on the advantages of taking

up special branches of study, Dr. Stirton and others stated that they would be happy to give every help and assistance, with regard to their own special branches, to any of the members who wished to take up such special study.

Mr. Cameron remarked on the value of attending to varieties in making up lists of species for a district, and adverted to Staudinger's nomenclature and division into *species*, *Darwinian species* (= sub-species), *varieties*, and *aberrations*, as a good working one.

16TH JUNE, 1874.

Mr. Richard M'Kay, Vice-President, in the chair.

Mr. J. C. Hutcheson was elected a resident member.

SPECIMENS EXHIBITED.

By Mr. Alexander Watt.—The four British species of Lemna, all from the Forth and Clyde Canal. He made some remarks on their structure, growth, and distribution; one species only, *L. minor*, is generally distributed through the district, the others being very rare, although *L. trisulca* is plentiful in its localities.

By Mr. Alexander M'Indoe.—*Rubus chamæmorus* from the Earl's Seat; *Trollius Europœus* and *Habenaria viridis* from Craigallian Loch.

By Mr. F. G. Binnie.—A fresh-water mollusc, *Planorbis nitidus*, Müller, from the Forth and Clyde Canal at Firhill. Also the apparently rare caddis-fly *Limnophilus luridus*—new to the district—from the Kilpatrick Hills and Caplaw Dam. Only five localities are given for this species in M'Lachlan's "Monograph of the British Trichoptera," Rannoch being the only Scottish station.

EXCURSION.

Neilston and Gleniffer.—Mr. J. R. Watson gave an account of this excursion. A number of interesting plants were found, including *Sedum villosum*, collected on the Gleniffer Braes. *Limnophilus luridus* was captured near Caplaw Dam.

At an excursion to Eaglesham and Ballagioch, on the 6th instant, besides observing *Lamium album*, *Empetrum nigrum*, and other unfrequent plants, a station was found for *Peucedanum Ostruthium*. Mr. Alexander Watt found *Chara flexilis* and *C.*

fragilis growing in the Eaglesham reservoirs; and Mr. F. G. Binnie observed here the small slug *Limax brunneus.*

It was stated to the meeting that at a recent visit to Kilpatrick Hills, *Isoetes lacustris* was found in the Lily Loch. It was previously found and recorded for Loch Cochno by the Society, thus making two localities among these hills for this species. *Sedum villosum* and *Vaccinium Vitis-Idæa* were also mentioned as having been observed, and likewise the fresh-water shell *Ancylus fluviatilis.*

30TH JUNE, 1874.

Mr. Peter Cameron, jun., Vice-President, in the chair.

SPECIMENS EXHIBITED.

By Mr. Richard M'Kay.—A number of uncommon plants from the Mill Burn, near Kilmalcolm, including *Meum athamanticum, Sedum villosum, Myosotis repens, Habenaria albida,* and *Carex pallescens.*

By Mr. Peter Cameron, jun.—The larvæ of *Nematus histrio,* Le Pel., a specimen recently added by him to the British list. The perfect insect was exhibited at the meeting held on 19th May, and an account given of its metamorphosis at that time.

A letter was read from Mr. David Gregorson, containing observations on the more noteworthy plants of the Kilsyth district, and a list given. Among those enumerated special mention may be made of *Ophioglossum vulgatum* and *Botrychium lunaria.*

EXCURSION.

Meikle Bin.—An account was given of the excursion to the Meikle Bin above Kilsyth, on the 27th. The members succeeded in finding many of the less frequent hill plants of the district; also the rare *Sambucus Ebulus,* near Milton, at a station long known by local botanists.

PAPER READ.

Mr. F. G. Binnie read a paper on "The Aquatic Fauna of Possil Marsh." Taking the various zoological sections in their order, he indicated the species that occur in the Marsh, pointing out the sections with regard to which our knowledge was still deficient. The sub-kingdom Vermes (Rolleston) was requiring investigation, also the sub-kingdom Protozoa; and several classes

of the other sub-kingdoms, especially the class Insecta, where full lists of the Coleoptera, Neuroptera, Trichoptera, Lepidoptera, Hemiptera, and Diptera are wanted. Of the Trichoptera a partial list was given in the present paper, which he hoped largely to increase and to complete during the present year. Of the Lepidoptera the only truly aquatic representatives found so far all belong to one family, the Hydrocampidæ. Out of the six British representatives of the aquatic family, there have occurred in the Marsh *Cataclysta Lemnalis, Hydrocampa Nymphœalis,* and *H. stagnalis.*

Of the Mollusca a full list was given (with the exception of the Polyzoa, and the genus Pisidium of the Lamellibranchiata; one or two species of the latter occur, but are not yet named). The species are as follows :—*Succinea putris, Planorbis albus, Physa fontinalis, Lymnœa peregra, L. stagnalis, L. palustris, L. truncatula, Bythinia tentaculata* and var. *decollata, Valvata piscinalis, V. cristata, Dreissena polymorpha, Cyclas cornea,* and *C. lacustris*—thirteen species, of which three may be considered as introduced : *Lymnœa stagnalis* and *Dreissena polymorpha* certainly, and *Cyclas lacustris* probably. *D. polymorpha* is introduced into the list of species for Possil Marsh proper from a single living specimen having been found within its limits, an escape from the adjoining canal, where it has long been known to occur in great numbers. It may be mentioned that no species of mollusc is known to be found in the canal here which has not also occurred in the Marsh. In conclusion, the compilation and completion of a full account of the Fauna and Flora of the Marsh was advocated, and if possible to appear in next year's Transactions. A number of living Mollusca and aquatic insects in various stages of development were exhibited in illustration of the paper; also collections of the Mollusca and Trichoptera (partial) of the Marsh.

14TH JULY, 1874.

Mr. Peter Cameron, jun., Vice-President, in the chair.

Mr. D. S. Carson was elected a resident member.

SPECIMENS EXHIBITED.

By Mr. F. G. Binnie.—*Trochilium crabroniforme,* Lewin, from Possil Marsh.

By Mr. Peter Cameron, Jun.—The fossorial wasp *Pompilus*

niger from Loch Duich. Also the following saw-flies:—Both sexes of *Cœnoneura Dahlbomi*, taken in Cadder Wilderness; the male of this species has hitherto been undescribed. A species new to science, which he has named *Nematus Vollenhoveni* after the talented Dutch entomologist, to whom we owe much of our present knowledge of the life-histories of saw-flies, more particularly those of Holland. A full description, together with an account of its habits and metamorphoses, appears in the "Scottish Naturalist." (vol. II., p. 296 *et seq.*) A number of the galls and living larvæ were also exhibited. Dr. Stirton pronounced the small tubercular elevations, which often broke up the surface of the galls, to be the work of a minute fungus.

EXCURSIONS.

Spout of Ballagan.—Owing to the unfavourable character of the day, very little of interest was done. The members, after leaving the glen, visited the Blairquosh oak and measured it. The minimum girth was found to be 16 feet $8\frac{1}{2}$ inches. In a list of remarkable trees which appeared in an old volume of the "Citizen" newspaper, the girth of this tree was stated to have been 15 feet in 1796.

Fin Glen, and the Earl's Seat.—In the Fin Glen a number of interesting plants were observed, from which the following may be selected for mention:—*Arabis hirsuta, Rubus chamœmorus, Cnicus heterophyllus, Campanula latifolia, Saxifraga aizoides* and *hypnoides, Sedum villosum, Arctium Lappa, Empetrum nigrum, Calamintha Clinopodium, Rumex sanguineus*, var. *viridis, Carex sylvatica, remota*, and *pallescens, Asplenium viride*, and *Lycopodium selaginoides.*

Mr. Alexander Watt reported the occurrence of *Jasione montana* in the railway cutting at Kirkintilloch.

28TH JULY, 1874.

Mr. Peter Cameron, jun., Vice-President, in the chair.

SPECIMENS EXHIBITED.

By Mr. James Allan.—*Sphagnum compactum, S. contortum*, and *Hypnum stellatum*, from Goatfell, Arran.

By Mr. Peter Cameron, jun.—*Dineura stilata*, a saw-fly new to the British list; taken in the end of June on *Pyrus aucuparia* in Cadder Wilderness.

EXCURSION.

Dunoon (dredging).—Mr. John Harvie gave an account of this excursion, which was a very successful one, a number of very interesting marine animals (chiefly Mollusca and Crustacea) being taken. Many of these were exhibited at the present meeting. Among the Mollusca may be mentioned *Fusus propinquus* and *Lima hians.* Several examples of the latter very beautiful species were taken—all inside the tubular conglomeration of marine débris bound together by byssal threads which zoologists term its nest. This habitation is probably intended as a protection from the rapacity of its carnivorous neighbours because it is unable to withdraw itself completely into its shell, which itself is not very strong, and the magnificent carmine tint of the tentacular fringes of the mantle must make it very conspicuous.

PAPER READ.

By Mr. John Harvie, entitled "Observations on the Nudibranchiata." He gave some very interesting facts with regard to the habits and food of this class, and a summary (with a list of species) of what he had done in the investigation of the Clyde fauna.

Mr. Alexander Watt gave a list of the more noteworthy plants observed by him on Ben Voirlich during a recent visit; they were as follows:—*Thalictrum alpinum, Silene acaulis, Alchemilla alpina, Epilobium alpinum, Sedum Rhodiola, Saxifraga stellaris, aizoides, oppositifolia,* and *hypnoides, Cochlearia officinalis,* var. *alpina, Gnaphalium supinum, Carduus heterophyllus, Armeria maritima, Polygonum viviparum, Oxyria reniformis, Salix herbacea, Juncus triglumis, Scirpus cæspitosus* var. *viviparus,* and *Carex rigida.*

Mr. Richard M'Kay gave a sketch of the botany of Ben Cruachan from recent observations. The following is a list of the more interesting plants noticed:—*Thalictrum alpinum, Alchemilla alpina, Sedum Rhodiola, Saxifraga stellaris* and *aizoides, Gnaphalium supinum, Carduus heterophyllus, Oxyria reniformis, Juncus triglumis, Scirpus cæspitosus, Sibbaldia procumbens,* and *Polypodium alpestre.* He remarked that the mountain did not seem one likely to produce many rarities.

11th August, 1874.

Mr. Richard M'Kay, Vice-President, in the chair.

SPECIMENS EXHIBITED.

By Mr. F. G. Binnie.—*Hydroptila tineoides* from the south bank of the Clyde above Cambuslang.

EXCURSION.

Troon.—Nothing of unusual interest was found. Mr. Richard M'Kay observed *Poa rigida*, and Mr. Alexander Watt noticed *Lepidium Draba*, both seemingly well established, although there is little doubt they are introduced.

25th August, 1874.

Mr. Richard M'Kay, Vice-President, in the chair.

SPECIMENS EXHIBITED.

By Mr. John Renwick.—*Inula dysenterica* from Whiting Bay, Arran.

By Mr. George Horn.—*Epilobium roseum* from a rubbish heap, Great Western Road; *Primula Scotica* and *Oxytropis Uralensis* from Orkney; *Carex teretiuscula*, var. *Ehrhartiana* from Bothwell woods; *Carex lævigata* from Innellan.

EXCURSIONS.

Roseneath.—Mr. Richard M'Kay gave an account of this excursion. No rare plants or animals were found. The large silver-fir trees in the Duke of Argyll's grounds were measured. The eastermost was found to be 21 feet 8 inches in circumference, and the westermost, 21 feet 10 inches.

Ben Lawers.—Dr. James Stirton gave an account of this excursion. He had found there five lichens new to Britain:—*Lecidea scutulata*, Stirton, from Ben Lawers; *L. lyperiza*, Stirton, from Killin; *Verrucaria peltophora*, Stirton, from Ben Lawers; *V. Colleta*, Stirton, and *Lecidea alpicola*, Schaer, also from Ben Lawers. He mentioned that he had found lichens growing on the decayed stumps of the elder near Grantown, a situation in which they had never been found before, and in this case they seemed to occupy the place of the fungi. There was considerable difference this year in the abundance of some of the rarer plants on Ben

Lawers. Some of them had increased considerably, and others—the rare *Gentiana nivalis* for instance—seemed to be getting rapidly exterminated. Mr. J. R. Watson succeeded in getting *Saxifraga cernua* in flower—a very unusual occurrence with the species in this country.

PAPER READ.

By Mr. Stewart Macdonald on "Mistakes in Natural History," in which he instanced many curious and absurd mistakes into which even great naturalists had fallen, in striving to interpret biological phenomena.

8TH SEPTEMBER, 1874.

Mr. Peter Cameron, jun., Vice-President, in the chair.

Messrs. Matthew J. Algie and John Renwick were elected resident members.

SPECIMENS EXHIBITED.

By Mr. George Horn.—A number of plants collected on rubbish heaps, Great Western Road; among them were:—*Veronica Buxbaumii, Coriandrum sativum* (in fruit), *Thlaspi arvense*,and a young plant of the Date Palm (*Phœnix dactylifera*).

By Mr. Alexander Macindoe.—Various species of Ferns from New Zealand.

By Mr. Peter Cameron, jun.—The undescribed *Nematus alnivorus* of Hartig, a saw-fly not previously reported as a native of Britain. It agrees very closely in size and colour with *Hemichroa luridiventris*, but it wants the white line on the pronotum. It seems to be a common species in Scotland, having been taken in the Possil district and in several localities in Inverness-shire. Nothing is known regarding its larva, but from the fact of the imago being always captured in the vicinity of willows, it is presumed that it feeds on these plants. He also exhibited the larva of *Abia nitens* from Possil Marsh, where it is now found feeding on *Scabiosa succisa*. When disturbed it ejects a watery fluid from pores in the body and rolls itself up into a ball.

Mr. Cameron also exhibited the female of the rare bee *Nomada mistura*, Smith. The male only has been described or known until the capture of this specimen, which was taken in Cadder Wilderness in August, on the Ragwort; another example was

likewise captured at Strathblane. Only four other specimens have been reported from Britain, and these were taken in Yorkshire and near Carlisle.

EXCURSIONS.

Ben Voirlich, Loch Lomond.—In addition to getting most of the plants already recorded in the minutes of the Society, the Parsley Fern (*Cryptogamme crispa*) was observed.

Auld Wives' Lifts.—Nothing of exceptional interest was found.

Mr. James Allan made some interesting remarks on *Vallisneria spiralis*, in which was mentioned the rapidity of its growth; from a recent observation of his own he had found it to be as much as 30 inches in five days.

22ND SEPTEMBER, 1874.

Mr. Richard M'Kay, Vice-President, in the chair.

Messrs. Alexander Noble and H. G. Gillum were elected resident members.

SPECIMENS EXHIBITED.

By Mr. Somerville.—A large wood-boring larva (coleopterous) found in a log of Maho from Cuba. It seemed in a perfectly healthy condition.

By Mr. James Allan.—The stem of the *Vallisneria spiralis* remarked upon at the previous meeting. Also a large number of mosses from Devonshire; and the rest of the evening was occupied in their examination under the microscope.

6TH OCTOBER, 1874.

Mr. Peter Cameron, jun., Vice-President, in the chair.

It was intimated that during the winter months the meetings would be held on Fridays instead of Tuesdays. The Syllabus for the winter session was laid on the table.

SPECIMENS EXHIBITED.

By Dr. Stirton.—*Parmelia Millaniana*, a lichen new to science, from Glen Croe, where it was found in July last, by the Rev. Dr. Hugh M'Millan, of Glasgow, and he had great pleasure in naming it after its discoverer. The following is a diagnosis of this lichen. Thallus thin, albido-glaucescent (K yellow, C yellow), laciniato-

lobate, laciniæ sinuato-incised, often imbricated, smooth, laxly affixed; medulla pale yellow, thin (C yellow); under surface black, towards the margin brown, with black branching radicles; apothecia unknown. Intermingled with it were specimens of *P. physodes*, Ach.

Dr. Stirton also exhibited the Lichen *Lecanora Breadalbanensis* new to science, found by him on Ben Lawers; he also laid on the table a large tuft of the moss *Myurium Hebridarum*, which he had received from T. J. Bulkeley, Esq., Procurator Fiscal, Lochmaddy, and referred to the observations on this species which he made at a previous meeting when discussing some of the "Challenger" specimens.

By Mr. Cameron—A variety of *Taxonus bicolor*, Kl.; intermediate between the type and *T. coxalis*, Kl., showing that the latter must necessarily be a variety of *T. bicolor*. He also exhibited a new species of Eriocampa taken by him near Beauly, and which he has named *E. testaceipes*. It is nearly related to *E. cinxia* (as shown by the similarity in the structure of the posterior wings) but is at once distinguished by having the feet nearly all of a testaceous colour.

23rd October, 1874.

Mr. Peter Cameron, jun., Vice-President, in the chair.

Mr. David R. Clark, M.A., was elected a resident member.

The Chairman gave notice that at next meeting he would move, "That this society be amalgamated, on suitable terms, with the Natural History Society of Glasgow."

PAPER READ.

Dr. Stirton gave an introductory address to the winter session. He prefaced his remarks with some observations on the progress made in the study of nature. Mental philosophy, despite the numerous and great advances made, was as yet without a firm and solid basis. Far different results have we in the study of external nature, where order may be said to have set in; minute, prolonged, and exhaustive observation have given us glimpses of the first links of the vast chain of law which unites all nature in one. The schoolman, with his dream of intuitive knowledge to be attained by the mind purified by severe privation, has vanished, and in his place we have got the healthy, vigorous naturalist, and

inductive philosopher, whose only idea of privation is that involved in incessant work. Referring to the extent of the field of study, and the absolute necessity for division of labour he insisted that advancement can only come from special study of special branches. Loss can be the only result of talent dissipated over the whole realm of nature. He concluded with a notice of a few of the primary advantages attending the study of nature, in preserving our higher nature pure amid the various adverse elements of a busy life, in elevating the mind by the contemplation of the grand harmony and unity of nature, and in training and improving the mental faculty itself.

6th November, 1874.

Mr. Richard M'Kay, Vice-President, in the chair.

Mr. Peter Cameron, jun., instead of previous motion, moved, "That this Society enters into negotiations with the Natural History Society of Glasgow, for the purpose of amalgamating with it on suitable terms."

Mr. Harvie moved as an amendment, "That this Society, whilst favourable to amalgamation, take no steps in the matter till the Natural History Society make a proposal stating terms of proposed union." After a discussion, the amendment was carried on a vote being taken. The votes were: for amendment, 10; for Mr. Cameron's motion, 9.

PAPER READ.

Mr. Gregorson read a paper entitled "Notes on the Natural History of Kilsyth." After explaining its position and leading physical features, and sketching the principal points and facts in its antiquities, history, and geology, he referred at more length to the botany of the district. Up to this date, his list of observed plants comprises 350 species, which, considering the limited time he has been enabled to devote to their investigation, he thought, showed that the district was a tolerably rich one. The carices, grasses, mosses, lichens, and fungi, he had scarcely touched. Twenty species of ferns have been observed, including amongst others, *Asplenium viride, Cryptogramme crispa, Aspidium angulare, Ophioglossum vulgatum,* and *Botrychium lunaria.* There is an absence of vegetation in the standing waters as compared with the immediate neighbourhood of Glasgow. He then enumerated in

their order of flowering the more characteristic plants, and after a reference to the zoology concluded by asking the assistance of the Society in working out its complete Natural History.

20th November, 1874.

Mr. Richard M'Kay, Vice-President, in the chair.

Mr. P. Cunningham, Maryhill, and Mr. J. Thomson, Glasgow, were elected resident members.

PAPER READ.

Mr. James Allan made some remarks on the arrangement of the genus Hypnum, in which he commented on the present unsatisfactory and unwieldy character of the genus, which greatly requires sub-division. The objections to the present division rest mainly on its not being founded on field characters, and so not a natural one. But as it has been arranged by the greatest living biologist, it must be accepted as a correct one. He exhibited a large number of mosses in illustration.

A discussion followed on the great variation exhibited by the common moss *Hypnum cupressiforme*, a series of which were exhibited by Mr. Allan. The extremes of these, in the absence of intermediate forms, might easily pass for distinct species. The similar variability of the genera Rosa, and Hieracium, and the fruticose Rubi, amongst plants and various species of Mollusca, were adverted to, and Mr. Darwin's observations on the subject were discussed.

4th December, 1874.

Mr. James Allan in the chair.

Mr. Fawcett, Crosshill, was elected a resident member.

PAPER READ.

Dr. Mathie read a paper on "The Leaf-beds of Ardtun." After describing the geographical position of the headland of Ardtun and the leading physical features of the surrounding district, he proceeded to explain the order and characters of the various strata of the sea cliff of Ardtun. Commencing at the top, there is first a bed of basalt; 2nd, a thin seam of shale with impressions of leaves and stems of plants; 3rd, a bed of volcanic ash; 4th, a

second leaf-bed; 5th, a second bed of volcanic ash; 6th, a bed of shale or consolidated mud with few leaf impressions; 7th, a seam of dark amorphous basalt; 8th, a base of columnar basalt.

As to the origin of these beds, Dr. Mathie thought that the theory advanced by the Duke of Argyll was the correct one. In a paper read before the Geological Society the Duke of Argyll said that alternations of quiet autumnal sheddings of leaves into the smooth, still waters of a shallow lake, with periods of volcanic eruption and activity, are the most probable causes of the Ardtun beds. Autumn after autumn the leaves are accumulated, till a period of volcanic eruption arrived when a stream of liquid mud was poured over them, insinuating itself between the upper and looser layers of the leaf-bed; upon this a strata of other volcanic matter was deposited; and thereafter came a period of rest and deposition of leaves, which in turn was followed by another volcanic eruption. He concluded by a description of the chief vegetable remains found in the beds.

The paper was illustrated by diagrams showing the geological arrangement of the beds, and by numerous specimens.

18th December, 1874.

Mr. Richard M'Kay, Vice-President, in the chair.

PAPER READ.

Mr. Stuart M'Donald read a paper on the common gnat, in which he gave some interesting details of the development and life history of this insect.

An interesting discussion followed, in which some account of the flight of insects was given by several members.

8th January, 1875.

Mr. Richard M'Kay, Vice-President, in the chair.

Mr. W. C. Crawford, Kelvinside Terrace, was elected a resident member, and Mr. James G. Scott, Rangoon, as a corresponding member.

SPECIMENS EXHIBITED.

By Mr. Allan.—An interesting series of mosses from Devon.

PAPER READ.

Mr. Milligan read a paper on the Foraminifera in which he remarked on the antiquity and importance of this class, the *Eozoon Canadense* being probably a foraminiferous animal. He gave an account of the leading features and physiology of the group, illustrating his remarks with pencil sketches of a few of the principal forms. He concluded with some observations on the recent researches of the "Challenger" expedition, and the extensive red clay deposits of the sea bottom.

22ND JANUARY, 1875.

Mr. Richard M'Kay, Vice-President, in the chair.

The Chairman intimated that this would be the last meeting at this place, as owing to building operations they must leave. It was moved that the cordial thanks of the Society be transmitted to Mr. Cousin, through whose kindness the Society's meetings had been held in this place at an outlay far below the value of the place of meeting, and that same be expressed in minutes. This was unanimously agreed to, and the Council was requested to take immediate steps as to a new place of meeting.

SPECIMENS EXHIBITED.

By Mr. Allan.—A collection of mosses from New Granada. The most of these were from the mountainous region of the Magdalena and Pacho, and a few were identical with British species. Many were quite new, and some of great beauty. The various species of Pelopagon, Prianodon, and Meteoreum attracted attention.

PAPER READ.

Mr. F. G. Binnie read a paper on "Caddis-flies," in which he gave a *resumé* of the characters of the group, its position and status in systems of classification. Prefacing his subject with a brief sketch of the distinctive peculiarities of the Insecta, and with an exposition of the doctrine of "Somites," he proceeded to a more elaborate account of the external configuration of the Trichoptera, and pointed out the various points in which they agreed with the several orders of insects, together with those in which they differed. Their affinities with the Neuroptera and Lepidoptera were chiefly dwelt upon. He was inclined to think that their affinities with the

Neuroptera were real, whilst the points of agreement between the Caddis-flies and the Lepidoptera were merely adaptive and not indicative of any close genetic relationship; but further research was needed before decisive affirmations could be made. By most British entomologists, and by a recent continental student—Kolenati—this group was given the status of a distinct order, a view favoured in the present paper: most continental entomologists, however, consider the group merely a sub-order of the Neuroptera. The current opinion of entomologists as to the rudimentary nature of the mouth organs of these insects was adverted to and doubted, at least as to its universality in the group. Recent study of a large number of individuals led to a different conclusion, but examination of living specimens was needed before this view could be considered fully established.

5TH FEBRUARY, 1875.

Mr. Richard M'Kay, Vice-President, in the chair.

PAPER READ.

By Mr. Thomas King.—Remarks on the Botany of Chile. He gave a prefatory sketch of the physical geography of Chile, as helping to elucidate its botanical features. Describing the situation and extent of Chile, he next contrasted North Chile—a desert, some years without a single shower—with the forest-clad and very rainy character of the south. Central Chile is intermediate in climate and has alternate rainy and dry seasons. Chile is mountainous, intersected by spurs from the Andes with flat-bottomed valleys between. Most of it has been elevated in the present epoch, the present state of South Chile being typical of the past condition of the whole of Chile. He described the order in which the vegetation appears. First the red, bare earth becomes green with the *Erodium moschatum and cicutarium* (Alferillo), considered introduced species by Professor Philippi; then the *Oxalis lobata* (Flor de perdiz) makes the fields gay with its golden blossom, occupying a similar position there to our wild gowans here, and as abundant. There is an absence in Chile of the luxuriant tropical vegetation one would naturally expect—owing to the fact that where the sun is powerful water is scarce, and where rain is abundant the heat is little.

The features that would strike a visitor from this country most upon landing (say at Valparaiso) would be the absence of sward, the abundance of bushes, and the presence of canes and palms. There was forest once (as at present in South Chile), but owing to the great destruction of wood, chiefly the Espino, for charcoal—the discovery and use of coal being of comparatively recent date there—trees are scarce, indeed absent, in North Chile, and the inhabitants have to grub up the *roots* of once-existing trees for fuel; even bushes disappear near towns. Before the Spanish Conquest the whole country is said to have been a forest. Another feature, not so evident, however, at the first glance, is that all the woody plants are evergreen, yet one of the most characteristic trees of Central Chile, the Espino, is deciduous. The fig tree and the vine, both thoroughly naturalized, are of course deciduous. Noticed that the imported elm gets its leaves sooner and keeps them longer than in Scotland.

Mr. King then particularized the leading and characteristic trees, shrubs, and herbaceous plants of the country, from which the following are selected:—

Litre *(Litrea venenosa)* tree and shrub, common. Reputed to possess poisonous properties, but could not verify.

Winter's Bark-tree *(Drymis Winteri* and *Chilensis)*, common. Named after Dr. Winter, who sailed in Drake's expedition, 1577, and introduced the bark, for medicinal purposes, into Europe. It is the sacred tree of the Araucanian Indians.

Antarctic Beeches *(Fagus obliqua, &c.)*, Roble.

Carbon *(Cordia decandra)*, a tree once, a shrub now. Found in the deserts of the north. It is the most ornamental wood of Chile.

Espino *(Acacia cavenia)*; which will be the hedge of the future, at present cut branches are set face to face. It grows in arid places away from streams.

Avellano *(Guevina avellana)*. The finest shrub of Chile; Habitat—South Chile. It might be acclimatized here like the Fuchsia.

Peumo *(Cryptocaria peumos)* comes second in order of beauty as an evergreen shrub. It is common, and the bark is used for tanning.

Copigue *(Lapageria rosea)*, common in the south, is the most beautiful flowering plant of Chile. It is an evergreen, woody climber, with thick, fleshy, scarlet, bell-shaped flowers, 3 inches long.

Algarrobillo *(Balsamocarpon brevifolium)*, a common shrub of the deserts of N. Chile, produces a pod which contains much tannin, and is used in preparing ink and leather.

Adesmia.—A characteristic genus of Chile. Leguminous shrubs of some 60 species.

Churco (*Oxalis gigantea*)—a deciduous shrub of the deserts of North Chile. It is the largest Oxalis known, and is used in house-building. There are at least 40 species of this genus in Chile.

Fuchsias, tropeolums, Bambusæ, palms, and the Myrtaceæ may be mentioned, also the Mano de leon (*Leontocheir ovallei*), the rarest of flowers, confined to a limited district in lat. 28° S. It has roots like those of the dahlia and large red flowers resembling those of the peony.

The potato is a native of Chile, and there are several species of this section of the genus Solanum—some, as *Solanum etuberosum*, without tubers. Suggested that fresh tubers might be imported into this country from Chile to test the opinion of those who argue that the potato disease has greater facilities owing to our stock being weakened by repeated cutting of the tubers.

A large number of plants are common to Chile and this country, some being cosmopolitan and native to both, others introduced there, as the violet (*Viola odorata*), now common on the banks of streams. The dandelion (*Taraxacum officinale*) was discovered in 1871. The foxglove is making way in South Chile. *Hymenophyllum Tunbridgense* occurs in South Chile.

Mr. King exhibited a very large number of plants, fruits, woods, &c., in illustration of his paper. Among them were many species which he had added to the Chilean Flora and to Science; and which have been fully described by his friend Professor Philippi, of the University of Chili, such as:—*Errazurisia glandulifera*, Ph.; *Adesmia Kingi*, Ph.; *Valeriana Senecioides*, Ph.; *Gymnophyton Kingi*, Ph.; *Crukshankia* (a genus peculiar to North Chile), several species; *Argylia villosa*, Ph., &c., &c.

19TH FEBRUARY, 1875.

Mr. Richard M'Kay, Vice-President, in the chair.

Mr. James Taylor, 129 High John Street, was elected a resident member.

PAPER READ.

By Mr. A. WATT on the Comparative Longevity of Plants.

In the discussion which followed, the desirability of having recorded in the minutes of the Society, any information and statistics with reference to ancient or remarkable trees in Scotland, was suggested, and met with unanimous approval.

5TH MARCH, 1875.

Mr. Richard M'Kay, Vice-President, in the chair.

SPECIMENS EXHIBITED.

By Mr. Richard M'Kay.—A large number of plants and varieties which he had recently received through the London Botanical Exchange Club. Among them were *Caltha palustris* var. *Guerangerii*, *Ranunculus Ophioglossifolium*, *R. arvensis*, *Arabis Turrita* (from St. John's College, Cambridge), *Helianthemum Breweri* (Holyhead), *Viola Curtisii* (Anglesea), *Stellaria umbrosa*, &c.

By Mr. J. M. Campbell.—A specimen of the Glass-rope sponge (*Hyalonema mirabilis*, Gray), taken 30 miles north of Yokohama, Japan: also a beautiful example of Venus' Flower-basket (*Euplectella*) from the Philippine Islands.

By Mr. John Harvie.—Under the microscope—the cell-circulation in *Vallisneria*, its peculiar phenomena being very clearly shown.

OFFICE-BEARERS, 1875-76.

President.

JAMES STIRTON, M.D.

Vice-Presidents.

RICHARD M'KAY AND JAMES ALLAN.

Secretaries.

JOHN HARVIE AND W. J. MILLIGAN.

Treasurer.

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ALEXANDER WATT.

Other Members of Council.

W. D. BENSON AND A. NOBLE.

TRANSACTIONS

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OF

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1876.

GLASGOW, ANDERSON'S UNIVERSITY,
28th Sept., 1875.

LICHENS, BRITISH AND FOREIGN.

BY DR. J. STIRTON.

PHYSCIA RETROGRESSA, *Sp. nov.*

Sat similis Ph. Stellari sed medulla (K—) et sporis nonnihil parvioribus, ·013 — ·018 × ·007 — ·009 mm.

Ad cortices prope Altnaharra, in Comitatu Sutherland.

PHYSCIA TENELLA, var. *fimbriatula.*

Similis Ph. tenellæ sed laciniis longioribus angustioribus (latit. ·2 — ·4 mm.) et plerumque extremitatibus albo-sorediatis, margine fibrilloso-ciliatis, ciliis longis et sæpissime extremitatibus digitato-divisis.

Ad saxa, Ben Lawers.

LECANORA ATRA.

* sub-byssoidea.

Thallus nigro-cinereus vel fere niger granulosus, effiguratus, hypothallo albo sub-byssoideo.

Ad saxa prope Blair-Athole.

LECANORA MAMMILLIFERA.

Thallus obscure cinereus vel fusco-cinereus, minute areolato-diffractus, areolis planis (K— C—); apothecia nigra vel fusco-nigra parva (latit. ·2 — ·3 mm.), prominula convexa, intus pallide cinerascentia, margine obtuso demum depresso cincta; sporæ 8næ incolores ellipsoideæ simplices, ·008 — ·01 × ·007 — ·0085 mm.; paraphyses parcæ distinctæ crassiusculæ (crass. circa ·0025 mm.), apicibus crasse clavatis conglutinatis fuscis, hypothecium incolor. Iodo gel. hym. cœrulescens dein fulvescens, præsertim ea thecarum.

Ad saxa, socia L. Kochianæ, apud Ben-y-gloe.

LECIDEA ANIPTIZA.

Thallus nigro-cinereus vel nigro-virescens granulosus tenuis; apothecia nigra parva prominula convexa immarginata, papillosa (quasi glomerata) intus tota cinerascentia; sporæ 8næ incolores

oblongæ vel oblongo-cylindraceæ simplices, ·0075 — 011 × ·0025 — ·003 mm., paraphyses irregulares non distinctæ. Iodo gel. hym. bene cœrulescens. Thalamium K, leviter sed distincte purpurascens.

Ad ligna decorticata prope Killiecrankie.

The paraphyses are rendered distinct by K. when they are seen, as slender, irregular, and occasionally branching filaments. Gonidia often conglomerate.

Lecidea confertula, *Sp. nov.*

Thallus pallide cinereus squamuloso-crustaceus, squamulis parvis contiguis vel dispersis (K— C—); apothecia fusca planiuscula minuta (latit ·2 — ·25 mm.) numerosissima, sæpe contigua, obtuse marginata, intus pallida; sporæ 8næ incolores ellipsoideæ simplices, ·01 — ·013 × ·0055 — ·007 mm., paraphyses non bene distinctæ fere conglutinatæ fusco-clavatæ; hypothecium incolor. Iodo gel. hym. cœrulescens dein mox vinose violacea, præsertim thecæ.

Ad saxa, prope Killiecrankie.

Lecidea phyllodisca.

Thallus niger mïnute granulosus vel furfurellus, tenuis sæpe vix ullus visibilis; apothecia nigra mediocria (latit. ·8 — 1·4 mm.) saepe 2 - 3-aggregata et tunc undulata, interdum conglomerata, margine nitido tenui fluxuoso vel sinuoso, intus pallide cinerascentia vel cœrulee cinerascentia [K. purpurascenti—(vel potius roseo—) dissoluta]; sporæ 8næ simplices ellipsoideæ incolores, ·007 — ·009 × ·0045 — ·0055 mm., paraphyses satis bene distinctæ nigro-clavatæ vel cœrulee nigro-clavatæ; hypothecium concolor vel interdum obscurius (1 — 4) - zonatum. Iodo gel. hym. cœrulescens (saltem leviter) dein mox vinose fulvescens vel interdum vinose violacea. Hymenium (cum hypothecio) acido nitrico purpurascens.

Ad saxa, prope Killiecrankie.

Affinis L. phylliscocarpæ (Nyl.)

Beneath the apothecia are often seen curious cushions composed of yellowish granular matter.

A description of this curious lichen is recorded here, rather for the purpose of directing attention to a peculiar group of the Lecideæ to which it belongs, than with any well-founded hope

that it will ultimately prove distinct from *L. Phylliscocarpa*, and one or two others. The study of lichenology is passing through a transitionary stage, but the field of observation is still so scattered, especially as regards the crustaceous lichens, that generalization is difficult and even impossible. A record meanwhile of the minuter differences will evidently tend towards the elucidation of general affinities, the study of which ought to be the main object of every botanist.

Lecidea asperella (*Sp. Nov.*)

Thallus crassiusculus niger granuloso-furfuraceus, diffracto-areolatus determinatus: apothecia parva (latit. ·2 – ·4 min.) adnata nigra nitida plana, margine tenui nitido, hymenium, lamina tenui visum, omnino cœruleo-virescens: sporæ 8næ incolores simplices ellipsoideæ vel oblongo-ellipsoideæ, ·0075 – ·01 × ·004 – ·005 mm., paraphyses non bene distinctae, apicibus clavatis cœrulescentibus (acido-nitrico violaceo-purpurascentibus); hypothecium incolor, receptaculo fusco-nigro subtensum. Iodo gel. hym. intense et persistenter cœrulescens.

Ad saxa, apud Ben-y-gloe.

Arete affinis (forte nimium) L. Furvellæ.

The stratum beneath the pale hypothecium is composed of large cells intermingled with branching fibres (which, however, prevail more in the lower portion), and is, accordingly, quite unlike the usual exciple.

Lecidea Braedalbanensis (*Sp. Nov.*)

Thallus niger vel fusco-niger tenuis nonnihil rugulosus; apothecia nigra vel fusco-nigra parva (latit. ·3 — ·4 mm.) convexa rugosa immarginata, sæpe conglomerata, intus pallida vel potius pallide rufescentia; sporæ (4 — 8)næ incolores ellipsoideæ simplices (episporio duplici), ·016 — ·022 (raro ·025) × ·011 — ·014 mm., paraphyses haud distinctæ conglutinatæ apicibus rufo-fuscescentibus: hypothecium pallidum vel lamina tenui, sub lente visum, rufum. Iodo gel. hym. intense cœrulescens.

Supra muscos et jungermannias, Ben Lawers.

Affinis L. Tornöensi (Nyl.)

K. reveals the paraphyses as slender, somewhat irregular, threads.

Lecidea corollidia.

Thallus pallidus vel pallide cinereus crassiusculus, diffracto-areolatus, areolis planiusculis (K e flavente rubens); apothecia nigra adnata majuscula (latit. 1 — 2 mm.) planiuscula rugosa, interdum cæsio-pruinosa, margine obtuso flexuoso vel sinuoso; sporæ 8næ incolores simplices ellipsoideæ, ·015 — ·02 × ·008 — ·011 mm., paraphyses pellucidæ non bene discretæ, apicibus fuscescentibus; hypothecium crassum fusco-nigrum. Iodo gel. hym. intense cœrulescens.

Ad saxa, Thurso.

Beautiful acicular crystals, ·018—·024 × ·002 mm., are formed by the action of K on thallus and subhymenial spaces. At first a clear solution of a yellow colour appears, and thereafter stellate groups of these reddish crystals.

Lecidea Calpodes, *Sp. nov.*

Thallus obscure cinereus areolato-diffractus, areolis convexiusculis contiguis vel dispersis; apothecia minuta (latit. ·15—25 mm.) numerosissima innato-sessilia nigra concava (suburceolata), acute marginata demum nonnihil explanata, intus pallida vel pallide fuscescentia; sporæ 8næ incolores simplices ellipsoideæ, fere sphæricæ, ·007—·0085 × ·006—·007 mm., paraphyses irregulares non bene distinctæ apicibus fuscescentibus; hypothecium fuscum vel pallide fuscescens tenue. Iodo gel. hym. leviter vel vix cœrulescens dein vinose rubens.

Ad saxa, Killicrankie. K renders the paraphyses as distinct, filiform, irregular branching fibres.

Lecidea Restricta, *Sp. nov.*

Thallus nigro-cinereus rugosus tenuis; apothecia adnata nigra parva (latit. ·3—·4 mm.) plana obtuse marginata; sporæ 8 næ simplices, in thecis saccatis, incolores ellipsoideæ (bi-nucleatæ), ·013—·017 × ·008—·01 mm.; paraphyses distinctæ filiformes crassæ (crass. ·0025—·003 mm.), epithecio fuscescente, acido nitrico roseo-purpurascente; hypothecium incolor. Iodo gel. hym. cœrulescens dein fulvescens præsertim thecarum.

Ad saxa, Blair Athole.

LECIDEA RELICTA, *Sp. nov.*

Thallus nigro-cinereus rugosus fere granulosus; apothecia adnata nigra parva plana, obtuse marginata, demum convexa immarginata et rugosa; sporæ 8næ incolores simplices oblongæ, ·009—·013 × ·005—·006 mm., paraphyses parcæ graciles satis bene discretæ pellucidæ, apicibus clavatis fuscis; hypothecium fusco-nigrum. Iodo gel. hym. leviter cœrulescens dein vinose rubens.

Ad saxa, Blair Athole.

LECIDEA HEMIPOLIELLA. (Nyl.)
* semialbula.

Thallo bene evoluto, albido vel lividescenti-albido tenui, leviter rimuloso-areolato.

Ad ligna decorticata prope Altnaharra.

The spores are very frequently (2—4) nucleated, and the septa are frequently indiscernible except under the action of K.

LECIDEA PLICATILIS (Leight).
Ben Lawers.

OPEGRAPHA ATRICOLOR, *Sp. nov.*

Thallus albidus tenuissimus, indeterminatus; apothecia nigra innato-sessilia angusta (latit. vix ·1 mm.) plerumque simplicia acutiuscula, intus cinerascentia vel pallide fuscescentia (K purpurascenti-dissoluta, præsertim stratum subhymeniale), epithecium primum rimiforme dein concaviusculum vel etiam explanatum, rugulosum; sporæ (4-8)næ oblongo-ovoideæ incolores 3-septatæ, ·015—·021 × ·004 — ·0055 mm., paraphyses indistinctæ irregulares, apicibus fuscis; hypothecium fusco-nigrum. Iodo pars supera hymenii persistenter cœrulescens, infera, e flavente vinose rubescens dein vinose rubens.

Ad ligna decorticata prope Altnaharra.

Affinis O. atræ.

ARTHONIA INSINUATA, *Sp. nov.*

Thallus albidus vel pallidus subsquamulosus tenuissimus; apothecia adnata fusca, vel fusco-nigra, rotunda vel oblonga vel nonnihil irregularia (primum velata) plerumque margine thallino squamulosulo cincta, intus pallida; sporæ (4-8)næ incolores inter-

dum leviter fuscescentes oblongæ, margine crenulatæ, 4-septatæ vel potius 5-loculares, loculis æqualibus, ·014 — ·021 × ·006 - ·008 mm. Iodo gel. hym. bene cœrulescens.

Ad cortices prope Killiecrankie.

I cannot reconcile myself to identifying this lichen with A. cinnabarina var: anerythrea. (Nyl.) The loculi of the spores are nearly of the same size, and certainly not larger at either extremity. No septa properly so called have been detected, although the loculi are at times in close apposition, &c.

The next two are descriptions of lichens picked out of a small parcel sent by Mr. D. A. P. Watt, who secured them in the neighbourhood of Montreal, Canada.

LECANORA PROTERVULA, *Sp. nov.*

Thallus pallidus vel pallide virescens subgranulosus, nonnihil rimuloso-areolatus (K e flavente rubens); apothecia adnata mediocria plana, pallide fuscescentia lævigata, margine albido integro nitido cincta; sporæ incolores simplices ellipsoideæ, ·01 — ·013 × ·006 — ·008 mm., paraphyses conglutinatæ pellucidæ, apicibus citrinis parce granuloso-inspersis. Iodo gel. hym. cœrulescens (saltem leviter) dein sordide flavescens, ea thecarum vinose violacea.

Ad cortices prope Montreal.

PERTUSARIA CANADENSIS, *Sp. nov.*

Thallus pallidus tenuis rimoso-areolatus passim ruguloso-inæqualis (K —, dein C addito, flavens, sed C separatim —); apothecia in verrucis convexiusculis vel convexis læviusculis inclusa, epitheciis fusco-nigris irregulariter lecanorinis (latit. ·2 — ·4 mm.) planiusculis; thecæ bisporæ interdum monosporæ, sporæ incolores simplices oblongæ, ·054 — ·077 × ·02 — ·03 mm., paraphyses parcæ. Iodo gel. hym. intense cœrulescens præsertim apices thecarum.

Ad cortices arborum prope Montreal.

GRAPHIS INUSTULA, *Sp. nov.*

Thallus albidus tenuis rimuloso-areolatus (K— C—); apothecia nigra innata rotundata oblonga vel irregularia, epithecio concaviusculo lato (latit. ·2 — ·3 mm.), perithecio laterali; sporæ (2-8)næ incolores demum fuscescentes, oblongæ vel fusformi-oblongæ

5 — 10-loculares, ·018 — ·045 × ·006 — ·008 mm.; paraphyses crassæ (crassit. ·0025 — ·0033 mm.), creberriter articulatæ, iodo flavescentes, apicibus fuscis clavatis; hypothecium incolor. Sporæ iodo violacee tinctæ.

Ad cortices prope Montreal (Dr. M. Black).

Forte nimium arcte affinis Gr. inustæ. (Ach.)

CALIDIA RHIZOPHORA, *gen. nov.*

Thallus pallide cinerascens tenuis farinaceus; apothecia adnata fusca parva (latit. ·2 — ·4 mm.) plana vel convexiuscula, intus obscura, albo-marginata, margine e fibrillis (latit. circiter ·0035 mm.) irregularibus ramosis non-septatis, omnino composito; sporæ 8næ incolores simplices vel 1—3-septatæ obovatæ, utrove apice attenuatæ, ·01 — ·014 × ·0035 — ·0045 mm.; paraphyses valde indistinctæ, apicibus incoloribus non-clavatis; hypothecium fuscum vel nigricanti-fuscum. Iodo gel. hym. cœrulescens præsertim thecarum, dein fulvescens.

Ad cortices prope Funchal in Madeira, lecta a Joseph Payne.

The thecæ are not arthonioid, but are (as well as the spores) obovate and sharp-pointed at the lower end. The paraphyses are rendered tolerably distinct by means of K.

This lichen holds a somewhat anomalous position. On the one hand it presents considerable affinity to a section of the Arthoniæ in which A. subvarians (Nyl.) may be taken as the type, and on the other, it plays between the Lecideæ and Lecanoræ, although more nearly allied to the former. The hymenium is that of an Arthonia (although firmer), but the thecæ which constitute the main element of distinction in this genus are not arthonioid; and, although the shape, &c., of the spores might lead us in the same direction, yet there are similar instances amongst the Lecideæ. The structure of the margine which is extended beneath the apothecia is, so far as my knowledge goes, unique, more especially as it presents the same characters in old and young apothecia and cannot, accordingly, be reckoned as a degeneration from a known type. The gonidia are of average size, and often irregular in outline.

The specimen is small, comprising only 6 Apothecia, and I dare not, meanwhile, make further investigations as to internal structure.

PERTUSARIA INTRANIDULANS.

Thallus albidus tenuis lævigatus (K— C—): apothecia in verrucis thallinis parvis inclusa, ostiolis nigrescentibus cæsio-pruinosis dein explanatis et lecanorinis farinosis: thecæ monosporæ, sporæ incolores simplices oblongæ, ·075 – ·09 × ·028 mm., paraphyses distinctæ irregulares ramosæ, thecas instar retis includentes, iodo flaventes. Iodo gelatina thecas ambiens cœrulescens (saltem leviter) dein intense fulvescens.

Ad cortices prope "Lake Superior" in Canada, lecta a Cel. J. Richardson.

Affinis, ut videtur, P. ophthalmizæ (Nyl.)

PYRENOPSIS AGNASCENS, *Sp. nov.*

Thallus tenuis fuscescens, vix ullus visibilis et tantum apotheciis vicinus: apothecia fusca parva (latit. ·1 – ·2 mm.) convexa; sporæ (4—8)næ incolores oblongæ vel fusiformi-oblongæ 3-septatæ vel 4-loculares, ·011 – ·015 × 0035 – ·0045 mm.; paraphyses graciles pellucidæ parcæ irregulares, apicibus incoloribus non-clavatis; hypothecium cœruleo-nigrum. Iodo gel. hym. cœrulescens dein sordida vel obscurata. Gonimia parva cœrulescentia vel rubescentia, in glomerulis majusculis contenta.

Ad culmum graminis cujusdam, verisimiliter in Africa occid. meridionali; ex hb. Cel. T. Chapman.

GRAPHIS IMPEXELLA.

Thallus pallide cervinus tenuis nonnihil pulverulentus (K— E— flavo rubens); apothecia nigra innata tortuosa et ramosa, conferta apice obtusa, margine thallino prominulo crassiusculo cincta, epithecio concaviusculo vel etiam planiusculo (latit. ·1 — ·3 mm.); sporæ plerumque 4næ interdum 8næ, fuscæ oblongæ vel ellipsoideæ, 4-loculares vel potius 3-septatæ, ·009 — ·014 × ·0035 — ·0045 mm.; paraphyses parcæ distinctæ filiformes non clavatæ; hypothecium pallidum. Iodo gel. hym. haud tincta.

Ad ramos arborum vetustos vel emortuos, prope Victoriam in Africa, lecta a Cel. G. Thomson.

The next nine form part of a collection by Mr. Hugh Paton of this city while on a tour through Australia.

PERTUSARIA PERTRACTATA (*Sp. nov.*)

Thallus albidus lævigatus nonnihil ruguloso-inæqualis (K— C—); apothecia in verrucis thallinis prominulis, supra planiusculis majusculis sparsis, plura sæpius in singulis inclusa, ostiolis sæpissime papillatis, pallidis vel pallide fuscescentibus; sporæ 8næ uniseriatæ parvæ, ·026 — ·038 × ·013 — ·018 mm., interdum haloniatæ; paraphyses parcæ. Iodo thecæ cœrulescentes, gel. hym. cæteroquin vix tincta.

Ad ligna decorticata in Tasmania, lecta a H. Paton.

This is closely alied to P. leioplaca var. minor, but the spores are much smaller, &c.

LECIDEA SUBTECTA, *Sp. nov.*

Thallus albidus vix ullus (C. aurantiacus?); apothecia fusca vel fuscescentia parva (latit. ·2 — ·4 mm.) plana vix marginata, in textura ligni insculpta (C. rubricosa); sporæ 8næ incolores ellipsoideæ simplices ·01 — ·014 × 006 — ·0075 mm., paraphyses mediocres distinctæ, apicibus fuscis magno-clavatis ramosis et interdum articulatis; hypothecium incolor. Iodo gel. hym. cœrulescens dein sordide violacea vel fulvescens.

Ad ligna decorticata in Tasmania.

LECIDEA LAMPRA, *Sp. nov.*

Thallus albidus tenuissimus; apothecia adnata nigra nitida mediocria (latit. circiter 1 mm.) plana vel convexiuscula, vix marginata, intus fuscescentia; sporæ 8næ incolores simplices oblongæ, ·008 — ·011 × ·0025 — ·003 mm., paraphyses non discretæ vel indistinctæ, apicibus fuscis; hypothecium incolor vel concolor. Iodo gel. hym. intense cœrulescens, ea strati subhymenialis violacea. Thalamium K haud tinctum vel absolete purpurascens (præsertim epithecium).

Ad ligna decorticata in Tasmania. Affinis L. euphoroidi (Nyl).

There is present a white stratum subjacent to the hypothecium.

This and the following are closely allied in several particulars, and grow associated. The thalamia are almost identical in anatomical characters, and present, especially under the action of K, abundance of large granular cells, in size ·003 — ·004 × ·002 — 0025 mm. The paraphyses are indistinct even under action of the same reagent, and merely show as vague, straight threads

somewhat interrupted and imbedded in a firm gelatine, while the thecæ are seen as having, at the apex, thickish, pellucid walls—*i.e.*, in a certain degree arthonioid.

I have meanwhile classified them with the Lecideæ.

Lecidea Subnexa, *Sp. nov.*

Thallus flavescens tenuis nonnihil rugulosus (K flav. C flav.); apothecia adnata nigra nitida plana majuscula (latit. ·6—1·5 mm.), margine pallidiore vel pallido undulato tenui cincta; thalamium ut in priori, sed K flavo-dissolutum (præsertim ejus pars supera). Iodo gel. hym. bene cœrulescens.

The paraphyses are rendered tolerably distinct by K, and are seen as irregular, somewhat branching threads.

Ad ligna decorticata.

Lecidea Aniptiza.

* intersociella, *Sp. nov.*

thallo albido et apotheciis nitidis.

Ad ligna decorticata, socia L. lampræ.

Lecidea Hypersporella, *Sp. nov.*

Thallus albidus, vix ullus visibilis; apothecia fusca vel fusco-nigra mediocria (latit. circiter 1 mm.) convexa et immarginata; sporæ (12—24) næ incolores simplices ellipsoideæ, ·006 — ·008 × ·004—·005 mm., paraphyses incolores parcæ indistinctæ (fere diffluentes) molliusculæ, apicibus incoloribus non clavatis; hypothecium crassum fusco-nigrum. Iodo gel. hym. cœrulescens dein obscurata.

Ad ligna decorticata in Tasmania.

Lecidea dissa, *Sp. nov.*

Thallus albus vel albidus tenuis (K pallide flavescens vel —, C—); apothecia nigra mediocria plana obtuse marginata dein convexa et immarginata, intus pallide cinerascentia. Sporæ 2 næ fuscæ ellipsoideæ 1-septatæ, ·022 — ·034 × ·011 — ·014 mm.; paraphyses graciles distinctæ filiformes, apicibus ramosis fusco-clavatis et interdum articulatis granuloso-inspersis: hypothecium fuscescens vel obscuratum. Iodo gel. hym. intense cœrulescens.

Ad ligna decorticata in Tasmaia.

GRAPHIS MUCRONATA, *Sp. nov.*

Thallus albus tenuissimus nonnihil farinosus (K—): apothecia nigra sub-sessilia hemisphærica (in sectione transversa) elongata flexuosa et interdum ramulos emittentia, epithecio rimiformi, perithecio laterali; sporæ (4—8) næ incolores demum fuscescentes fusiformi-oblongæ utroque apice mucronatæ vel apiculatæ (sicut in Phlyctide agelæa), 7 — 10-loculares, ·03 — ·045 × ·007 — ·009 mm. (iodo cœruleo-infuscatæ præsertim juniores); paraphyses destinctæ crassiusculæ apicibus fuscis: hypothecium incolor.

Iodo gel. hym. haud tincta nisi flavescens.

Ad cortices arborum, prope Riverinam in Australia.

VERRUCARIA ANALTIZA, *Sp. nov.*

Thallus albus vix ullus: apothecia nigra prominula fere hemisphærica majuscula (latit. ·5 — ·9 mm.), perithecio dimidiato, epithecio poriformi; sporæ 8næ in thecis cylindricis, uniseriatæ ellipsoideæ fuscæ 1—septatæ, ·008 — ·011 × ·004 — 005 mm.; paraphyses gracillimæ (latit. vix ·001 mm.) irregulares nonnihil ramosæ. Iodo gel. hym. haud tincta nisi flavescens.

Ad cortices prope Riverinam in Australia.

TRANSACTIONS

OF THE

GLASGOW SOCIETY OF FIELD NATURALISTS.

FOURTH ANNUAL MEETING.

ATHENÆUM, INGRAM STREET,
16*th March*, 1875.

THE Annual Business Meeting of the Society was held here this evening—Mr. James Allan, Vice-President, in the chair.

The Secretary read a summary of the work done by the Society during the past year, from which it was evident that a considerable amount of work had been done, and that the number of members had largely increased. The following gentlemen were then elected to office:—JAMES STIRTON, M.D., *President;* RICHARD M'KAY and JAMES ALLAN, *Vice-Presidents;* JOHN HARVIE and WILLIAM J. MILLIGAN, *Secretaries;* GEORGE BARLAS, *Treasurer;* ALEX. WATT, *Curator;* W. D. BENSON and ALEX. NOBLE, *Members of Council.*

30TH MARCH, 1875.

The first meeting of the summer session was held this evening—Mr. Richard M'Kay, Vice-President, in the chair.

The members were recommended to give as much attention as they could to the time of re-appearance of well-known migratory birds, and to the apparent influence of the weather in retarding or hastening their visits, and it was urged that all well authenticated instances of unusually early or late arrivals should be recorded for future reference.

SPECIMENS EXHIBITED.

By Mr. James Allan.—Two mosses from Possil Marsh, *Climacium dendroides* and *Hypnum giganteum.*

PAPER READ.

By Mr. James Allan, on "The Tendencies of Science." He glanced at the growth of the Natural History Sciences particularly, and traced their development from the simple observation of the habits of animals and plants to the elaborate classification and closer investigation of their reproduction and life history prevalent in modern times. He advocated the desirability of carrying on direct experiments such as those made by Mr. Darwin and Sir John Lubbock, side by side with attentive observation of the usual habits of animals and plants.

13th April, 1875.

Mr. Richard M'Kay, Vice-President, in the chair.

Mr. John Armstrong, 14 Kinning Street, was elected a resident member.

EXCURSION.

Craigen Glen.—Mr. W. J. Milligan reported that at this excursion many common fossils and several of those peculiar to this locality had been found. They had yet to be arranged, and would be exhibited at a future meeting. It was remarked that neither in this district nor at the Loup of Fintry, which had been recently visited by several members of the Society, had any primroses been found bitten through in the manner described by Mr. Darwin in a recent number of *Nature*, and which he supposed had been done by birds for the sake of the nectar of the flowers. It was remarked in connection with the eagerness of some insects and birds for nectar, that in some cases it has inebriating properties. Moths get intoxicated by sipping it from the Sallow-blossoms, a fact well-known to Lepidopterists.

Some discussion followed the reading of an extract from the *Herald*, in which it was asserted that the cuckoo was never heard or seen in Scotland after the 25th of June at the latest. One member said that in the previous year he had both seen and heard this bird near Garelochhead early in July.

PAPERS READ.

By Mr. James Allan, "Some Notes on the Arrival of Migratory

Birds," which tended to show that they all arrive first in the south of England and go north gradually.

By Mr. S. Macdonald, on "Antennæ." He referred to the wonderful variety in the shape of these organs, and to the doubts which still existed as to their use. The question whether they were organs of feeling, tasting, smelling, or hearing, was carefully discussed. The latest suggestion, he said, was that they were the organs of an unknown sense, but there did not seem to be sufficient evidence to prove this. In some species of insects the antennæ are more highly developed in the males than in the females, and it has been observed that those males are able from a great distance to discover the presence of the females.

27th April, 1875.

Mr. James Allan, Vice-President, in the chair.

Mr. M'Ewan, 18 Edmond St., was elected a resident member.

SPECIMENS EXHIBITED.

By Mr. Thomas King.—A collection of plants from Southern Patagonia.

EXCURSION.

Finn Glen.—Mr. Allan said that at this excursion the usual spring flowers had been found, but none of them were rare enough to be worth recording. The cuckoo was heard near Strathblane. Another member reported that he had heard it near Kirn on April 11.

PAPER READ.

Mr. John M. Campbell then read a paper entitled "Notes on Patagonia," being extracts from a journal he had kept during a visit to that country. He described the physical features of the country, and gave details of the habits of the more common animals. The natives, he said, were above the average European height, but not so tall as some travellers have stated they are. He gave some account of their habits, their mode of hunting, and their religion.

11th May, 1875.

Mr. Richard M'Kay, Vice-President, in the chair.

Mr. Thomas Shand, 132 Renfrew Street, was elected a resident member.

EXCURSION.

Possil Marsh.—Mr. W. D. Benson said that nothing worth reporting had been found at this excursion.

PAPER READ.

Mr. James Allan read some notes regarding the arrival of migratory birds. He said he had noted the dates of the arrival of most of them for ten years. He found that over the whole country the cuckoo had appeared about seven days earlier than its usual this year, while the swallow was on an average three or four days later.

25th May, 1875.

Mr. James Allan, Vice-President, in the chair.

Mr. F. G. Binnie, on behalf of Mr. Alex. Watt, reported that the rare grass *Melica nutans*, L., had been found in a new locality, viz., the Kilpatrick Hills.

EXCURSION.

Bowling.—Mr. Alex. Noble related the chief incidents of this excursion. Nothing worth reporting had been found till they came to Dumbarton Castle, where several interesting plants had been found—among them the wild wall-flower (*Cheiranthus Cheiri*).

PAPER READ.

Mr. James Allan then read a paper entitled "Strictures on some Geological Theories," in which he chiefly dealt with the theory of the uniformity of action of geological agents, and contended that sufficient prominence was not usually given to the action of catastrophes. Mr. Allan's paper gave rise to a lengthened discussion.

8th June, 1875.

Mr. James Allan, Vice-President, in the chair.

Mr. David Gregorson reported that he had found the somewhat rare *Valeriana Pyrenaica* at Kilsyth.

EXCURSION.

Blairmore.—Mr. J. C. Hutcheson reported that owing to the stormy nature of the day this dredging excursion had not been a great success.

PAPER READ.

Mr. David Gregorson then read a paper which he had called in the syllabus "Plant Life," but which he said should rather have been called "Notes of some Analogies between Plants and Animals, made for the purpose of determining more exactly the Position of the various Classes of the Vegetable Kingdom as to the order of their development."

Andersonian University, 22nd June, 1875.

Mr. James Allan, Vice-President, in the chair.

Mr. W. D. Benson described and showed a sketch of an Angel Fish which had been caught in a fisherman's net off the Ayrshire coast and which he had secured. The fish is preserved in the Kelvingrove Museum.

Mr. George Horn exhibited a common primrose with both stalked and sessile umbels on the same plant gathered in Bothwell Woods.

PAPER READ.

Mr. Thomas King read a paper called "Remarks on the Natural History of Chili." He first gave an account of the principal writers on the Natural History of the country, including Molina, Darwin, Gay, the U. S. Expedition of 1849, Phillipi, Reid, and Cunningham, and the results of their work. From this he passed on to a description of the various animals, the vampire, chinchilla, puma, *Canis Magellanicus*, guanaco, and huemal. He also described many of the birds, and exhibited preserved specimens of them.

6th July, 1875.

Mr. James Allan, Vice-President, in the chair.

The Chairman remarked that the lapwing was a migratory bird in the north of Scotland, but that he had observed it on Mugdock Moor in mid-winter. Some of these birds remain the whole year in districts in the south of Scotland, and they are not migratory in England. A member stated that in Sutherlandshire they are absent about three months in mid-winter.

SPECIMENS EXHIBITED.

By Mr. George Horn.—*Carex ornithopoda*, Wills, from Miller's Dale, Derbyshire, a plant recently discovered in Britain.

By Mr. Malcolm Black.—A collection of lichens which he had brought from Canada.

PAPER READ.

Dr. Stirton, the President of the Society, then read a paper on "Cosmopolitan Lichens." He said that lichens depended for their support on the atmosphere and the moisture contained in it. They will not flourish in an atmosphere in any degree vitiated, and so they are a good test of the purity of the atmosphere of any district. They are not to be found in fruit within a radius of six miles from the centre of Glasgow. On the other hand, there is no place in Scotland where they are found in greater abundance than on Loch Tay side, and other facts tend to show that this district is blessed with a pure and healthful atmosphere. But there are some lichens which seem to flourish in a greater variety of conditions than others, and these he called Cosmopolitan. He selected as examples of these *Urceolaria scruposa*, *Lecanora subfusca*, *L. atra*, and *Leptogium tremelloides*, which are found in nearly every climate, in a strange variety of positions, and at almost every altitude. He also exhibited the Reindeer Moss, which is of universal distribution. Lichens being so easily affected by any change in the atmosphere, it follows that during the long period in which they have flourished on the earth the atmosphere must have remained practically unchanged in its constitution. He also adverted to the genera *Graphis* and *Arthonia*, and described the curious phenomena of their fructification.

20TH JULY, 1875.

Mr. James Allan, Vice-President, in the chair.

Messrs. James Galbraith, M.A., LL.B., Bath Street; A. F. Woodbridge, 18 Albert Drive, Crosshill; and R. H. Paterson, 6 Windsor Place, Sauchiehall Street, were elected resident members.

SPECIMENS EXHIBITED.

By Mr. John Renwick.—*Lepidium Smithii* from the neighbourhood of Milngavie; *Centaurea cyanus* from Maryhill; and *Senecio saracenicus* from near Kilwinning.

By Mr. R. H. Paterson.—*Epilobium alpinum, Sibbaldia procumbens, Cerastium alpinum, C. latifolium*, and *Arenaria verna* from Ben Lomond. This was the first time that this last-named plant had been found in the West of Scotland. He also said that he had found the Holly Fern (*Aspidium lonchitis*) in great abundance on a part of the same hill. He also exhibited the rare fungi *Phallus impudicus* and *Agaricus squamosus* from Cadder Wilderness.

By Mr. W. D. Benson.—A large collection of zoophytes mounted for the microscope.

Mr. W. D. Benson stated that a few days ago he had observed diatoms in great abundance in the river Girvan. The day after he had observed them there were heavy rains, and when on the day following he had tried to collect some more he could not find one. They had evidently been carried into the sea by the floods. This would seem to show that many of the diatoms which are found in strata of undoubted marine origin may themselves not have lived in the sea, but may have been carried into it in the same manner as sand or other inorganic matter.

3RD AUGUST, 1875.

Mr. James Allan, Vice-President, in the chair.

SPECIMEN EXHIBITED.

By Mr. Richard M'Kay.—*Avena flavescens* from Johnstone.

EXCURSION.

Lochwinnoch.—Mr. Thomas King gave an account of this excursion, which had been a very enjoyable one although nothing worth

recording was discovered with the exception of *Meum athamanticum*, which was found in considerable abundance.

PAPER READ.

Mr. Richard M'Kay then gave a *résumé* of Mr. Darwin's new work on "Insectivorous Plants," confining himself chiefly to that part of the book which treats of *Drosera rotundifolia*. He described the various experiments which Mr. Darwin had made for the purpose of determining whether the insects which are found adhering to the leaves of this plant are really digested by it, and also the numerous bodies which he had placed on the leaves and had found were digested in the same manner as the insects.

17TH AUGUST, 1875.

Mr. James Allan, Vice-President, in the chair.

SPECIMENS EXHIBITED.

By Mr. Alex. Noble.—A collection of shells from Moreton Bay, Queensland.

By Mr. Thomas King.—A collection of marine shells from Rio de Janeiro; also a collection of butterflies and beetles from Chili.

By Mr. R. H. Paterson.—The rare Bird's-nest Fungus (*Clathrus cancellatus*) from the south of Ireland; also some rare plants from the Gareloch, among which may be named *Lathræa squamaria*.

By Mr. John Renwick.—*Malaxis paludosa*, from Lochwinnoch. It has not previously been reported from this district.

By Mr. Richard M'Kay.—A series of rare British plants.

EXCURSION.

Ben Voirlich.—Dr. Stirton gave an account of this excursion, which had been tolerably successful. He had found a lichen apparently new to science which he had not yet named. The following plants had been found:—*Sibbaldia procumbens, Luzula spicata, Cerastium alpinum, Lycopodium annotinum*, the Holly Fern (*Aspidium lonchitis*), previously recorded but very rare, the moss *Campylopus Schwarzii*, first found here, and *Didymodon daldeanea*. Glacial markings were very plainly seen on the sides of the hill, especially on the side next Loch Sloy.

31st August, 1875.

Mr. James Allan, Vice-President, in the chair.

SPECIMENS EXHIBITED.

By Mr. R. H. Paterson.—The rare fungus *Coprinus Hendersonii*, and a collection of fac-similes of ferns and club-mosses printed from the plants themselves. He also mentioned that he had found the fungus *Saprolequia ferax* growing on a fresh-water snail, *Limnea peregra*. This is a curious example of what may be called an amphibious fungus, as it is quite indistinguishable from *Sporendonema muscæ*, the fungus which grows on and is supposed to cause the death of the common house-fly.

By Mr. Alex. Macindoe.—The following plants from the neighbourhood of Maryhill:—*Lychnis githago*, *Linum usitatissimum*, *Cichorium intybus*, and *Sisymbrium sophia*.

EXCURSION.

Kilsyth Glen.—In the absence of Mr. D. Gregorson, the chairman gave an account of this excursion. The Green Spleenwort (*Asplenium viride*), had been found in considerable abundance; also all the plants peculiar to the district.

PAPER READ.

By Mr. W. J. Milligan on "The theory of Spontaneous Generation." After reviewing various analogies which might lead us to look favourably on the theory, he went on to look at the subject in its chemical aspect, and to point out that many organic substances had been formed synthetically from the simple elements, and that thus there could be no break between organic and inorganic chemistry. He then gave an account of the latest experiments of Bastian and others, and said that it had been undeniably proved that organisms had appeared in sealed flasks which had been exposed to a temperature of 230 deg. Fahrenheit. Those who deny that life can originate *de novo*, at one time asserted that a temperature of about 140 deg. Fahrenheit was sufficient to destroy all animal or vegetable life; but they now content themselves with affirming that the germs must be able to resist a temperature of 230 deg., whereas all the experiments of Dr. Child

seemed to prove that 140 deg. was the greatest heat which any germs could withstand. Pasteur's infusions had been examined with too low microscopic power, and other observers had, with higher magnifying powers, found life in infusions in which Pasteur had failed to detect any.

Considerable discussion followed the reading of this paper, and one member said that a new observer, Dr. Drysdale, stated that germs were not all killed by a temperature of 250 deg. Fahr.

14th September, 1875.

Mr. James Allan, Vice-President, in the chair.

SPECIMENS EXHIBITED.

By Mr. R. H. Paterson.—An erratic form of *Chrysanthemum leucanthemum*, having the outer florets tubular and barren instead of being ligulate and female; also two specimens of *Scabiosa succisa* having two of the florets enlarged into secondary heads like the Hen-and-chicken Daisy. This might be accounted for either by supposing that the central footstalk had become contracted or that two florets had become enlarged. This interesting subject deserves attention. Mr. Paterson also exhibited a specimen of the fungus *Hypochinus plumosa* from Victoria, presented by Mr. George Thompson.

By Mr. George Horn.—A specimen of the hop in flower got near Uddingston; also some rare plants from Sutherland and Caithness. Among these were *Primula Scotica* (both forms), *Saussurea alpina* Decandolle, *Hippophaë rhamnoides*, *Carex aquatilis*, var. *watsoni*, *Elymus arenareus*, *Menziesia cerulea*, *Lycopodium annotinum*, the last two from the Sow of Athol.

EXCURSION.

Mr. M'Kay gave an account of the excursion to Stevenston on the 11th. Nothing of interest was got, and the district seemed to be barren in all branches.

PAPER READ.

Mr. George Horn read an interesting account of the Society's excursion to Sutherland. They had gone over a large tract of

country and were delighted with the scenery and the beauty of the country, more especially during the long drives they had taken at night when it was scarcely ever dark. Ben Hope had been visited but not thoroughly examined, but would well repay minute examination.

Dr. Stirton made some remarks on the character of the vegetation observed during the excursion.

Mr. Harvie placed on the table the very handsome "Guide to Belfast," published by the Belfast Naturalists' Field Club for the British Association meeting, and which had been presented by them. The thanks of the Society were accorded to the Belfast Club, and a hope was expressed that something of the same kind would be got up before the British Association came here.

28TH SEPTEMBER, 1875.

Mr. James Allan, Vice-President, in the chair.

SPECIMENS EXHIBITED.

By Mr. W. R. M'Lean.—Some interesting birds' nests and stuffed birds, and a specimen of the edible bird's nest from India.

By Mr. Allan.—Five species of lady-birds.

By Mr. R. H. Paterson.—A fine collection of fungi from Cadder Wilderness.

EXCURSION.

Campsie Glen.—Mr. Taylor reported that the final excursion of the summer session took place on Saturday, 25th instant, when the members went to Campsie Glen. All the plants common to the district were found, but nothing was observed worthy of record. The members took tea together in the Clachan Inn, and spent an agreeable afternoon.

PAPER READ.

By Mr. Noble.—On the "Butterflies of Arran." He said that of the sixty-five species common to Britain twenty were found in Arran. He had captured the Red Admiral (*Vanessa Atalanta*) there, which had not been previously reported. He illustrated his observations by a classified collection in which all the Arran species were represented, some of them being beautifully coloured. Among them was *Colias edusa*, rare in Scotland.

12th October, 1875.

Mr. James Allan, Vice-President, in the chair.

Mr. Alex. Watt and Mr. James R. Watson, both of whom were about to leave for India, were elected corresponding members.

SPECIMENS EXHIBITED.

By Mr. W. R. M'Lean.—Mounted specimens of the Common Heron and Red-throated Diver, with their eggs.

By Mr. R. H. Paterson.—*Splachnum rubrum* and *S. luteum* from Sweden; and *Tayloria serrata* and *Buxbaumia aphylla* from Campsie Glen; also, *Telephora versicolor* from Bowling. This fungus is rather rare.

By Mr. M'Indoe.—A collection of shells from New Zealand.

PAPER READ.

Dr. Stirton announced three lichens new to science collected by a member of the Society, Dr. Malcolm Black, near Montreal. They have been named, *Lecanora protervula*, *Pertusaria canadensis*, and *Graphis inustula*.

26th October, 1875.

Mr. James Allan, Vice-President, in the chair.

Messrs. Adolf Schulze, George Street, and J. S. Nairne, Winton Terrace, were elected members of the Society.

SPECIMENS EXHIBITED.

By Mr. R. H. Paterson.—Specimens of *Dionœa muscipula*, one of the insectivorous plants, sent by an American botanist. One of the specimens had a fly inclosed in the shut leaf.

PAPER READ.

Dr. Stirton gave the introductory address of the winter session. He congratulated the Society on its continued progress and increasing influence, and dwelt on the pleasure to be derived from an intimate knowledge of nature. He urged students not to flag in their endeavours, not to rest satisfied with mere surface knowledge, but to advance steadily to a minute acquaintance with that

branch of natural history which they may have chosen for their study. Such a careful investigating of nature will infallibly bring a rich reward. He paid a warm tribute to the memory of the late Mr. M'Kinlay, whose studies and investigations in Botany had made the West of Scotland famous, and had attracted the most learned botanists of the Continent. He then, for the purpose of attracting members to the study of mosses, gave a clear account of their growth and mode of development.

9TH NOVEMBER, 1875.

Mr. James Allan, Vice-President, in the chair.

Mr. George Russell, Auchentiber, Neilston, and Mr. James Thomson, Crossford Mills, Paisley, were elected members of the Society.

SPECIMENS EXHIBITED.

By Mr. Alex. M'Indoe.—The fungus *Torrubia militaris*, a parasite on the pupa of a moth, collected at Dalsholm, Maryhill.

PAPER READ.

On the Prevention of Self-fertilisation in Plants. By Mr. R. H. PATERSON.

In a typical flower there are two sets of floral envelopes—the outer one, usually of a green colour, is called the calyx; the inner one, usually highly coloured, is called the corolla. The male and female organs are termed respectively stamens and pistils. The stamen or male organ consists of two parts—an elongated portion termed the filament, and a terminal expanded portion called the anther. The female organ or pistil consists of three parts—a large hollow chamber called the ovary, from which there springs a more or less slender portion called the style, and this again is terminated by a more or less viscid knob called the stigma. In the interior of the anther of the stamen there are developed little cells, to which the name of pollen granules has been applied; and it is these pollen granules that, when applied to the surface of the viscid stigma, fertilise the plant. If then it is necessary that the pollen be applied to the surface of the stigma in order to fertilise the plant, how is the pollen conveyed to the stigma? Before

answering this question, I may state my firm belief that all organic beings, whether belonging to the animal or vegetable kingdom, require an occasional cross with another individual; or, what is the same thing, no hermaphrodite can fertilise itself for a perpetuity of generations. It is well known to most people that flowers are of the greatest necessity for the existence of insects; but it is little known, on the other hand, how necessary insects are for the existence of flowers. Many flowers in fact are entirely dependent on insects for the safe carriage of the pollen of one flower to the pistil of another, while in others which could fertilise themselves it is of the greatest importance that we occasionally get a crossing from one individual to another. Every person who has paid the least attention to the breeding of animals knows the importance of this fact. Well, it is of no less advantage to plants that the pistil of one flower be fertilised by the pollen of another than it is to animals that one animal should be fertilised by another animal not closely related to it.

If then it is advantageous to flowers that they should be visited by insects, it will be evident to every one that those flowers which, either by larger size, brighter colour, sweeter scent, or greater richness of honey, were most attractive to insects, would, *cæteris paribus*, have the best chance of living in the struggle for existence that is going on among all members of the vegetable world. Suppose a flower were to fertilise itself for any length of time, it would become so weak that it would not be able to survive owing to this continual war. It is a well-known fact that stock deteriorates where the young are produced from parents of near kinship. Similarly in the human family, intermarriage of near relationship, *i.e.*, when the degree of consanguinity is close, appears to exaggerate in their offspring any diseases, whether nervous or otherwise, under which their parents may have been labouring.

Let it then be assumed that cross-fertilisation is advantageous, and that "in and in" breeding does the greatest harm; and of this I think there is very little doubt. How then is the propagation of plants insured?

For this, nature employs various means.

First, she may develope the male and female organs on entirely different flowers of the same plant, and to this the term monœcious is applied. Again, she may develope the male organs on the flowers of one plant and the female organs on the flowers of another plant,

Plate. I.

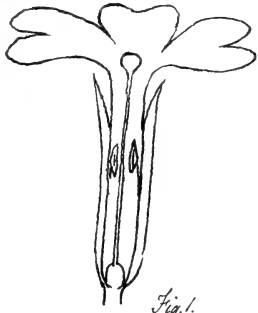


Fig. 1.

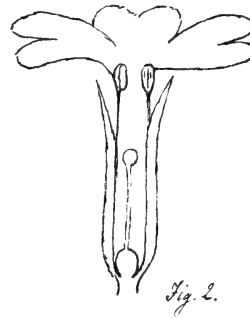


Fig. 2.

Fig. 4.

Fig. 5.

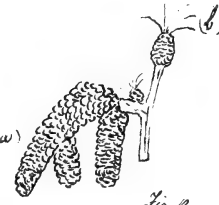


Fig. 6.

Fig. 7.

Fig. 11.

Fig. 8.

Fig. 9.

Fig. 10.

and to this the term dicœcious is applied. She may cause the organs of reproduction to reach their maturity at different times, and to this the term dichogamy is applied. The term protandrous dichogamy is applied to those cases in which the stamen is the first to mature, and the term protogynous dichogamy to those cases in which the female is the first to reach maturity.

Again, we may have the male and female organs of different lengths. The term dimorphous is applied to those cases where we have two different lengths, as in the primrose. In the one form of the primrose (Fig. 2) the pistil is short and situated about the middle of the corolla tube, while the stamens are long and lie in the throat of the corolla. In the other form (Fig. 1) the positions are reversed, the stamens are short and situated in the middle of the corolla tube, while the pistil is long and occupies the throat of the corolla. The term trimorphous is applied to those cases where we have three different lengths, as in Lythrum and Oxalis.

Again, we may have the stamens developed in such a manner that it is quite impossible that they can fertilise the plant unless removed by insects. We have good examples of this in the various species of Orchidaceous plants.

Or lastly, nature may develope pollen that has no effect on the pistil of the same plant, or even on the flowers of the same plant on which it is situated.

Until very lately it was supposed that male and female organs were developed on the same plant in order that the plant might the more easily be fertilised; but I am sure that if the fertilisation of the various flowers be carefully examined, it will be found that self-fertilisation is the exception, and not the rule as was formerly supposed.

Among the various flowers we will find contrivances for the fertilisation of one flower by the pollen of another as perfect and varied as the most beautiful adaptation found in the animal kingdom.

For the sake of convenience, I have divided flowers into two great classes, according as they are fertilised by the wind, or by means of insects.

Plants that are fertilised by the wind have, as a rule, no proper floral envelopes, no development of nectar, and very loose pollen granules. Plants fertilised by means of insects have conspicuous floral envelopes, a development of nectar, and more or less coherent pollen.

Of those plants that are fertilised by the wind, the best example I can give is what is found in the various grasses (Fig. 4). The pollen in them is very loose and easily wafted about by the wind, so that when they grow together, as in a field of corn, there is every chance of the plant being fertilised. The pistils are more or less feathery (Fig. 5), and present a very large surface, so that they will be sure to catch some of the pollen as it flies about. In the alder, hazel, and willows we have very good examples of wind-fertilised plants. In these the stamens are in one set of flowers and the pistils are in another, either on the same plant, as in the alder and hazel, or on different plants, as in some willows. Now, in these plants, as the leaves might interfere with the application of pollen to the stigma, it is found that they are not developed till after the plant has been fertilised.

Let us take the case of the hazel, in which the stamens are matured first.

Here, as in grasses, we have loose pollen, easily carried about by the wind, and if the trees are in close proximity, there is every reason to believe that pollen will be blown from one plant to another. Whether or not, shortly after the stamens (*a*) are matured, the female flowers (*b*) begin to send out their pistils, and the slightest breath of wind is sufficient to send a shower of pollen about the female flower.

Again, to take the case of the willows. Most of them are fertilised in the same manner as the hazel; but there are some willows, *e.g.*, *Salix pentandra*, which cannot be fertilised in this way. Curiously enough, here we have the leaves developed before either the male or female flowers; and as the pollen is not loose, as in other willows, and besides, the male and female flowers are on different plants, fertilisation would be absolutely impossible without the agency of insects. Consequently we have the development of a kind of nectar. The whole plant has a sweet smell; hence the name of Sweet-bay Willow. And in spring, when standing under one of these trees, we can hear the perpetual hum of the bees as they fly from flower to flower. In another group of plants, fertilised by the agency of the wind, viz., the great group of cone-bearing plants, *Coniferæ*, we have the evergreen leaves very narrow, and besides, we have a peculiar structure developed in connection with the pollen grain, which serves in a great measure to enable the pollen to reach the female flower.

The outer coat of the pollen granule is dilated into two large hollow chambers, which are filled with air. This serves to render the pollen easily carried about by the wind from one plant to another. In the pines there is a very large quantity of pollen developed, and it has been stated that, in America, the pollen from the pine forests is sometimes carried to a great distance by the wind and falls like showers of sulphur.

So much for the first group which shows no special adaptation for the prevention of self-fertilisation. Let us now pass on to the second, and by far the most interesting group, which shows such varied and beautiful adaptation for the prevention of self-fertilisation.

Let us first take some simple case of protandrous dichogamy as illustrated by the order *Malvaceæ*. In this order the stamens are united so as to form a tube, in the interior of which the pistils are situated. In the male stage the stamens shed their pollen while the pistils are in the centre; in the female stage the anthers drop off and the pistils appear, and the stigmas separating from each other, curve around till they occupy the same position as the stamens formerly did, so that an insect visiting the flower in the first stage would get dusted over with pollen, and then, on visiting a flower in the second stage, would touch the stigmas with the same part of its body as had formerly touched the stamens, and so pollen would be deposited on the stigma and the plant fertilised.

In *Lamium album* (White Dead Nettle) we have a bilabiate corolla (Fig. 11).

The honey is at the bottom of the tube, and is protected from rain by the arched upper lip and by hairs. The lower lip projects considerably, and forms an admirable landing place for insects. The length of the corolla tube and certain hairs in the throat of the corolla prevent the access of small insects, which would remove the source of attraction for bees without effecting the grand object for which it was designed. The arched upper lip, in its form, size, and position is admirably adapted as a protection against rain, as well as to prevent the anthers and pistil from yielding too easily to the pressure of the insect, and thus to ensure that it should press the pollen which it has brought from other flowers against the pistil. The stamens do not form a ring round the pistil as in the last case. On the contrary, one stamen is absent, while the other four lie along the outer arch of the corolla on either side of the

pistil. These four stamens are not of equal length, two being shorter than the other two. The reason of this is because, if the stamens had lain side by side, the pollen would have adhered to parts of the insect's head which do not come in contact with the pistil, and would therefore have been wasted. Besides, it might have been deposited on the eyes of the insect so as to blind it, and consequently would have deterred the bee from ever visiting the flower again. This idea is strengthened by the fact that in some flowers, *e. g.* Foxglove (*Digitalis purpurea*), the anthers are transverse when immature, but become longitudinal as they ripen. From the position of the stigma which hangs down below the anthers the bee comes in contact with the former before it touches the latter, and consequently fertilises the stigma with pollen from another flower.

In *Salvia officinalis*, Figs. 7 to 10 (from Lubbock), the anthers, as they shed their pollen, shrivel up, and on the other hand, the pistil increases in length, and curves downwards till it comes into the position shown in the diagram (Fig. 9). The stamens here are reduced to two, and of these two only one half developes pollen. The barren half is widely separated from the fertile one by what is termed a distractile connective (Fig. 8). This connective rotates upon its axis upon the filament of the stamen, as shown at Fig 10. The lower lip forms a good landing place for insects and the barren parts of the anthers block up the entrance to the corolla tube. Now, to explain the manner of fertilisation here, let us suppose that an insect visits the flower in the male stage, it will in pushing its head down the corolla tube, as at Fig. 7, come in contact with the barren anther lobe, which, revolving on its axis, will get pushed back into the back part of the corolla (marked *x*), and the fertile anther will be at the same time brought down upon the back of the insect, and brush its pollen on to the back of the insect. Now, suppose that the insect were now to visit a flower in the female stage where the pistil had elongated and curved round so as to block up the entrance to the corolla tube, the first thing that it would come in contact with would be the elongated pistil, and as its back and sides were dusted over with pollen, some of that pollen would be sure to be dusted into the stigma and so the plant would be fertilised. The foregoing is certainly the most wonderful arrangement for the prevention of self-fertilisation that is to be found in the vegetable kingdom.


BRITISH
NATURAL

Plate II.

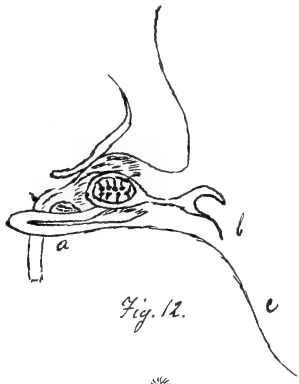


Fig. 12.

Fig. 13.

Fig. 14.

Fig. 15.

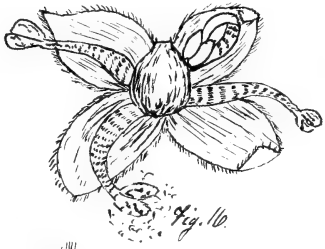


Fig. 16.

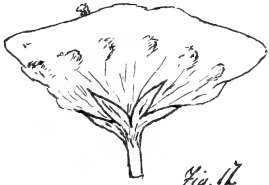


Fig. 17.

Fig. 18.

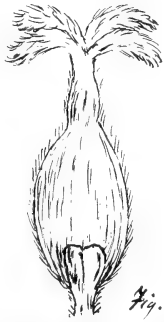


Fig. 19.

In *Viola tricolor* (Fig. 12, 13), or Common Violet, the corolla is irregular and composed of five petals. Upon each petal we see certain lines directed to the more or less conspicuous centre of the flower which contains the organs of reproduction. The anthers of the stamens are all united together, but if separated or disturbed immediately discharge a shower of pollen. The lower petal is spurred, and contains two tail-like processes (*a*). These processes are the prolonged connectives of the two lower stamens, which secrete nectar for the purpose of attracting insects. The pistil has a two-lipped hooded stigma (*b*), the upper surface of which is viscid for the application of pollen. By referring to Fig. 12 the mechanism will be better understood. Suppose an insect were to alight upon the lower petal (*c*) it would be guided to the entrance to the reproductive organs by the streaks upon the corolla. Inserting its proboscis down the spur upon the lower petal in search of honey, it would disturb the anthers, upon sucking the nectar from the connectives a shower of pollen would then fall upon the proboscis of the insect. The insect, on withdrawing its proboscis, will come in contact with the stigma, but as the viscid surface is uppermost, and as there is a protecting lip, the pollen will not be deposited upon the stigma of that flower. Suppose it were now to visit another flower, guided as before to the centre, it would leave some of the pollen upon the viscid stigma, because, in inserting its proboscis into the spur of the corolla it would brush the proper viscid surface of the stigma, there being no valve to hinder it in its entrance, as there is upon its exit from the flower.

In *Kalmia*, sp. (Fig. 15 and 17), the corolla is large, and has a number of pouches, into which the stamens are inserted by their anthers. As the flower opens, the filaments of the stamens are put in great tension, and whenever an insect lands upon the flower, the corolla is violently depressed. The stamens are at the same time dislodged from their pouches, springing forward with great force, scattering their pollen upon the insect as well as on the neighbouring flowers.

In *Parietaria officinalis*, or Wall Pellitory (Fig. 14), we have protogynous dichogamy. Before the flower opens, the little red stigmas appear at the mouth of the flower (Fig. 14), and are ready to receive any pollen that may be brought into contact with them. In the male stage the stigmas drop off. The anthers are lodged in little pouches at the base of the ovary, and the filaments are very

elastic. As the flower opens these filaments are put into the utmost tension, and are gradually dislodged from the pouches in the ovary, when they spring back with great force, bursting their anthers, and scattering their pollen all over the neighbouring plants (Fig. 16). Here, although we have not an insect-fertilised plant, it is wholly impossible that self-fertilisation can take place owing to the stigmas falling off before the flower opens.

In *Streptocarpus* sp. the filaments of the stamens are so situated that when any object enters the tube of the corolla it is sure to separate them. The pollen is contained in little boxes, and when the filaments are separated this box is sure to be opened, and a shower of pollen falls out. In the male stage the pistil is very short, but after the maturity of the stamens is over it elongates, and comes to occupy the same position as was formerly held by the stamens. To explain the manner of fertilisation here let us suppose that an insect in search of honey visits this flower: on inserting its head down the tube of the corolla it will come in contact with the filaments of the stamen. On doing this the pollen box is opened, a shower of pollen is let fall upon the head and back of the insect. The insect then flies away to a flower in the female stage, and on inserting its head down the corolla tube as before the first object that it comes in contact with is the elongated pistil. Then as its head was dusted over with pollen gathered from another flower, some of the pollen will be sure to be left on the pistil, and so the plant will be fertilised.

23rd November, 1875.

Mr. James Allan, Vice-President, in the chair.

Mr. Andrew A. Hogarth, 465 St. Vincent Street, and Mr. J. Haddow, 292 St. George's Road, were elected members of the Society.

SPECIMENS EXHIBITED.

By Mr. Schulze.—Two beautiful microscopes, and a large collection of microscopic apparatus and slides. His instruments were by Ross, of London, and Whyte, Glasgow, and he had also microscopes on the table by Smith and Beck, Hartnack, &c. He exhibited several objects under 1-50th object-glass of Powell and Lealand.

PAPER READ.

On the Microscope and Microscopic Illumination. By Mr. Adolf Schulze.

I purpose speaking this evening on the Microscope, making special reference to the most recent improvements on it, and to the best modes of microscopic illumination. My remarks will be principally addressed to those gentlemen among you who are not or only little acquainted with the microscope, in the hope that they may incite them to engage in one of the most fascinating and useful of studies, and that they may assist them in the selection and proper use of a microscope.

Of all the instruments with which the scientific observer of nature can arm himself, there is none which holds a higher place, with regard to general utility, than the microscope, which is now produced in such a state of perfection, yielding so excellent results, that it seems almost impossible to improve on it. I need hardly remind you of what the microscope has done for Science—the Botanist, the Chemist, the Geologist, the Physiologist, the Pathologist, and all those engaged in the examination of minute objects and structures, can no longer be without it. It has even created a new Science, I refer to Histology, or the science of the animal and vegetable tissues, and it has become an inexhaustible source of the purest intellectual enjoyment and of interesting information, even to the non-scientific enquirer. The extremes of minuteness are as wonderful as the extremes of vastness, although the tendency is generally to estimate things by their material grandeur alone. It would be impossible to enumerate all the advantages derived by microscopic observations, and any microscopist, with even less eloquence than I am possessed of, might spend a great deal of time to vent his enthusiasm on this subject. Those persons who pass their lives content with seeing only what they can see with their unarmed eyes, deserve really our sympathy, for to them half of the beauties and wonders of nature remain ever a book with seven seals, which they might easily break open, to feast their eyes and their minds by the perusal of this instructive and edifying volume.

Gentlemen, the Microscope, as you are aware, is an optical contrivance which enables the observer to see minute objects, or their details of form and structure, magnified, if brought within its reach

or focus, which in most cases would not be visible to the unarmed eye. Magnifying power has to do with size only, and refers to the angle subtended by the enlarged image at the eye, as compared with the angle subtended by the object itself under the circumstances of ordinary vision, which is about 10 inches from the eye. The nearer an object is approached to our eyes, the larger it appears; and if our eyes could accommodate themselves to the shortest distances, we would have no necessity for microscopes or magnifying glasses.

There are microscopes and microscopes, an infinite variety of models, many of them constructed for special purposes. They are all divided into two classes, namely, *simple* and *compound microscopes*. The simple microscope may consist of one, two, or three lenses, but these latter are so arranged as to have only the effect of a single lens, *i.e.*, they show the object itself magnified. In the compound microscope not less than two lenses must be employed, one to form an inverted image of the object, which being nearest to it is called the object-glass, and the other to magnify this image, and which is called the eye-glass, because it is nearest to the eye of the observer. Both object-glass and eye-glass, eye-piece or ocular, as it is commonly called, may be, and in good microscopes always are, composed of a number of lenses.

Like most other inventions, the microscope has its history, but time will only allow me to glance briefly over it. Simple microscopes seem to have been in use thousands of years ago, as we have not only ancient records of microscopic work having been done, such as minute engravings, minute writings, and minute mechanical contrivances, many of them contained in a nutshell—hence the common expression, "in a nutshell,"—which could not have been made with the unassisted eyes, unless the visual powers of former generations had been immensely superior to our own, which was not the case; but lenses of rock crystal, many of them of short focus, have also been found, which were clearly intended for optical purposes, and not as ornaments, as some have sought to maintain.

Zacharias Jansens and his son are said to have made microscopes before the year 1590, one of which was at that time brought to England. *Fontana*, in a work published in 1646, maintains having made microscopes as early as 1618. It was with such

imperfect instruments that *Leuwenhoek, Swammerdam,* and others, examined the minute forms of nature, and afterwards described them so correctly that we cannot help wondering how it was possible for them to do so. *Robert Hooke* published in 1667 his Micrographia, a wonderful production for those times, which was, however, soon eclipsed by the researches of Leuwenhoek, which were first published in the transactions of the Philosophical Society in 1673, as well as by those of *Grew* and *Malpighi,* the former of whom laid the foundation for our knowledge of the vegetable tissues, and the latter of the tissues of the animal body. Small glass globules, by the application of which to the simple microscope, instead of convex lenses, an enormous magnification was obtained, were first used by Dr. Hooke and Hartsoeker. Stephen Gray discovered in 1696 that drops of water, containing animalcules, if hung to the end of a wire and held close to the eye, showed these animalcules enormously magnified. Whilst many observers of those times added discovery to discovery, little improvement was effected in the simple microscope until the celebrated *Dr. Nathaniel Lieberkuhn of Berlin,* about the year 1740, brought out his improved instrument, which consists of a short tube of about 1 inch diameter, in one end of which is a bi-convex lens for collecting the rays and throwing them on a concave silver speculum near to the other end, the latter having a round aperture in the centre. The rays are reflected by this speculum to its focus, about one-half inch distance, in which is placed the opaque object glued to a little disc adjustable by a wire in the side of the instrument. The object brilliantly lit up is viewed by a small lens of half-inch focus through the circular opening of the speculum. This instrument, which was only adapted for viewing opaque objects, was held by a handle. Leuwenhoek's microscopes were nearly all single lenses fitted in a tube having a slide holder. He had hundreds of such microscopes, one each for one or two objects.

The first three compound microscopes worthy of notice are those of *Dr. Hooke, Eustachio Divini,* and *Philip Bonnani.* Dr. Hooke describes his instrument in the Micrographia, in 1667, as being 3 inches diameter, 7 inches long, and having four draws. It had three glasses, a small object-glass, a middle glass, and a deep eye-piece. Divini's microscope was described, in 1668, as having an object-glass, a middle glass, and two eye-glasses, which were plano-convex, touching each other in the centre of their

convex surfaces. The tube in which the lenses were inclosed was as large as a man's leg, and the eye-glass as broad as the palm of the hand. It had four draws magnifying from 41 to 143 diameters, and must have been an instrument looking more like a cannon than one of our present microscopes. Philip Bonnani's was similar, but was placed horizontally and had beneath its stage a convex lens which condensed the light on the object. This was the first microscope with a condenser, and the account of it was published in 1698.

In 1738 Lieberkuhn gave his *solar microscope* to the world, which, owing to its enormous magnifying power and to the ease with which it exhibited the minute wonders of nature to a large audience, drew universal attention to the microscope. In 1742 Henry Baker, F.R.S., published an admirable treatise on the microscope, which was soon followed by others. In 1811 *Frauenhofer*, a celebrated optician of Munich, constructed *the first achromatic object-glasses for the microscope*, in which the two glasses, although in juxtaposition, were not cemented together. Although considerable improvements in the making of achromatic object-glasses had taken place since their first discovery by *Euler* a German mathematician, in 1776, opticians at that time entertained the opinion that it would be impossible to make a good achromatic microscope. *Dr. Wollaston*, the inventor of the celebrated doublet named after him, also thought that the compound microscope would never rival the single. Further experiments conducted by Selligues, Frauenhofer, Professor Amici of Modena, Chevalier in Paris, and Dr. Goring in London, resulted in Selligues making the first compound object-glass composed of four achromatic compound lenses each consisting of two lenses which could be used combinedly or separately. In 1824 Mr. *Tulley*, at the suggestion of Dr. Goring, constructed an achromatic object-glass for a compound microscope of 9-10ths of an inch focal length, composed of three lenses transmitting a pencil of 18 degrees, the first achromatic object-glass ever made in England. In 1825 Chevalier made an achromatic objective of four lines focus, and in 1827 Amici brought to England a horizontal microscope the object-glass of which consisted of three superposed achromatic lenses of large aperture. In 1829 Mr. *Jackson Lister* proposed a combination of lenses upon the theories of achromatism propounded by Sir John Herschel, Professors Sir George Airy,

Barlow, and Mr. Coddington; he joined a plano-concave flint lens and a convex crown glass lens together by means of the transparent medium *Canada balsam*, which may be taken as the basis of our present excellent object-glasses, as by the cementing of the lenses together nearly half of the loss of light from reflection is prevented, which is very considerable in consequence of the numerous surfaces in a compound achromatic object-glass. Since that time the late Mr. A. Ross, in London, was constantly employed in bringing object-glasses to greater perfection by applying Mr. Lister's principle of cementing the lenses together with Canada balsam, and he succeeded in balancing the errors of chromatic and spheric aberration so well that the circumstance of covering the object with the thinnest glass disturbed its correction. This unsuspected difficulty was finally overcome in 1837, when Mr. Ross was able to announce to the Society of Arts that he had succeeded in doing so by making the distance of the anterior lenses of the object-glass to the middle combination adjustable by means of a screw-collar. Other makers followed soon, among whom notably Smith and Beck, Powell and Lealand in London; Hartnack, the successor of Oberhauser, and Nachet in Paris; Gundlach in Berlin; Zeiss in Jena; Schiek, Merz; and in America R. Tolles and Zentmayer. The latest and greatest improvements in object-glasses have been effected by Mr. F. H. Wenham, in 1873, who reduced the number of surfaces by six, thus securing a great increase of brilliancy and definition.

At the beginning of the present century the microscope had fallen rather into discredit, and began to be neglected, but since the introduction of achromatic object-glasses it has been improved, not by steps, but by leaps and bounds. I must not forget to mention that prince of microscopists, the great *Professor Ehrenberg*, of Berlin, who astonished the world by his wonderful researches and discoveries, and who was principally instrumental in restoring the credit to the microscope, which it seemed to have lost for a while. In 1846, Mohl, an eminent German savant and microscopist, stated that the limit of the best microscope at that time was a magnification of 300 to 400 diameters, or 90,000 to 160,000 times, superficially, and that any further magnification would only result in loss of light and definition. In 1840, however, Powell and Lealand made their first celebrated object-glass of one-sixteenth of an inch focus, magnifying nearly 1000 diameters, and in 1860 they

made a twenty-sixth, magnifying nearly 1800 diameters, and this was generally considered, for some time, the utmost magnification attainable. Not satisfied, Powell and Lealand have made since then several object-glasses of only 1-50th inch nominal focus, magnifying with the lowest eye-piece 2500 diameters, and with the highest eye-piece 20,000 diameters, or from $6\frac{1}{4}$ to 400,000 million times, superficially. These glasses are indeed optical marvels; they are excellent, but their use is limited to the smallest transparent objects, as their actual working distance is only 0·003 of an inch. Powell and Lealand have even made a 1-80th inch object-glass, but I am not able to speak of its optical performance. I presume, however, that it is inferior to their celebrated 1-50th, or we would have heard more of it.

It appears just now that the utmost, as regards both magnification and definition, has been reached for the present, and until the chemist will have supplied the optician with a denser transparent medium of higher refractive power than any we can use just now. Certain it is that microscopists and opticians will not rest satisfied with the wonderful progress made lately, and that the powers of microscopic definition and magnification will advance more and more. The *ne plus ultra* of a microscope would be an instrument with which we could see the ultimate particles of matter, enabling us to verify, by ocular demonstration, our already sufficiently proven theories of the co-relation of the great forces of nature—heat, magnetism, electricity, and chemical affinity—and how they affect the molecules, whose shape would no longer remain a hypothesis; but so powerful a microscope will never be constructed by human hands.

I will now proceed to explain *the construction of the compound microscope*, and of the various pieces of apparatus pertaining to it.

The principal parts of a compound microscope are the object-glass and the eye-piece, which are placed at the extreme ends of a tube called the "body."

In order to explain the principle upon which the performance of object-glass and eye-piece is based, I must interpolate in this place a few remarks about *light*, which is not matter, but motion, and consists of the undulations of a highly elastic fluid called the luminiferous ether, which fills all space and matter in the universe. These undulations are extremely small, measuring from the 1-30,000th to the 1-60,000th of an inch, according to the

colour and composition of the light. The undulations of the rays of light exciting vision vary between 1-481st and 1-764th of a billionth of a second of time, and they take place in two planes perpendicular to the direction of the ray. The light, or the undulations of the luminiferous ether, emitted from a luminous body, travel in straight lines, but when they pass through a medium falling upon its surface not perpendicularly they are deviated from their course or refracted. They are always refracted when passing, at an angle of less than 90 deg., from one medium into another of more or less density. The amount of refraction is dependent upon the relative densities of the media, and is further conditioned by their form, in a microscope by the shape and the material of the various lenses. In optical instruments the curvature of the lenses is spherical, being the only form that can be given by grinding with the requisite amount of truth. Unfortunately, spherical convergent lenses do not bring all the rays of light which pass through them to one and the same focus. The peripheral rays have a shorter focus than the central rays, and the extreme distance between the various foci of a lens is called *spherical aberration.* The consequence is, that an object-glass whose spherical aberration is not corrected will not show the various portions of the surface of a plane object to be in focus at the same time; it will either only show the central portion defined or the peripheral portion alone, and this fault in an object-glass is called *want of flatness of field.*

In the best objectives of $\frac{1}{8}$-inch focus the spherical aberration is computed to be still the 1-50,000th of an inch, a small fault, it is true, but sufficient to prevent the resolution of markings several times closer than 1-50,000th inch.

The second difficulty is the *chromatic aberration*, which results from the unequal refrangibility of the different colours of which the white light is composed, so that they are not all brought to the same focus, even by a lens free from spherical aberration. If you look through a microscope in which the chromatic aberration of the lenses is not corrected, you will find that the image has an iridescent border of red, yellow, and blue. In fact, you see one image for each of the colours of the spectrum, but as all these images overlap in the centre, they produce white light. Not so at the outlines. The correction of this chromatic aberration is effected by combining in the construction of lenses two media of

opposite form and different material, and differing from each other in the proportion in which they respectively refract and disperse the light so that the one medium may by equal and contrary dispersion counteract the dispersion caused by the other, without, at the same time, wholly neutralising its refractions. The media most suitable for this purpose are the crown glass and the denser flint glass. As previously stated, Frauenhofer made, in 1811, the first achromatic object-glasses for the microscope, by combining lenses of crown and flint glass, and Mr. Jackson Lister was the first to cement concave and convex lenses of crown and flint glass together by means of Canada balsam. A lens so achromatized looks as if made of one piece. Sometimes the balsam becomes cloudy between the surfaces, which destroys the optical properties of the lens.

I will now explain *the construction of the object-glasses*, the number and quality of which constitute the true value of a microscope. Object-glasses in England are designated by their focal lengths, thus we have a 3-in., 2-in., 1-in., $\frac{2}{3}$-in., $\frac{1}{2}$-in., $\frac{1}{4}$-in., $\frac{1}{5}$-in., $\frac{1}{8}$-in., $\frac{1}{10}$-in., $\frac{1}{12}$-in., $\frac{1}{16}$-in., $\frac{1}{25}$-in., $\frac{1}{40}$-in., $\frac{1}{50}$-in., but these designations do not represent the actual focal lengths of compound objectives, which are far shorter, but they represent the focal lengths of single lenses of equivalent magnifying power. *The angular aperture* of an object-glass is that angle formed by the extreme rays of light entering the glass from the focus. Large angled object-glasses are dearer than low angled ones. The former show surface markings best, owing to the greater number of oblique rays which pass through them, whilst glasses with smaller angular aperture show various planes of the object to be at the same time in focus. Object-glasses of moderate angular aperture are preferable, unless the microscopist be engaged in special studies requiring a large angled glass, but such may be provided with stops to reduce the angle in order to increase the penetration. Wide angled glasses give more light than narrow angled ones, but the latter have a greater working distance.

Low powers are all glasses from the 5-in to the $\frac{2}{3}$-in.; medium powers from the $\frac{1}{2}$-in., to the $\frac{1}{5}$-in.; and all object-glasses of shorter focus are called *high powers.*

The simplest object-glasses are single bi-convex (Pl. III. fig. 1) or plano-convex lenses; if achromatic, they consist of a bi-convex and a plano-concave lens (fig. 3). In low compound objectives there are

Fig. 1.

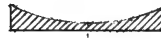


Fig. 2.

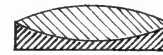
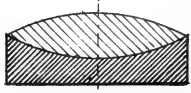


Fig. 3.



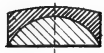


Fig. 4.

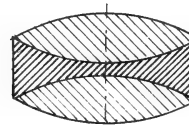
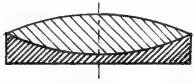
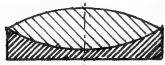


Fig. 5





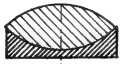
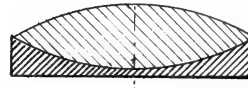
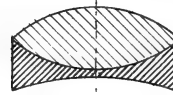


Fig. 6.





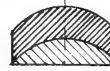
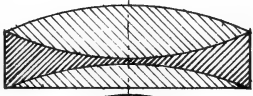


Fig. 7.



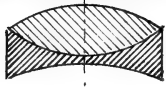
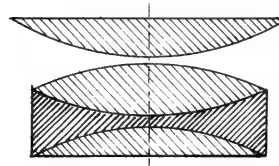


Fig. 8.



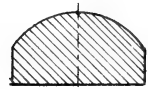


Fig. 9.

two systems of lenses, the anterior, consisting of a plano-convex front lens and a concavo-convex lens cemented together; the posterior combination consists of a plano-concave and bi-convex, (fig. 4) or of a bi-concave lens with a bi-convex lens above and below (fig. 5). In higher powers these lenses become more numerous, consisting of a triple anterior and posterior and a double middle combination as shown in diagram No. 8. Mr. F. H. Wenham has proved that a pencil of rays exceeding an angle of 40° from a luminous point, cannot be secured with less than three superposed lenses of increasing focus and diameter, but by the use of such a triple combination rays beyond this angle can be transmitted with successive reflections in their course towards the posterior conjugate focus. The first object-glass made by Mr. Ross in 1831, consisted of three bi-convex lenses of crown glass, each of which was achromatized by its own plano-concave lens of flint glass (fig. 6). It was in one of these glasses that Mr. Ross made the anterior combination adjustable in order to correct the errors of spherical aberration consequent upon using covered or uncovered objects. In 1837, Mr. Lister gave Mr. Ross a diagram for a $\frac{1}{8}$-in., having a triple front lens to facilitate the passages of the extreme rays. In 1850, the same gentleman communicated to Mr. Wenham his invention of the triple back combination (fig. 8), which was a considerable improvement on the double one. Mr. Wenham, in the course of his trials, invented the single front of crown glass, the front part being cylindrical and the back convex. The height of the cylindrical part is one of the most essential parts of corrections, as for instance, in a $\frac{1}{15}$ a difference of thickness of only ·002 inch determines the quality between a good and an indifferent glass. This single front devised by Mr. Wenham has, after much hesitation on the part of other makers, been adopted by them all. Mr. Wenham constructed an excellent object-glass of five lenses only, and since then he has devised object-glasses of only four lenses as shown in the diagram, fig. 9, thus dispensing with six surfaces as formerly used. It is obvious that these objectives, if properly corrected, must give an increase of brilliancy and definition. Another advantage is, that high powers constructed on this plan can be used both as dry and as wet or immersion lenses, by simply adjusting the screw collar. The system of *immersion lenses* is due to Professor Amici, who discovered that by placing a small drop of water on the front lens

which will unite with the covering glass, an increase of light and definition is obtained, as the most divergent rays are by their passage through water, instead of through air, so refracted that they enter the object-glass.

The object-glasses last described have been patented by Mr. Wenham, and they are made by the celebrated firm of Ross & Co. in London, at prices considerably below those of their great rival object-glassmakers, Powell & Lealand, whose $\frac{1}{8}$ and $\frac{1}{16}$-in. immersion lenses have for a considerable time been regarded as the most perfect glasses made. The latter firm has just brought out a $\frac{1}{4}$ and a $\frac{1}{8}$ constructed on a new formula, which they say are superior to their former glasses of the same focal length. These new glasses cost, with immersion arrangements, eleven guineas a-piece.

The qualities a first-rate object-glass should possess are,

1. *Defining power*, which depends upon the completeness of its corrections.

2. *Penetrating power*, or focal depth, which depends upon the degree of distinctness with which part of the objects that are a little out of focus may be seen.

3. *Resolving power*, by which minute surface markings are seen and clearly separated from each other.

4. *Flatness of field*, which depends on the distinctness with which both the central and peripheral portions of an object are seen.

An object-glass combining all the preceding attributes in the highest degree in which they are compatible with each other may be pronounced perfect.

The optical qualities of an object-glass are examined by means of tests or test-objects, such as sections of spines of echinus, of deal, proboscis of fly, pygideum of flea, muscular fibres, finely marked valves of diatoms, scales of insects, especially the Podura scales, and Nobert's test-plate having as many as 200,000 parallel lines to the inch ruled on a piece of glass with a diamond. I cannot refrain from mentioning here the marvellous Micro-engravings of Mr. W. Webb, whose finest engraving of the Lord's Prayer is on a scale equal to that of writing the whole Bible *fifty* times in the space of only one square inch.*

* These engravings, Nobert's test-lines, Möller's typenplatten and test-objects, are supplied by Mr. Edmund Wheeler, 48 Tollington Road, Holloway, London, N.

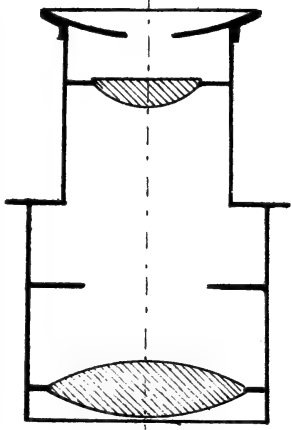


Fig. 10.

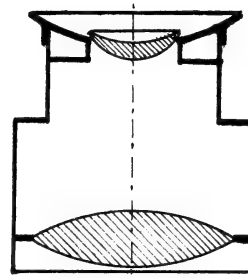


Fig. 11.

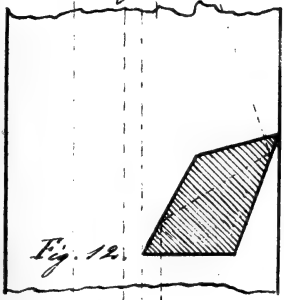
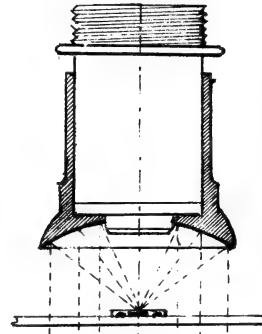


Fig. 12.



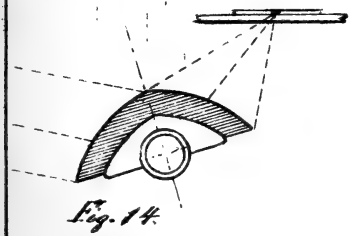


Fig. 14.

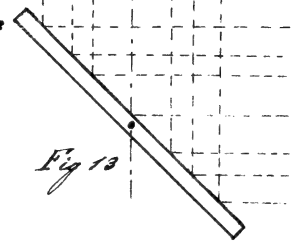


Fig 13


NATURAL HISTORY

The magnified image produced by the rays of light after having passed the object-glass and crossed in the focus of the back combination, are viewed by a simple microscope at the upper end of the body called the *Eye-piece.*

The *Huyghenian eye-piece* (fig. 10), commonly used, consists of two plano-convex lenses with their convex sides directed towards the object-glass. The lower larger one is called the field-glass, the upper one the eye-glass. These eye-pieces give a field of from 4 to 6 inches diameter. The Huyghenian eye-piece is not achromatic, being under corrected for colour, and to secure achromatism of the microscope all good object-glasses are so constructed that they are over corrected for colour.

The *Kellner or orthoscopic eye-piece* (fig. 11) has a double convex lens placed in the focus of the achromatic eye-glass without the interposition of a diaphragm. It does not give quite as good definition as the ordinary eye-piece, but it yields a large, flat, well-lit-up field of from 12 to 14 inches diameter. I can confidently recommend the Kellner eye-piece No. C, as made by Ross, but these Kellner eye-pieces should not be bought in pairs.

To every first-class microscope there belong a number of eye-pieces of various powers, which English makers commonly designate by A, B, C, D, E, and F; A being the shallowest and least powerful, F the deepest and most powerful, magnifying diametrically about eight times as much as A. Although a great increase of magnification is obtained by the use of high eye-pieces, these magnifications are not of great value, as the brilliancy with which an object appears illuminated is reduced in inverse ratio to the superficial magnifying power; thus by the use of eye-piece F, the object appears only 1-64th as brightly lit up as under A. In addition to the loss of light, the errors of the object-glass are magnified without gaining any compensation in focal depth. Moreover, high eye-pieces, owing to their short foci, are very trying to the eyes. In fact the use of high eye-pieces recommends itself, only when without the trouble of changing the object-glass a large magnification has to be obtained, good definition being only a matter of secondary importance. The magnification of a microscope may also be increased without impairing the definition perceptibly, especially when shallow eye-pieces are used, by increasing the distance between the object-glass and the eye-piece by means of a *draw-tube,* which is generally graduated.

A microscope having only one body, and which can only be used with one eye at a time, is called *monocular;* a microscope having two tubes and eye-pieces, allowing an object to be viewed simultaneously with both eyes, is called *binocular*. The advantages of a binocular microscope over a monocular one are the following :—

1. It is pleasanter and less trying to the eyes, permitting consequently a far more prolonged use.
2. Much greater focal depth is gained.
3. A stereoscopic effect is obtained, giving the observer a more correct idea of the shape of the object under observation; and
4. By its use the mind is relieved of the constructive effort which it has to make in order to realize the shape of the object or its details, when viewed only with one eye.

Altogether, I cannot sufficiently advocate the use of the binocular microscope; every one who values his eyesight, and has to make prolonged microscopical observations, should use a binocular. An observer using a monocular microscope can form no better idea of the object he views than a man using one eye alone can judge of distance and form in a strange place. I am aware that many scientific men, especially some old microscopists, still deprecate the use of the binocular, but this arises either simply from prejudice, or because they have only seen instruments with faulty binocular arrangements, or because their eyes have different foci.

The best binocular arrangement is undoubtedly that invented by *Mr. F. H. Wenham* in 1860, and consists of a very small prism of peculiar form (Fig. 12), which is placed in a small frame in the nose-piece or the lower end of the body of the microscope. The lower surface of this prism intercepts exactly half of the cone of light coming from the object-glass, and reflects them up the slanting tube, whilst the other half of the rays passes through the reflected bundle of rays straight in the eye-piece above the object-glass. By the withdrawal of the prism the binocular microscope is instantly converted into a monocular one. The effect of this splendid arrangement is truly stereoscopic; unfortunately it can only be used with low powers, namely, up to the one half-inch object-glass inclusive, and only then when the latter has not more than 40° aperture.

For high powers one of these small Wenham prisms would require to be fitted immediately behind the posterior combination of lenses of

each object-glass, which is both expensive and not very practicable. Various methods for obtaining stereoscopic binocular vision under high and the highest powers have been devised, and the best and the one most in use seems to be the one invented by Mr. Stephenson. In his apparatus the rays on emerging from the object-glass pass through two small prisms, but owing to their considerable length a great deal of light is abstracted. These binocular arrangements for bringing into each eye only one-half of the bundle or cone of rays which have passed through the objective, act stereoscopically. Other methods of enabling the observer to use both eyes have been devised, as for instance Powell and Lealand's patent, but as they reflect identical *images* into the two eye-pieces their effect is non- or pseudo-stereoscopic.

The *stand* of the compound microscope consists of the support for the body, the focal adjustment, the stage to carry the object, a mirror for illuminating the latter, and which is attached to the so-called tail-piece, and a diaphragm beneath the stage to regulate the quantity of light reflected from the mirror. The most complete microscope stands have an additional sub-stage for holding the various pieces of illumination apparatus, which in second or third-class instruments have to be placed into a short tube-fitting attached to the stage. The stand must be heavy, in order to be quite steady and free from tremor. There is a great variety of models of stands, but I shall only mention a few of the principal ones. There is first a draw-tube stand, which we find in all old microscopes, and which is still retained by most German and French makers, notably in the excellent microscopes of Hartnacks and Nachet, which I cannot sufficiently recommend on account of their portability, cheapness, excellence of workmanship, and high quality of object-glasses. Then there is the so-called Ross model, in which the body is supported by a rectangular arm; and there is the Jackson model, the steadiest of all, in which the body is supported along the greatest part of its length. Even the great house of Ross & Co. has, at the suggestion of Mr. Wenham, adopted the Jackson model in 1874, and their new stand I consider to be the handsomest and best of all.

The coarse adjustment consists in simple microscopes of a draw-tube, and in the better English models of a rack and pinion movement by means of large milled heads. The fine adjustment which in Ross' new model is placed behind the body to protect it from

injury, consists of a fine micrometer screw, having in good microscopes from 100 to 200 turns to the inch. This screw acts by means of a lever upon the so-called nose-piece in the lower end of the body into which the object-glass screws, and which is pressed downwards by means of a spring. I must not forget to state that the Royal Microscopical Society in London has introduced a standard gauge of screw, with which the nose-pieces of all good English microscopes and all good English object-glasses are now-a-days provided. By means of one of the best fine adjustments we can easily focus through a distance of only the one five-thousandth part of an inch, and it serves at the same time to measure roughly the height or depth of small objects.

The *stage* may either be plain or mechanical, and a good plain stage is infinitely preferable to a bad mechanical one. The stage should be large, have a large opening in the centre, and ought to be as thin as possible, to allow of the most oblique illumination. There are various contrivances in use to assist in moving the slide, but the ordinary mechanical stage consists of rectangular rack and pinion and screw movements. In addition to these rectangular movements there is a circular movement which is seldom mechanical. The latest perfection of the stage is the concentric rotating movement, which allows of an object being kept in the field of view when the stage is rotated. In order to obtain this concentric rotating movement, the rectangular movements are placed on the rotating movement, and not the rotating stage on the rectangular movement, as in the ordinary mechanical stage. To some simple instrument without rectangular movements a concentric stage is sometimes added, which is generally made of glass. In the larger instruments the concentric rotating stage is graduated into 360°.

The *diaphragm* is placed under the stage or in the sub-stage. It consists in its simplest form of a disc of metal having various sized apertures for admitting more or less light on the object. The graduating diaphragm is a superior contrivance for gradually reducing or increasing the aperture of the diaphragm, which is of great importance for obtaining the best effects.

The *sub-stage* is only added to first-class and to some of the second-class microscopes. It has generally a rotating movement by means of a wheel and pinion and two centring screws. A rack and pinion raises or lowers the sub-stage, which is also generally graduated into 360°. Ordinary microscopes have, as mentioned

already, a tube-fitting attached to the stage into which the sub-stage illumination apparatus is fixed by means of a bayonet catch, but the length of this tube prevents oblique illumination by means of the mirror or prisms. On the tail-piece of the microscope a large *mirror* held by a jointed, often doubly jointed, arm can be made to slide up and down. One side of the mirror is generally plane and the other concave.

Having described the essential parts of the microscope itself, I will now enumerate and explain those accessories which the microscopist will find useful and often indispensable.

1. The *stage or mineral forceps* for holding unmounted objects, such as insects, parts of plants, minerals, &c.

2. The *stage plate,* which is made of glass and has a glass ledge, serves for unmounted objects, especially fluids, which might injure the stage if they came in contact with it.

3. The *Polyp or Zoophyte trough* of ground glass, for viewing Polyps, &c., in water.

4. The *live-box,* of which it is well to have various sizes. It consists of a circular box fixed on a plate all of brass and having a glass bottom and a thin glass cap to slide over it. A convenient form for condenser illumination is the live-box with flush glass bottom. These live-boxes are used for the examination of live objects such as insects, but especially for Infusoriæ.

5. The *compresser* is an instrument consisting of two plane parallel glass surfaces, which, by means of levers, screws, or wedges, may be more or less approached to each other. These compressers serve to apply a gradual pressure to objects whose structure can be better, or can only then be, seen when they are flattened out. Such pressure may be applied to crush small shells, to flatten a cuticle, to hold larger animalcules in the same place so that they are unable to move out of the field of vision, &c. Strict parallelism of the surfaces is most essential, especially for the examination of fluids, which otherwise would be at once squeezed out in one direction instead of being spread out.

6. The *frog and fish plate* for examining the circulation of the blood in the web of a frog's foot, or in the tail or fins of a fish, the animal being wrapped in a little piece of wetted linen and tied by means of threads to the plate which is then fixed on the stage.

7. The *double, triple, or quadruple object-glass carrier,* or Brooke's arm or double nose-piece, which screws into the nose-piece of the

microscope body and can be swung round for the purpose of bringing rapidly another object-glass in position. The double nose-piece is handier than the triple or quadruple one, but only the bent form as devised by Powell and Lealand should be bought, as it is the safest, carrying the objectives which are not in use entirely off the stage.

8. The *camera lucida*, a small instrument fitting over the eye-piece and reflecting the image on a sheet of paper on the table when the microscope is placed horizontally, so that the outlines of an image can easily be traced and measured. The observer must look with the upper half of the pupil of one of his eyes on the prism or on the steel or glass disc, and with the lower half of the pupil he requires to follow the pencil point. The illumination must not be too bright, else the pencil point is hardly seen. The best form is Wollaston's prism camera-lucida. To measure the magnification a micrometer, *i.e.*, a slip of glass, divided into hundredths, thousandths, or ten-thousandths of an inch, must be placed on the stage and focussed, and the magnified image of these divisions traced by means of the camera and measured.

9. The *eye-piece micrometer* for measuring objects in the microscope consists of a micrometer either permanently or temporarily fixed between the field and the eye-glass of the eye-piece, and after the value of its divisions has been ascertained by means of a stage micrometer, the sizes of objects under observation may easily be read off. Jackson's micrometer is a scale on glass in a brass frame which can be inserted into the eye-piece, and which is further adjustable by means of a very finely divided screw. *Ramsden's screw micrometer* is the most perfect apparatus for measuring the size of objects in the microscope, and consists of an eye-piece containing two parallel thin wires which can be separated or approached by means of a screw. Up to the 1-75,000th of an inch can be measured by means of this instrument.

The simplest way of measuring roughly the size of the magnified image is to look down the microscope with one eye and with the other eye to look on a scale held close to the body of the instrument at a distance of 10 inches from the eye. In this position the observer sees both object and scale simultaneously, and can read off the size with tolerable accuracy.

10. The *eye-piece goniometer* serves for measuring the angles of crystals, &c., by means of a scale in the eye-piece, which can be

made to revolve with it if a milled head is turned. The size of the angle is read off on a brass plate which is divided into 360°.

11. The *erector or erecting glass*, for showing the inverted image in the same position as the object, is useful when a dissection is to be made under the microscope. It consists of a tube carrying three lenses, which is fixed into the lower end of the draw-tube, and by its means the image can be more or less magnified.

12. The *centring glass*, fitting over the eye-piece, serves for testing the centricity of the illuminating apparatus and of the sub-stage. It has a minute aperture, and by looking through it both the diaphragms of the object-glass and of the condenser are seen, which must appear concentric if the sub-stage is properly centred.

13. The *object-finder*, for finding objects on slides previously seen, and the position of which has been registered. I will only explain Mr. Maltwood's finder, which consists of a small plate of glass on which a field of one square inch is photographed. This field is divided by horizontal and vertical lines into 2500 small squares, each of which bears a different number. If the position of an object under the microscope is to be registered, the Maltwood finder is placed in exactly the same position as the slide, which is resting against the ledge of the stage, and against a pin fixed on it. The number of the corresponding field is then read off and either marked on the label of the slide or in the catalogue. By reversing this proceeding the registered object is easily found again.

I have now arrived at the last chapter of my lecture, in which I shall speak of *microscopic illumination* and *illuminating apparatus.*

Illumination in microscopy is the principal thing, and successful observation, especially under high powers, is mainly dependent upon proper illumination, for by its means inferior object-glasses may be made to show more than the best objectives will show if the object under examination is not properly illumined. The first thing requisite is good light, and the light best suited for magnification, up to 2000 diameters, is *daylight reflected by a white cloud*, against which the sun shines. Such light is, at the same time, least detrimental to the eye-sight. For the highest powers, and for the resolution of the most difficult tests, sunlight may be employed, but, owing to its great brilliancy, it should be modified by the interpolation of a light modifier of roughly ground white glass, or it

should not be used from the mirror, but should be reflected from a piece of plate glass, under which fine black silk velvet has been laid. As the ordinary white light is often dispersed into prismatic colours by the nature and form of the objects themselves, resulting in impaired definition and resolution, this difficulty may be overcome by the use of *monochromatic light* or light of one colour. Such light may be obtained from the spectrum, or by passing the white light through coloured glass or through a flat glass cell containing an ammoniacal solution of sulphate of copper, the blue and violet rays being the most suitable owing to the greater length of their waves. Such coloured glasses or cells containing coloured solutions are called *light modifiers*. As daylight, and especially sunlight, are scarce commodities in this country, at least in our large cities, and as the amateur microscopist has generally to pursue his observations in the evening after his day's work is done, recourse must be had to artificial light, which indeed, especially for high powers, is the handiest, and suffices for all but the resolution of a few of the most difficult tests. Gaslight is not very suitable owing to the ever varying pressure in the main, in consequence of which the flame does not burn steadily enough. An ordinary paraffin or camphine lamp for one shilling will do very well as far as light is concerned, but I recommend to you *How's Microscope Lamp* and also the so-called *Bocket Lamp*. How's lamp consists of a glass reservoir holding sufficient oil to last for four to five hours, and is adjustable on a brass rod fixed in a large circular foot. A ring of stout wire holds one of Hale's porcelain shades, which has only one opening in front to allow of the passage of the rays; this shade keeps in the heat, protects the eyes from the glare, and reflects a white light. Every one using a microscope regularly, even if it be only a small student's microscope, should provide himself with one of these lamps; he will find that the few shillings it costs are well invested. A handsomer lamp is Swift's, which packs in little space and has an additional reflector and bull's-eye condenser with blue light modifier turning on the same arm. The glass stopper in the reservoir for introducing a further supply of oil when necessary is, in my opinion, no great improvement, as the oil oozes out when the lamp gets hot. *Fiddian's Microscope Lamp* has a metallic chimney which is internally coated with plaster of Paris, and has a white cloud reflector, neutral tint-shade, &c. It is the most complete and best lamp made, but

costs about six pounds. A microscope lamp must have its burner adjustable in vertical directions and allow of its being revolved, or it does not deserve the name, although various patterns not having these properties are made and sold as microscope lamps. For bringing out markings and for obtaining very intense illumination the narrow side of the wick should be used: indeed, various sides of the flame should always be tried, as by this means the best intensity of light can easily be ascertained.

In the illumination of objects the rays ought to be parallel in nearly all cases. By paying attention to this, most structures of transparent objects can be made out by the mirror or rectangular prism alone. The angle of illumination should not be excessive, and should not exceed 90 degs. Objects are either opaque or transparent, and the latter may be viewed by transmitted or by reflected light.

The simplest means of *illuminating opaque objects* is by means of the so-called *bull's-eye condenser*, which is a plano-convex lens mounted on a separate stand, or fitting into the stage or the stand of the microscope; the latter form is called a stage condenser, and is not very useful. The convex side should always be turned towards the source of light in order to obtain parallel rays, else by the crossing and recrossing of an infinite number of rays all the shadows will be destroyed which are absolutely requisite to bring out the shape and nature of the surface of the object under examination. Greater brilliancy is obtained by passing the rays first through a bull's-eye condenser on to a *silvered side reflector* of parabolic surface, often called a speculum, which in its turn reflects the rays on the object. Objects which are mounted on an opaque ground, about $\frac{3}{8}$-inch or less diameter, may be illuminated by means of the *Lieberkuhn* (figure 13), which resembles the mouth-piece of a wind instrument, and is silvered on its hollow parabolic surface. It is slid over the object-glass, and the rays are reflected on it from the plane mirror. The Lieberkuhn's parabolic surface reflects in its turn the light on the object, which is placed in its focus. A separate Lieberkuhn is required for each object-glass, and the highest power under which an opaque object can be illuminated with a Lieberkuhn, a parabolic side reflector, or the bull's-eye condenser, is the $\frac{1}{2}$-inch, or a very narrow-angled $\frac{1}{4}$-inch glass, provided they have a long working distance. Many microscopists condemn the Lieberkuhn as throwing light from all

sides on the object, thus allowing of no shadows; but this holds only good so long as the mirror throws up rays parallel to the axis of the microscope. Altogether, I consider the Lieberkuhn the easiest, and an excellent piece of apparatus for the illumination of opaque objects. *Lister's dark wells* are little blackened cups supported at the end of wires, and if one is placed by means of an adapter in the sub-stage, it intercepts the central rays from the mirror, and the transparent object having now a dark ground, may be viewed by means of the Lieberkuhn.

The apparatus for viewing opaque objects, especially covered ones under high powers, are not very satisfactory. *R. & J. Beck's patent illuminator* is one of the best, and consists in an adapter which has to be screwed between the nose-piece and the object-glass. It has a circular aperture, and a disc of very thin glass placed under an angle of 45 degs. By its means the object-glass is made its own illuminator, the light being reflected through the aperture on the glass disc and from thence on the uncovered object, which in its turn reflects the light back again through the object-glass in the eye-piece.

Transparent objects may be viewed either by *transmitted* or by *reflected light;* the latter is called *dark ground illumination.* The simplest way of viewing transparent objects is by means of the plane mirror, on which parallel rays are thrown by the bull's-eye condenser. For thick objects direct rays are necessary, but for thin and lined objects oblique rays are essential; they are easily obtained by throwing the mirror out of the axis of the microscope. When the mirror is so much out of the centre that the parallel rays reflected from it pass so obliquely over the object that they do not enter the object-glass, we gain *dark ground illumination,* the object then appearing self-luminous and brilliantly lit up on a black ground. As the mirror gives a double reflection, namely, one from the outer surface, and one from the inner or silvered side, and as these two sets of rays are not parallel, those having passed through the glass being refracted, a *rectangular prism* is often substituted for the mirror. Such a prism reflects the light totally, and gives therefore more, and only parallel, rays; it is generally fitted to the tail-piece of the microscope, but it may also be mounted on a stand similar to that of the bull's-eye condenser. Two such prisms enable the microscopist, who has good object-glasses but only a small and simple stand, to resolve the most

difficult lined tests, provided the stage be very thin to allow of very oblique illumination. This arrangement is also cheaper than an expensive condenser, but two lamps are required for it.

Modifications of the rectangular prism are the *Nachet* and the *Amici Prism* (Fig. 14), which serve both to reflect and to condense the light. I can highly recommend the Amici prism as an excellent piece of apparatus for the resolution of lined objects, as it gives rays of great obliquity if thrown out of the axis, or intense direct light if placed in the axis, of the microscope. This prism, although small, gives sufficient light for magnifications of thousands of diameters, and is very easily used, but it is not achromatic.

The best appliances for obtaining various quantities and qualities of light for the illumination of transparent objects are the *achromatic condensers*. Any achromatic object-glass of medium power placed under the stage with its anterior lens nearest the object, will act as a good condenser. Opticians supply special achromatic combinations for this purpose, having close to the lower lens one or two diaphragms with various apertures and stops to regulate both the quantity and quality of light. The stops are generally six in number, namely, three central dark ground spots of various sizes for excluding the central rays, one lateral stop, one having two slots forming a right angle, and one stop having two slots forming an obtuse angle. In Ross' condenser the pencil of light may be reduced from 110° to 20° by the circular holes in the upper diaphragm. It is considered the most useful condenser, and suffices for the resolution of the most difficult tests. Powell and Lealand's condenser is similar, but has 170° angular aperture, and consequently a shorter working distance, but it is the best for the highest powers. Gillet's condenser has the diaphragm in the shape of a flat ring which stands nearly perpendicular, and whose various apertures can be brought successively under the field lens. If parallel markings are to be resolved, it is evident that the unilateral stop has to be used, and that the condenser has to be rotated until the light falls perpendicularly against the markings or ribs; for cross markings the right or obtuse angle stops have to be used, for obtaining dark ground illumination under low powers or for great obliquity of light under high powers the central dark ground spots have to be employed. Mr. Reade's hemispherical condenser consists of two plano-convex lenses with the plane surfaces directed upwards, and yields very oblique and

even monochromatic light. The Kellner eye-piece C, if placed in the sub-stage and provided with a number of stops fitting over the eye-lens instead of the cap, makes a very good condenser and yields abundant light up to 10,000 diameter magnification.

The Webster and Swift condensers are each of them a *multum in parvo*, uniting in an efficient and not expensive way all the various pieces of sub-stage illumination apparatus, and will be found quite satisfactory in nearly all cases. I have obtained excellent results with the paraboloid for light ground illumination under the highest powers, as it gives plenty of oblique and white light. In fact I have, by its aid, resolved certain markings which some first-class achromatic condensers refused to bring out.

The *diffusion condenser*, invented by Mr. Wenham, gives splendid effects on transparent objects viewed under the stereoscopic binocular microscope. It consists of an achromatic combination of 170°, having a white cloud cap, *i.e.*, a cap of two thin glass discs between which some powdered glass is placed, which breaks up the pencils of light in all directions; it yields a soft white light, and by its means the two fields of the binocular are easily illuminated. This is sometimes a difficulty under medium powers, which may be overcome by placing a piece of roughened glass under the object. The object should be well lit up, but not too much so, else the binocular effect will be destroyed. Beginners generally think that the best effects are obtained by flooding the field with light, which is a very great mistake.

The next class of condensers are those for *dark ground illumination of transparent objects*, the simplest is the *spot-lens*. This is a large plano-convex or bi-convex lens, the upper and lower surfaces of which with the exception of a narrow border are ground flat and blackened, so that if the light from the mirror is thrown on it, the marginal rays alone pass through it, and these being much refracted pass over the object without entering the object-glass; the result is brilliant illumination of the objects on a black ground. The spot-lens is suitable for object-glasses up to half-inch focus. A more perfect instrument for the same purpose is the *Paraboloid* (Fig. 15) of Mr. Wenham. A parabola is a curve produced by the section of a cone and of a plane under certain conditions, and it has the property of reflecting all rays, which fall on it parallel to its axis, to one point in the same, called the focus. By rotating the parabola round its axis, we get a paraboloid which has the

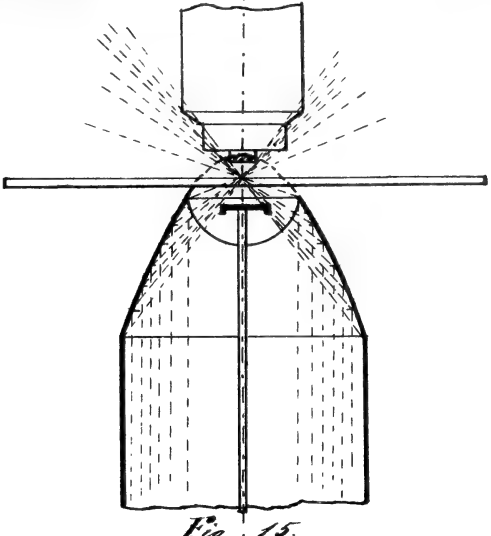


Fig. 15.

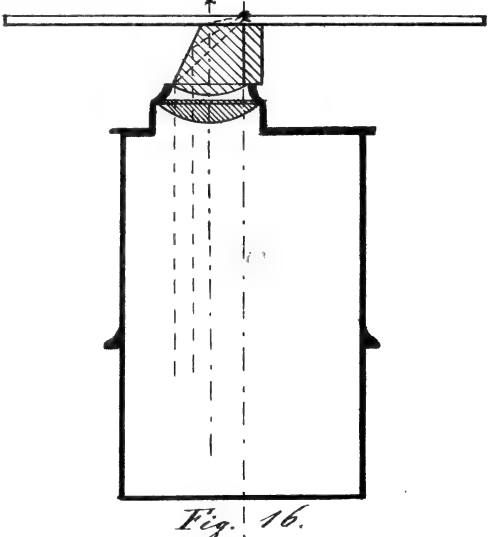


Fig. 16.

Pl. V

identical property with the parabola. Mr. Wenham's paraboloid has its apex ground off down to $\frac{1}{4}$-inch below the focus, and a dark-ground stop in the centre. If the light is reflected from the plane mirror or rectangular prism on the paraboloid, an object placed in its focus will appear brilliantly lit up on dark ground. The paraboloid yields a blacker ground than the spot-lens, and the rays passing out of it in a more horizontal direction, it can be employed with the 1-5th object-glass.

Wenham's Reflex Illuminator (Fig. 16) is another most ingenious contrivance for obtaining oblique dark-ground illumination under the highest powers, provided the objects to be examined by its aid are suitable ones, attached to the slide and not to the cover, and mounted dry, that is, not in balsam or any other medium. This reflex illuminator is composed of a glass cylinder half-an-inch long and 4-10ths inch diameter, the lower convex surface of which is polished to a radius of 4-10ths inch. The top is flat. Starting from the bottom edge the cylinder is worked off to a polished face at an angle of 64°. Close beneath the cylinder is set a plain convex lens of $1\frac{1}{4}$-inch focus. Parallel rays thrown up through the apparatus are reflected from the polished off plane of the cylinder on to the glass-slide, at an angle of total reflection; but if a suitable object adheres to the surface of the slide, the light reaches it on an angle that admits of its passage. In order to ensure the continuous passage of the rays to the object, the top of the glass cylinder and the lower surface of the slide must be united by a film of water. The object appears then brilliantly lit up upon a dark ground, and when the apparatus is rotated splendid effects and an exquisite unfolding of structure is obtained.

Nothing remains now but to speak of microscopical illumination with *polarized light*. I mentioned at the outset that light consists of the undulations of the luminiferous ether, and that these undulations take place in two planes at right angles to the ray. The object of the polarization is to bring these two sets of undulations into *one* plane, and this is effected by double reflection. An apparatus which polarizes light is called a *Polariscope*, and the phenomenon of polarization is one of the most gorgeous in nature, and serves at the same time the practical purpose of enabling the microscopist to form conclusions as to the nature of the object under observation by polarized light. The *Micro-polariscope* consists of two prisms made of Iceland spar, or

carbonate of lime, which crystallizes in rhombs and gives a double reflection. Mr. Nicol first succeeded in making single image prisms of Iceland spar, which reflect only the ordinary or the extraordinary ray at the time. A polariscope consists of two such prisms, one of which is placed under the stage below the object and is called the *Polarizer*, and the other is either placed behind the object-glass or above the eye-piece and is called the *Analyzer;* both Polarizer and Analyzer are made to turn. If then an object such as doubly refractive crystals are placed on the stage, and either of the prisms is turned, they will exhibit the polarization of light in gorgeous colours. If objects are only simply refractive they require the interposition of a film of selenite, which according to its thickness will exhibit two complementary colours such as red and green, blue and yellow, &c. By combining several selenites a large variety of colours and tints may be obtained during half a revolution. Selenite is the native crystallized hydrated sulphate of lime. The best arrangement of selenites is Darker's, who places three selenite films of various thicknesses in a box in which they can be rotated both singly and in combination with each other. The variety of tints of a selenite may be greatly increased by interpolating a rotating film of *mica*, and if one such mica film is combined with two selenites, the one blue and yellow and the other red and green, the entire series of tints which are produced by any number of selenites combined can be obtained. The polariscope may be combined with the spot-lens or paraboloid for a dark-ground polariscope. If the analyzer consists of a double image prism or an original rhomb of Iceland spar, and if a brass plate with a small hole be placed on the stage, two magnified images of the latter will be seen which exhibit complementary colours, and if the hole be large enough the two images will partly overlap each other, and that portion where they overlap will look *white*, thus proving that the complementary colours produce white light. The objects especially suited for the polariscope are chemical crystals, hairs, fish scales, sections of horns and hoof, starch grains, vegetable and muscular fibres, the palates or lingual bands of molluscs, &c. Crystals are thus seen as they cannot be seen otherwise, and the chemically distinct constituents of vegetable and animal tissues become apparent in a way which no mere magnifying power could resolve. By the addition of a polariscope a great increase of power is thus gained.

In conclusion I will only mention that the spectroscope has also been combined with the microscope, and that such a combination is termed a Micro-spectroscope.

7th December, 1875.

Mr. Alex. Noble in the chair.

Mr. John M'Glashan, 114 Candleriggs, and Mr. George Sturrock, were elected members of the Society.

SPECIMENS EXHIBITED.

By Mr. R. H. Paterson.—Specimens of various edible fungi from Cadder Wilderness. Among them were fine specimens of the "Chantarelle" of the French (*Cantharellus cibarius*); two of the Milky Fungi (*Lactarius piperatus* and *L. insulsus*); the Hedgehog Mushroom (*Hydnum repandum*); *Clavaria flava*, and *C. amethystina*,—the latter rare in Scotland. He also exhibited three of the British sponges from the Dornoch Frith, and a specimen of *Lycopodium squamatum*. This plant grows in the arid deserts of Central South America, and is possessed of remarkable hygrometric properties. In the dry season it curls up its leaves and contracts its roots so as to form a ball, which lies on the surface of the sand and is blown about from place to place. As soon however as it meets with wet ground, or on return of wet weather, it sends its roots down into the sand and unfolds its leaves, thus exchanging death for life.

PAPER READ.

By Mr. Thomas King.—On the "Classification of the Mammalia." Beginning with the highest order, *Bimana*, in which we had man, he went over the lower orders, describing the distinguishing characteristics of each, making some important remarks on the habits and distribution of the more important animals included under each order. Next to the *Bimana* we have the *Quadrumana*, which includes the monkeys of the Old and New Worlds. Some of the monkeys of the Old World had no tail, and none of them had a prehensile one; whereas all those of the New World had a long tail, generally prehensile. In the former we had the Orang-outang and Blue-faced Baboon, and in the latter such

animals as the Spider-monkeys and the Howlers. In the *Insectivora* we had no very marked characters. It includes such animals as the mole, shrew, and hedgehog. To this group belongs the smallest of all mammals, *Sorex Etruscus*, which is only two and a half inches in length including the tail. Passing on we come to the *Cheiroptera* or bats. In this order the bones of the hands are greatly elongated, and have a membrane stretched between the separate fingers which is attached to the sides of the animal and to the feet. It is this large membrane which gives to the animals their power of flight. In Britain there are several distinct species of bats, all of them being very small compared with those of other countries. The *Rodentia*, or gnawing animals, are characterized by the possession of two long incisor teeth in each jaw separated by a gap from the molars. These teeth are continually growing, and if from any cause one be broken the corresponding one in the other jaw elongates to a great extent. To this group belong such animals as the rat, hare, and beaver. The *Carnivora* are divided into three groups—the *Digitigrada*, or animals that walk on their toes, such as the lion and cat; the *Plantigrada*, animals that walk on the soles of their feet, as in the bears; the *Pinnigrada*, in which the legs form paddles, like what we find in the seals of our shores. The *Proboscidea* are characterised by the absence of canine teeth; the incisor teeth are enormously developed and are termed tusks, as in the elephant and mammoth. The *Ungulata* include the *Ruminantia*, such as the oxen, sheep, and deer; the *Pachydermata*, or thick-skinned animals; and the *Solidungula*, where the foot is terminated by a single toe, as in the horse. The next group, *Cetacea*, includes those animals which have a more or less fish-like body, as in the whales and porpoises. The order *Marsupialia* includes such animals as the kangaroo, and is characterised by the possession of a pouch in which the young are reared. The animals are chiefly inhabitants of Australia. In the last and lowest group, *Monotremata*, the jaws are destitute of teeth, and present the characters of the bills of birds. It includes the duck-billed animal and the echidna. The paper was illustrated with numerous diagrams and specimens.

21st December, 1875.

Mr. James Allan, Vice-President, in the chair.

Mr. Robert Walker, 6 Nelson Terrace, Hillhead, was elected a member of the Society.

SPECIMENS EXHIBITED.

By Mr. R. H. Paterson.—A collection of lichens: *Scyphophorus alicornis, S. bellidiflora, S. deformis, S. fimbriatus, S. coccifera, S. gracilis, Cenomyce pigridate.* Also the fungus *Polyporus giganteus.* The last from the Cameroons, Africa.

PAPER READ.

Mr. J. Galbraith, M.A., read a paper on "Volcanism," or, as he said he would prefer to have it called, "Vulcanology"—the science which treats of volcanoes and earthquakes, and the causes which produce them. After reviewing the various theories of Sir Humphry Davy, Mallet, Hopkins, and others, he went on to propound a theory which might, to some extent at least, harmonize the whole of them. He afterwards gave an account of the various manners in which changes of igneous origin are produced on the earth's crust, of the best known volcanic eruptions which had occurred, and of the active volcanoes which are best known to science.

11TH JANUARY, 1876.

Mr. Richard M'Kay, Vice-President, in the chair.

PAPERS READ.

Mr. James Allan read a paper on the "Migration of Birds." He began by noticing the wonder excited by the disappearance of birds, and the legends connected therewith, and the omens drawn from their flight by the ancients. Partial migration occurred in the case of the lapwing, which leaves the bare moorlands in winter and proceeds to the sheltered valleys. He laid before the meeting the following series of tables, in which the arrivals and departures of various birds were registered, extending over a series of years. He found that the corncrake seemed to be the most regular in its return, and the swallow the most irregular. But taking the average of any one year, it cannot be said that in such a season all birds appeared later or earlier. The chiff-chaff is

generally the first to arrive. He considered that the return of birds was not connected so much with the state of weather of the country to which they come, as with the meteorological conditions of the country which they leave. He proposes to continue his registry of bird migrations over a wider area and embracing a longer period, and hopes to obtain more reliable results therefrom.

In the following tables the double figures indicate the day and month, as 25/4, the twenty-fifth of April or 4th month.

LANDRAIL (*Gallinula Crex*).

	1864	1865	1866	1867	1868	1869	1870	1871	1872	1873	1874	1875
Bradford-on-Avon,	...	...	...	...	...	...	...	...	..	...	...	23/4
Uttoxeter,	...	...	...	..	...	...	...	...	...	...	...	15/4
Barnsley,	...	...	27/4	26/4	28/4	26/4	29/4	30/4	26/4	27/4	26/4	2/5
Mansfield,	...	...	...	...	...	...	...	..	...	...	...	6/5
Masham, Yorkshire,	...	...	...	...	...	...	...	...	...	...	...	1/5
York,	4/5	...	6/5	5/5	9/5	5/5	2/5	...	27/4	...	...	...
Corwen, N. Wales,	...	...	...	...	...	...	...	...	2/5	9/5	6/5	2/5
Fochabers,	...	...	2/5	3/5	1/5	6/5	27/4	3/5	1/5	5/5	2/5	3/5
Kent,	...	6/5	...	...	...	...	...	...	...	...	...	...
Middlesex,	11/5	12/5	10/5	11/5	11/5	...	...	...	...	...	...	...
Somerset,	...	...	...	...	...	23/4	14/5	...	...	...	...	...
Notts,	...	...	...	...	...	...	...	...	...	...	...	11/5
Derby,	...	...	...	..	...	...	...	...	29/4	..	...	...
Cumberland,	...	...	...	...	...	...	...	...	...	12/5	5/5	...

WHITE THROAT (*Curruca cinerea*).

	1865	1866	1867	1868	1869	1870	1871	1872	1873	1874	1875
Mansfield,	...	...	...	...	..	...	...	...	...	...	29/4
Masham, York,	...	...	...	...	...	...	...	...	...	...	2/5
Ipswich,	...	...	...	...	...	...	...	...	...	...	24/4
Barnsley,	...	25/4	25/4	25/4	25/4	25/4	25/4	25/4	25/4	25/4	25/4
Bromley, 14/4 in 1846	...	...	...	...	...	...	...	...	...	...	...
Corwen,	...	...	...	...	...	...	...	26/4	10/5	26/4	29/4
Fochabers,	...	...	...	...	...	...	...	3/5	4/5	5/5	4/5
Kent,	18/4	17/4	...	23/4	16/4	...	...	22/4	15/4	24/4	21/4
Middlesex,	...	..	16/4	...	21/4	...	...	...	...	...	...
Somerset,	...	...	...	...	21/4	19/4	18/4	...	...	...	...
Notts,	...	...	..	...	...	...	...	...	...	...	22/4
Derbyshire,	...	...	...	...	...	...	...	25/4	...	...	...
Westmoreland,	...	...	...	...	...	...	...	...	...	23/4	...
Cumberland,	...	...	...	...	...	...	...	...	10/5	4/5	...

Nightingale (*Philomela luscinia*).

	1864	1865	1866	1867	1868	1869	1870	1871	1872	1873	1874	1875
Ipswich,	...	...	...	...	...	...	...	...	...	...	...	19/4
Bromley,	..	...	...	9/4	..	...	...	...	...	...	...	20/4
Barnsley,	...	...	29/4	28/4	30/4	26/4	1/5	27/4	26/4	29/4	1/5	9/5
Bradford-on-Avon	...	...	...	...	...	...	...	...	...	...	...	20/4
Bagshot,	...	...	...	20/4	18/4	13/4	15/4	15/4	15/4	17/4	17/4	19/4
Kent,	...	20/4	18/4	17/4	23/4	14/4	....	...	12/4	15/4	24/4	21/4
Middlesex,	20/4	...	...	18/4	21/4	...	...	...	...	...	...	...

Blackcap (*Curruca atricapilla*).

	1865	1866	1867	1868	1869	1870	1871	1872	1873	1874	1875
Mansfield,	...	...	...	...	...	..	...	..	...	...	6/5
Masham,	...	...	...	...	...	...	...	...	...	...	2/5
Bromley,	...	...	...	...	...	...	...	7/4	...	...	...
Corwen, N. Wales,	...	...	...	...	...	...	...	7/5	7/5	3/5	4/5
Kent,	...	19/4	...	21/4	10/4	...	...	5/4	11/4	16/4	8/5
Middlesex,	...	...	3/4	23/4	...	...	...	...	...	..	...
Somerset,	...	...	...	...	17/4	13/4	6/4	...	...	...	...
Notts,	...	...	...	..	...	...	...	...	...	...	27/4
Derbyshire,	...	...	...	...	...	...	...	1/5	...	..	...
Westmoreland,	...	...	...	...	...	...	...	...	...	24/4	...

Red Backed Shrike (*Lanius collurio*).

	1862	1863	1866	1867	1868	1869	1870	1872
Kent,	16/5	...	...	...	16/5	...	...	11/5
Middlesex,	...	1/6	10/5	2/5	...	...	...	...
Somerset,	...	...	...	...	...	27/5	16/5	...

Redstart (*Phoenicura ruticilla*).

	1864	1865	1866	1867	1868	1869	1870	1871	1872	1873	1874	1875
Kent,	...	20/4	14/4	29/4	26/4	20/4	...	...	15/4	15/4	17/4	...
Middlesex,	...	...	...	16/4	...	...	...	...	...	...	...	...
Somerset,	...	...	...	...	...	14/4	13/4	14/4	...	...	..	..
Derbyshire,	...	...	...	...	...	...	...	...	25/4	...	...	...
Wales,	...	...	...	...	...	...	...	...	...	20/4	...	...
Westmoreland,	...	...	...	...	...	...	...	...	...	...	21/4	...
Notts,	...	...	...	...	...	...	...	...	...	...	...	19/4

Cuckoo (*Cuculus canorus*).

	1864	1865	1866	1867	1868	1869	1870	1871	1872	1873	1874	1875
Aldershot,	...	...	...	...	...	..	...	...	...	...	...	18/4
Bradford-on-Avon,	...	...	...	...	...	...	...	...	...	...	...	17/4
Penshurst, Kent,	...	...	...	...	...	...	..	...	...	...	...	15/4
Morebattle, Devon	...	...	...	...	...	20/4	21/4	22/4	24/4	21/4	21/4	22/4 18/4
Stowmarket,	...	...	...	...	...	...	...	...	...	...	...	31/3
York,	23/4	23/4	22/4	27/4	25/4	9/4	24/4	...	24/4	...	...	...
Hovingham, York,	...	26/4	26/4	26/4	26/4	26/4	26/4	26/4	26/4	26/4	26/4	19/4
Great Messenden	...	...	...	...	...	...	...	...	...	...	26/4	19/4
Bicester,	...	...	...	...	...	...	...	...	...	...	...	16/4
Llanderfell, Wls.	...	...	...	...	...	...	...	...	24/4	23/4	25/4	19/4
Kirn, Clyde,	...	...	...	...	...	...	...	...	...	...	...	11/4
Tynehead, Lothians,	...	...	...	...	...	...	..	...	...	...	...	17/4
Balgonie, Fife,	...	...	...	...	...	...	...	...	...	...	...	14/4
Mansfield, Notts,	...	...	...	...	...	...	...	..	...	...	...	30/4
Uttoxeter,	...	...	...	...	...	...	...	...	...	...	...	14/4
Masham, York,	...	...	...	...	...	...	...	...	...	...	...	2/5
Ipswich,	...	...	...	...	...	...	...	...	...	...	..	27/4
Barnsley,	...	...	14/4	14/4	14/4	14/4	14/4	14/4	14/4	14/4	14/4	12/4
Burnley, Kent,	...	...	11/4	...	...	..	...	...	...	...	...	..
Bagshot,	...	...	9/4	12/4	...	18/4	16/4	...	14/4	23/4	...	19/4
Strathblane,	...	...	...	...	...	...	...	...	...	...	...	28/4
Corwen, Wales,	...	...	...	...	...	...	...	...	26/4	28/4	25/4	23/4
Fochabers,	...	...	29/4	29/4	29/4	29/4	29/4	29/4	29/4	29/4	29/4	29/4
Roscommon,	...	...	1/5	1/5	1/5	1/5	1/5	1/5	1/5	1/5	1/5	26/4
Hants,	...	...	...	...	23/4	...	...	...	...	...	...	..
Kent,	...	22/4	14/4	17/4	20/4	20/4	..	...	23/4	25/4	26/4	...
Middlesex,	20/4	...	...	27/4	...	...	...	...	...	...	...	...
Somerset,	...	...	...	...	...	21/4	16/4	19/4	...	...	...	...
Derby,	...	...	...	...	...	...	...	...	27/4	...	...	...
Westmoreland,	...	...	...	...	...	...	...	...	...	..	27/4	...
Cumberland,	...	...	...	...	...	...	...	...	...	5/5	2/5	...
Worcester,	...	...	...	...	...	...	...	...	...	...	...	21/4

Whinchat (*Saxicola rubetra*).

	1863	1864	1866	1867	1868	1869	1870	1871	1872	1873	1874	1875
Middlesex,	27/4	16/4	...	27/4	...	...	...	..	...	...	...	...
Kent,	...	...	18/4	...	23/4	20/4	...	...	29/4	23/4	...	21/4
Somerset,	...	..	...	...	...	21/4	11/4	25/4	...	...	...	...
Notts,	...	...	...	...	...	..	..	...	...	...	...	26/4
Derbyshire,	...	...	...	...	...	...	...	...	25/4	...	..	...
Wales,	...	...	...	...	...	...	...	...	...	21/4	...	...
Westmoreland,	...	...	...	...	...	...	...	...	...	3/5	23/4	...
Cumberland,	...	...	...	...	...	...	...	...	...	3/5	4/5	...

Willow Wren (*Sylvia trochilus*).

	1866	1867	1868	1869	1870	1871	1872	1873	1874	1875
Bromley, Kent,	...	...	...	...	...	...	6/4	...	...	...
Mansfield, Notts,	...	...	...	...	...	...	...	...	...	16/4
Corwen,	...	...	...	...	...	...	28/4	4/5	26/4	2/5
Fochabers,	...	...	...	25/4	25/4	25/4	25/4	25/4	25/4	25/4
Surrey,	...	...	11/4	...	...	...	...	...	..	19/4
Kent,	12/4	9/4	16/4	11/4	...	...	5/4	11/4	5/4	21/4
Middlesex,	...	5/4	...	...	...	..	...	...	...	...
Somerset,	...	...	...	11/4	12/4	12/4	...	...	...	...
Derby,	...	...	...	...	...	...	3/4	...	...	...
Notts,	...	...	...	...	...	...	...	...	...	15/4
Cumberland,	...	...	...	...	...	...	...	23/4	11/4	...

Chiff Chaff (*Sylvia rufa*).

	1864	1865	1866	1867	1868	1869	1870	1871	1872	1873	1874	1875
Isle of Wight,	...	...	...	...	...	...	...	...	...	...	...	20/3
Barnsley,	...	2/4	2/4	2/4	2/4	2/4	2/4	2/4	2/4	2/4	2/4	15/4
Worcestershire,	...	...	...	...	...	...	...	...	...	...	...	31/3
Mansfield, Notts,	...	...	...	...	...	...	...	...	...	...	...	4/4
York,	9/4	...	31/3	30/3	10/4	...	27/3	15/3	...	...	...	...
Hovingham,	...	30/3	30/3	30/3	30/3	30/3	30/3	30/3	30/3	30/3	30/3	1/4
Durham,	...	...	...	...	...	...	...	...	...	...	...	19/4
Corwen,	...	...	..	...	...	...	...	..	9/4	13/4	16/4	13/4
Somerset,	...	...	...	...	...	7/4	2/4	23/3	...	...	...	...
Bromley, 27/3/62,	...	...	...	...	..	...	...	...	...	...	...	...
Kent,	7/4	...	25/3	8/4	...	11/4	...	23/3	18/3	27/3	25/3	26/3
Middlesex,	...	...	7/4	..	4/4	...	..	23/3	...	...	...	...
Hants,	...	3/4	...	...	...	...	...	...	...	...	...	...
Derby,	...	...	...	...	...	...	...	...	9/4	...	...	...
Notts,	...	...	...	...	...	...	...	...	...	...	...	6/4
Cumberland,	...	...	...	...	...	...	...	...	...	...	11/4	...

Sedge Warbler (*Salicaria phragmitis*).

	1865	1866	1867	1868	1869	1870	1871	1872	1873	1874	1875
Barnsley,	...	24/4	24/4	24/4	24/4	24/4	24/4	24/4	24/4	24/4	22/4
Mansfield,	...	...	...	...	...	...	...	...	...	...	2/5
Masham,	...	...	...	...	...	...	...	...	..	...	2/5
Kent,	26/4	17/4	...	...	19/4	...	...	10/5	10/5	...	...
Middlesex,	...	...	27/4	...	...	...	...	...	...	...	...
Hants,	...	...	...	23/4	...	...	...	...	...	...	...
Notts,	...	...	...	...	...	...	...	...	...	...	19/4
Derbyshire,	...	...	...	...	...	...	...	1/5	...	...	...
Westmoreland,	...	...	...	...	...	...	...	...	...	30/4	...
Cumberland,	...	...	...	...	...	...	...	...	8/5	4/5	...

Wryneck (*Yunx torquilla*).

	1866	1867	1868	1869	1870	1871	1872	1873	1874	1875
Bradford,	...	...	...	...	...	...	...	...	...	14/4
Ipswich,	...	...	...	...	...	...	...	...	...	2/4
Bromley,	...	...	...	...	...	...	1/4	...	...	...
Bagshot,	...	...	...	...	...	...	2/4	2/4	15/4	10/4
Kent,	5/4	31/3	5/4	10/4	...	...	10/4	4/4	10/4	14/4
Middlesex,	...	7/4	8/4	..	...	...	...	...	...	...
Somerset,	...	...	...	22/4	16/4	12/4	...	...	...	...

Wheatear (*Saxicola oenanthe*).

	1864	1865	1866	1867	1868	1869	1870	1871	1872	1873	1874	1875
Middlesex,	7/4	...	...	...	...	...	...	...	...	...	...	...
Kent,	...	18/4	12/4	23/3	23/4	...	...	...	...	...	1/4	...
Somerset,	...	...	...	...	...	...	11/4	...	...	...	...	...
Derby,	...	...	...	...	...	...	...	...	24/3	...	...	...
Notts,	...	...	...	...	...	...	...	...	...	..	...	1/5
Wales,	...	...	...	...	...	...	...	...	21/3	...	...	...
Westmoreland,	...	...	...	...	...	...	...	...	...	...	28/4	...

Swift (*Hirundo apus*).

	1866	1867	1868	1869	1870	1871	1872	1873	1874	1875
Bradford-on-Avon,	..	...	...	...	...	...	...	...	...	3/5
Masham, York,	...	...	...	...	...	...	...	...	...	6/5
Mansfield, Notts,	...	...	...	...	...	...	..	..	...	6/5
Ipswich,	...	...	...	...	...	...	..	...	..	21/5
Barnsley,	8/5	8/5	8/5	8/5	8/5	8/5	8/5	8/5	8/5	8/5
Bromley,	...	...	...	...	...	...	...	...	3/5	...
Corwen,	...	...	...	...	...	...	5/5	7/5	30/4	3/5
Forres,	...	...	...	8/5	9/5	7/5	14/5	8/5	17/5	7/5
Fochabers,	...	...	...	...	...	...	28/4	28/4	28/4	28/4
Kent,	28/4	...	...	5/5	...	...	4/5	...	23/5	...
Middlesex,	...	4/5	3/5	...	...	..	...	...	...	..
Hants,	...	...	4/5	...	...	...	...	...	...	...
Cumberland,	..	...	...	...	...	...	...	14/5	16/5	...
Notts,	...	...	...	...	...	...	...	...	...	9/5
Somerset,	...	...	...	...	9/5	10/5	...	...	...	...

Swallow (*Hirundo rusticus*).

	1864	1865	1866	1867	1868	1869	1870	1871	1872	1873	1874	1875
Taunton,	...	...	...	...	...	...	...	...	...	...	...	6/4
South Devon,	...	...	...	...	...	...	...	...	...	...	...	4/4
Penshurst,	...	...	...	...	...	...	...	...	..	...	...	20/4
Morebattle,	...	...	...	...	...	...	...	...	...	...	...	9/4
Mansfield,	...	...	...	...	...	...	...	...	...	...	...	17/4
Bradford-on-Avon	...	...	...	...	...	...	...	...	...	...	...	19/4
Ipswich,	...	...	...	...	...	...	...	...	...	...	...	18/4
Bagshot,	...	...	...	...	19/4	9/4	6/4	8/4	2/4	13/4	21/4	17/4
Hovingham,	...	14/4	14/4	14/4	14/4	14/4	14/4	14/4	14/4	14/4	14/4	18/4
York,	9/4	23/4	...	...	25/4	12/4	21/4	16/4	18/4	...	...	...
Durham,	...	...	...	...	...	...	...	...	...	...	...	17/4
Dalmarnock,	...	...	...	...	...	...	...	...	...	...	...	1/5
Kirn,	...	...	...	...	...	...	...	...	...	...	...	11/4
Glasgow,	...	...	...	...	...	...	...	...	...	...	...	1/5
Corwen,	...	...	...	...	...	...	...	...	2/5	22/4	27/4	23/4
Calder Vale,	...	...	...	...	...	...	...	...	...	...	...	7/4
South Yorkshire,	...	...	...	...	...	...	...	...	...	..	...	15/4
Kent,		18/4	{12/4 / 15/4}	13/4	10/4	10/4	...	...	29/3	15/4	18/4	12/4
Middlesex,	7/4	...	...	13/4	6/4	...	...	...	...	...	...	...
Surrey,	...	...	...	...	...	...	...	...	...	...	...	18/4
Notts,	...	...	...	...	...	...	...	...	...	..	...	6/4
Derby,	...	..	...	...	...	...	...	...	13/4	...	...	...
Westmoreland,	...	...	...	...	...	...	...	...	...	...	22/4	...
Cumberland,	...	...	...	...	...	...	...	...	...	6/5	21/4	...
Somerset,	...	...	...	...	...	8/4	11/4	9/4	...	...	...	...

House Marten (*Hirundo urbica*).

	1866	1867	1868	1869	1870	1871	1872	1873	1874	1875
Bradford-on-Avon,	...	...	...	...	...	...	...	...	...	18/4
Ipswich,	...	...	...	...	...	...	...	...	...	2/5
Barnsley,	14/5	14/5	14/5	14/5	14/5	14/5	14/5	14/5	14/5	18/5
Bromley,	...	...	...	...	...	..	18/4	...	...	...
Masham, York,	...	...	..	...	...	...	...	...	...	6/5
Corwen, N. Wales,	...	...	...	..	...	...	13/5	7/5	21/4	4/5
Forres,	...	...	...	...	7/5	6/5	23/4	7/5	...	...
Kent,	27/4	..	26/4	28/4	...	...	3/5	5/5	...	21/4
Middlesex,	...	4/5	...	...	...	...	...	...	...	...
Hants,	...	...	23/4	...	...	...	...	...	...	...
Bucks,	...	4/5	...	...	...	...	...	...	...	...
Notts,	...	...	...	...	...	...	...	...	...	19/4
Derby,	...	...	...	...	...	...	5/5	...	...	...
Westmoreland,	...	...	...	...	...	...	...	...	24/4	...
Cumberland,	...	...	...	...	...	...	...	8/5	...	...
Somerset,	...	...	...	30/4	25/4	4/5	...	...	...	...

Sand Marten (*Hirundo riparia*).

	1866	1867	1868	1869	1870	1871	1872	1873	1874	1875
Bradford-on-Avon,	...	...	...	...	...	...	...	...	...	12/4
Mansfield,	...	...	...	...	...	...	...	...	...	24/4
Barnsley,	9/4	9/4	9/4	9/4	9/4	9/4	9/4	9/4	9/4	17/4
Corwen,	...	...	...	...	...	...	13/4	14/4	21/4	18/4
Forres,	28/4	22/4	17/4	18/4	15/4	22/4	19 4	20/4	...	...
Fochabers,	...	...	...	...	15/4	15/4	15/4	15/4	15/4	15/4
Middlesex,	...	10/4	...	...	...	...	...	...	...	...
Kent,	13/4	...	10/4	12/4	...	...	17/4	...	23/4	...
Somerset,	...	...	...	14/4	24/4	6/4	...	...	...	...
Notts,	...	...	...	...	...	...	...	...	...	6/4
Bucks,	...	...	...	...	...	...	...	18/4	...	...

Pied Flycatcher (*Muscicapa atricapilla*).

	1866	1867	1868	1869	1870	1871	1872	1873	1874	1875
Mansfield,	...	...	...	...	...	...	...	...	...	16/5
Ipswich,	...	...	...	...	...	...	...	..	...	23/5
Barnsley,	14/5	14/5	14/5	14/5	14/5	14/5	14/5	14/5	14/5	9/5
Bromley,	...	...	...	...	...	...	...	...	...	...
Corwen,	...	...	...	...	...	...	28/4	4/5	2/5	2/5

ARRIVAL OF BIRDS.

TABLE OF AVERAGES.

	1864	1865	1866	1867	1868	1869	1870	1871	1872	1873	1874	1875
Swallow,	9/4	18/4	14/4	14/4	19/4	12/4	14/4	13/4	16/4	16/4	21/4	16/4
Swift,	...	...	8/5	8/5	8/5	8/5	8/5	7/5	29/4	5/5	5/5	6/5
House Marten,	...	...	14/5	14/5	14/5	14/5	10/5	10/5	4/5	9/5	4/5	26/4
Sand Marten,	...	..	14/4	16/4	13/4	14/4	13/4	15/4	14/4	14/4	15/4	17/4
Cuckoo,	23/4	24/4	20/4	23/4	25/4	21/4	21/4	24/4	24/4	24/4	25/4	20/4
Landrail,	4/5	...	2/5	1/5	3/5	2/5	29/4	2/5	29/4	4/5	1/5	29/4
Nightingale,	...	...	29/4	19/4	24/4	19/4	23/4	21/4	20/4	23/4	24/4	20/4
Chiff Chaff,	9/4	31/3	31/3	31/3	4/4	31/3	30/3	25/3	3/4	4/4	5/4	7/4
Hedge Warbler,	...	...	24/4	24/4	24/4	24/4	24/4	24/4	24/4	24/4	24/4	29/4
Willow Wren,	...	...	...	...	...	25/4	25/4	25/4	20/4	30/4	25/4	27/4
White Throat,	...	...	25/4	25/4	25/4	25/4	25/4	25/4	28/4	3/5	29/4	29/4
Black Cap,	...	...	...	...	...	..	...	...	22/4	7/5	3/5	4/5
Fly Catcher,	...	..	14/5	14/5	14/5	14/5	14/5	14/5	22/4	9/5	8/5	13/5
Wryneck	...	...	...	...	...	...	...	...	1/4	2/4	15/4	9/4

TABLE OF AVERAGES,

Showing how many days earlier or later than their average date the arrival of each bird is in each year. The letter "*e*" indicates that the bird arrived earlier, and the letter "*l*" that it arrived later.

	Average arrival over 10 years.	1864	1865	1866	1867	1868	1869	1870	1871	1872	1873	1874	1875
Swallow, ...	15/4	6 *e*	3 *l*	1 *e*	1 *e*	4 *l*	3 *e*	1 *e*	2 *e*	1 *l*	1 *l*	6 *l*	1 *l*
Swift, ...	7/5	..	...	1 *l*	1 *l*	1 *l*	1 *l*	1 *l*	*o*	8 *e*	2 *e*	2 *e*	1 *e*
House Marten,	9/5	...	...	5 *l*	5 *l*	5 *l*	5 *l*	1 *l*	1 *l*	5 *e*	*o*	5 *e*	13 *e*
Sand Marten,..	14/4	...	...	*o*	2 *l*	1 *e*	*o*	1 *e*	1 *l*	*o*	*o*	1 *l*	3 *l*
Cuckoo,.....	23/4	*o*	1 *l*	3 *e*	*o*	2 *l*	2 *e*	2 *e*	1 *l*	1 *l*	1 *l*	2 *l*	3 *e*
Landrail, ...	1/5	3 *l*	...	1 *l*	*o*	2 *l*	1 *l*	2 *e*	1 *l*	2 *e*	3 *l*	*o*	2 *e*
Nightingale, ...	22/4	...	...	7 *l*	3 *e*	2 *l*	3 *e*	1 *l*	1 *e*	2 *e*	1 *l*	2 *l*	2 *e*
Chiff Chaff, ...	2/4	7 *l*	2 *e*	2 *e*	2 *e*	2 *l*	2 *e*	3 *e*	8 *e*	1 *l*	2 *l*	3 *l*	5 *l*
Sedge Warbler,	24/4		...	*o*	*o*	*o*	*o*	*o*	*o*	*o*	*o*	*o*	5 *l*
Willow Wren,.	25/4	...	...	...	...	...	*o*	*o*	*o*	5 *e*	5 *l*	*o*	2 *l*
White Throat,	27/4	...	..	2 *e*	2 *e*	2 *e*	2 *e*	2 *e*	2 *e*	2 *l*	6 *l*	2 *l*	2 *l*
Black Cap, ...	1/5	...	...	...	...	...	...	...	...	9 *e*	6 *l*	2 *l*	3 *l*
Fly Catcher,...	12/5	...	...	2 *l*	2 *l*	2 *l*	2 *l*	2 *l*	2 *l*	22 *e*	5 *e*	4 *e*	1 *l*
Wryneck,.....	7/4	...	...	...	...	...	...	...	...	6 *e*	5 *e*	8 *l*	2 *l*

Mr. John Harvie next read a paper on "The Alternation of Generations." He confined his remarks to his own observations on the Cœlenterata, particularly to the common Medusa or Jelly-fish, *Aurelia aurita*. After describing the Medusa he traced the development of the little active ciliated organisms produced by it, which after a time affix themselves by the proximal end to some object. This plant-like rooted Zoophyte becomes indented at the free end, and four tentacles are developed. These tentacles split up, and at length a large number are produced. The body becomes ringed, and gradually these rings break off one by one in cup-shaped forms, and rapidly enlarging develop into Medusæ similar to the parent organism. This phenomenon had been termed by Steenstrup the alternation of generations, but there were good reasons for rejecting the phrase as not being one which accurately described what took place. Most observers were now of the opinion that the Medusa was not entitled to be called an animal, but was simply an organ of one, and they called it a generative bud or gonophore. The whole question turned on the meaning of the word individual. If an individual be defined to be an animal form that has an independent existence, has the power of assimilating food and of reproducing itself, then alternation of generations seemed to be quite an admissible term; but if an individual be defined, as it had been, as the sum of the contents of a single

ovum, it would at once be seen that the Medusa could not be considered a perfect animal. However, if this definition were accepted, we were compelled to consider that animals which had originated by budding were not separate individuals even although in every particular they were the same as the animals they had sprung from. In the course of his paper Mr. Harvie referred to the beneficial effects of syringing the water of an aquarium, and suggested that storms might have a similar effect on the ocean by oxygenating its waters. The paper was illustrated by carefully executed drawings.

At its close an interesting discussion on the various definitions of the term "individual" took place.

25th January, 1876.

Mr. James Allan, Vice-President, in the chair.

Messrs. John M'Intyre, 52 Weaver Street, and T. B. Birchall, 46 Shamrock Street, were elected members of the Society.

SPECIMENS EXHIBITED.

By Mr. R. H. Paterson.—Specimens of the Cape Pigeon, the Stormy Petrel, and the Sooty Albatross, from the neighbourhood of Cape Horn. Also the skin of a Pelican from the Australian bush.

PAPER READ.

Mr. David Gregorson read a paper entitled "Marks of Biological Progress," in which he gave the outlines of what he supposed might have been the sequence of organic development, and instanced various supposed analogies between different branches of the animal and vegetable kingdoms. A lengthened discussion followed the reading of Mr. Gregorson's paper.

8th February, 1876.

Mr. James Allan, Vice-President. in the chair.

Mr. Robert Kidston, 97 Kent Road, was elected a member of the Society.

EXCURSION.

Mr. Allan gave a short account of an excursion to Bowling, in which all the mosses of the district were found. He mentioned the occurrence of one of the Alpine mosses *(Andreæa crassinerva)* on the hills there. This moss had never been found so low down before.

SPECIMENS EXHIBITED.

By Mr. R. H. Paterson.—Specimens of some of the underground fungi: *Octaviania Stephensii* and *Rhizopogon rubescens* from Helensburgh, and *Hydnangium carneum* from the Botanic Gardens—the last named being new to Britain. Also specimens of *Clavaria acuta* from Helensburgh; *Polyporus brumalis, Tremella lutescens,* and *T. frondosa* from Cadder Wilderness, all rather rare fungi.

By Mr. Allan.—A collection of uncommon mosses collected in the neighbourhood of Glasgow, among which were *Glyphomitrium Daviesii, Andreæa Rothii, A. alpina, Grimmia unicolor, G. torta,* and *Campylopus torfaceus.*

PAPER READ.

Mr. Alexander Macindoe read a paper on "Fungi." After a short introduction, he mentioned some of the properties of fungi, entering pretty fully into their useful and destructive characters. Besides the great number of those used as food we have some used for making ornaments—*e.g.*, the Green Oak of commerce, used for making Tunbridge ware. A species of *Coprinus* produces a good ink. The Fly Agaric, which possesses narcotic properties, is used in some countries for the purpose of intoxicating. Passing on to the destructive properties, we have the dry rot produced by the spawn of the fungus *Merulius lacrymans.* Next, we have the moulds of our food and clothes—the fungi which are supposed to be the cause of various infectious diseases, as cholera and thrush; the ergot of rye, caused by the fungus *Claviceps purpurea,* which produces such distressing symptoms on the person who by chance has taken it. And lastly, and perhaps most important of all, we have the potato disease produced by the fungus *Peronospora infestans.* The spores of this fungus at a certain season pass into the stomata of the leaves; it then sends its spawn down the stem into the tubers, producing that disease which has nearly ruined

our potato crop. Fungi have been found in very peculiar situations, such as in the eggs of birds, the seeds of plants, and the brains of animals. He then gave a short description of the more important and conspicuous groups—*Agaricini*, *Polypori*, *Hydnei*, *Auricularini*, *Clavarici*, and *Tremellini*. The paper was illustrated throughout with numerous diagrams and specimens. Among the specimens was a very large plant of *Polyporus betulina*. It may be mentioned here that Dr. Cooke, a great authority on the subject, says that fungi do not grow in winter. This cannot be the case, as most of the specimens exhibited were gathered in February, and were growing in profusion in Cadder Wilderness.

22nd February, 1876.

Mr. James Allan, Vice-President, in the chair.

SPECIMENS EXHIBITED.

By Mr. R. H. Paterson.—Some splendid specimens of corals, sponges, and Sertularidæ from New Zealand.

PAPER READ.

On Dipterous Gall-makers and their Galls. By Mr. F. G. Binnie.

Plants and animals, in addition to the ordinary and normal features of their growth, exhibit, not unfrequently, diseased enlargements and out-growths. These irregular and superinduced formations, according to the particular characters which they assume, are known as warts, excrescences, tumours, galls, and so on. That change of structure which is brought about by the puncture or irritation of some animal, usually an insect, is specifically known as a "gall."

I need scarcely remark that animals as well as plants are subject to galls; I will only instance the tumours produced beneath the skin of our domestic ox by the bots or larvæ of *Œstrus Bovis*, De Geer. These abnormal swellings have, however, in *animals* a very uniform character, and are generally included under the term "tumour;" the designation "gall" being more particularly and usually applied to the diseased structures produced on *plants*. In such restricted sense I use it in this paper.

Taking a general survey of the animal kingdom, we find gall-makers are confined to the sub-kingdom Arthropoda, and, with the exception of certain mites (*Acaridæ*), belonging to the class Arachnida (spiders), to the Insecta. Most of the orders of insects possess gall-makers, but it is in the Hymenoptera and Diptera that we get the gall-makers *par excellence*. In the rest, gall-making exists only as an accidental feature found solitarily here and there throughout the orders; the Homoptera (which includes the Plant-lice) showing perhaps, like the *Acaridæ*, a tendency to aggregation.

Each of the two orders just cited possesses a group or family in which gall-making forms a prominent and characteristic feature, and is the mode of life of the majority of its component species. These two families are the Cynipidæ among the Hymenoptera, and the Cecidomyidæ among the Diptera. For an account of the former I cannot do better than refer you to the paper on the Scottish species by Mr. P. Cameron, junr., published in the second part of our "Transactions" (Session 1873-74). The Cecidomyidæ I propose to consider in this paper.

It may be well to preface my observations with a few very brief remarks on the position of our group.

The Diptera are known at once from all other insects by having *two* wings instead of *four*, the posterior pair being represented by peculiar clubbed appendages termed *haltêres* or balancers.

The larvæ of Diptera may be broadly arranged into two groups by the mode of pupating. In the one the larva changes to a pupa *inside* the larval skin, which hardens and becomes a compact and more or less sculptured case, protecting the pupa which lies free inside; this case receives the name *puparium*. In the other group the larval skin is cast off, and does not become a *puparium*, the pupa being completely swathed in a thin horny envelope, as we see in the pupa of most insects, for example that of any moth. Upon the manner in which the perfect insect emerges from the pupa are founded the two sub-orders into which the Diptera are divided.

The *Orthorhapha* split the encasing membrane in the form of a longitudinal or T-shaped dorsal fissure. The *Cyclorhapha* emerge by pushing out the end of the *puparium* as a round lid-like valve.

The larvæ of the sub-order Cyclorhapha do not possess a differentiated head, and the mouth organs are represented by a pair of

hooked mandibles. The maggot of the common Blue-bottle or Blow-flies (*Musca erythrocephala* and *vomitoria*) may be taken as good examples of this type. In the Orthorhapha, on the contrary, we have a larva with a more or less well differentiated head, often bearing antennæ; a good example is that pest of pasture-land—the "grub" of the farmer, the larva of the Crane-fly, for an account of whose ravages I will refer you to Kirby and Spence's "Introduction," a book which ought to be in the hands of every one who desires to know something about our common insects.

In the perfect or *imago* state the two sub-orders possess good characters, but these are of too technical a nature to interest any but the specialist.

The Orthorhapha are subdivided into two groups, the Nematocera and the Brachycera. The first is distinguished from all other Diptera by having antennæ with at least six joints—generally many jointed. Other Diptera possess only three-jointed antennæ, in some the terminal joint is subsegmented so as to give *apparently* six or more joints. The *Nematocera* includes, besides the Cecidomyidæ or gall-midges, the gnats, crane-flies, and many others.

The more salient characters upon which the family Cecidomyidæ is founded are: wings without *alulæ*, with one transverse and three to five longitudinal nervures; margin of wing fringed, and the surface hairy. *Alula* is that false winglet which is found at the base of the wing of the common house-fly and others.

To Meigen is due the credit of bringing order into the chaos of scattered observations on gall-midges. In the first volume of his "Diptera of Europe," published in 1818, he formulated the characters of the group, which he divided into three genera—*Cecidomyia*, *Lasioptera*, and *Campylomyza*. Several genera have been added since, and Meigen's *Cecidomyia*, the principal genus, is now split up into a number of genera.

The gall-making larva of a *Cecidomyia* has a very characteristic and constant shape, sharply tapering to the head and truncately rounded behind. It is divided into fourteen segments; the head is small, bearing a pair of antennæ; eyes on the third segment; and has nine pairs of spiracles, one on prothoracic segment or that next to the head, and a pair on each of the first eight abdominal segments.

Not all the larvæ of the *Cecidomyidæ* are gall-makers. Some live free under the bark of trees, among rotten wood, or as inqui-

lines in galls formed by other animals. But all, so far as is known, feed on vegetable matter, and there are no examples of species which feed upon the substance of other insects, as we find in the Hymenopterous *Cynipidæ*, species of which are parasitic upon the true gall-makers of their own group and in some instances upon other insects. Certainly we find Cecidomyious larvæ inhabiting galls not formed by them, but by mites, as, for example, the larvæ of *C. peregrina*, Winn., found in the woolly mite-galls on *Thymus serpyllum;* these have been observed to lick eagerly the secretions or excretions of their hosts, but no evidence has been found—the dried skins of mites, for instance—to show that they ever devoured their hosts.

I cannot leave this part of my subject without referring to a remarkable discovery made in the summer of 1861 by Professor Wagner of Kasan, that of the asexual reproduction of the larvæ of a Cecidomyid which lived gregariously beneath the bark of a tree. Inside certain of these larvæ germ-cells were formed, from which larvæ were developed—a number in each parent larva. These lived upon the tissues of their host and in due time emerged from what had at last become an empty skin, giving birth in their turn to other larvæ; until the cycle was completed by the larvæ becoming pupæ and producing the perfect insect, which laid properly fertilized eggs, the larvæ from which would in their turn reproduce in this asexual way for a period. Pagenstecher, Meinert, Ganine, and Von Baer have confirmed it. For details I would refer you to the abstracts which appeared (with illustrations) in the "Annales des Sciences Naturelles" for 1865. Grimm has recorded similar facts in the pupa of a gnat, *Chironomus sp.* We have here an example of what has been termed by Steenstrup "Alternation of Generations"—a form sexually producing an unlike form, which reproduces itself asexually, ultimately completing the cycle by assuming the first form. This reproduction in the preparatory stages of development has received from Von Baer the designation of "Pædogenesis."

It may be interesting to mention here that the once dreaded Hessian-fly is a Cecidomyid, very aptly named by the American entomologist Say, *C. destructor.* For an account of its habits I must again refer you to the pages of Kirby and Spence.

The larva of the *Cecidomyidæ* assumes the pupa state sometimes within the gall, but often leaving it and entering the ground; and

with or without spinning a cocoon. The pupæ of those species which pass that state inside hard galls, for example *C. Salicis,* are provided with a tooth-like process at the root of each antenna by means of which they force their way out, when about to assume the perfect state.

Having treated of the Insect—the gall-maker—I now turn to its production the Gall. This I described as that change of structure brought about by the puncture or irritation of the gall-maker.

The Cynipidæ and Cecidomyidæ seem broadly and markedly contrasted in the making of the gall. In the Cynipidæ the gall is formed—often fully developed—before the egg is hatched. In the Cecidomyidæ it is very different. The eggs are deposited deep down in the interstice between leaf-stalk and stem, or other sheltered nook; here it is hatched and sometimes has to travel to the seat of its operations, but no gall is formed by the parent-fly; it is due to the irritation of the larva itself, which thus builds its own dwelling.

The irritation of the larva takes effect in one or both of two ways. It excites abnormal activity in the formative powers of the plant at the place affected, resulting in a thickening or enlargement of the parenchyma, an increased fleshiness; or in the excessive development of such epidermal appendages as hairs; or in regular outgrowths. Secondly, it causes an arrestment of growth in certain directions.

We may classify galls according to the part of the plant upon which they are found; upon the root, stem, bud, or leaf. Bud galls we may divide into terminal, axillary, and flower-bud galls. Leaf galls we may divide into leaf-rollers, leaf-folders, and leaf galls proper.

I have paid some attention to the dipterous gall-makers of the Glasgow district, but as in many cases I have not been able to rear the maker of many galls I have met with, I have thought it better to give here a list of the *galls* only, taking the plants in their botanical order, and leaving any detailed account of the *makers* till a future occasion when my material is more complete. This list will serve another purpose, in drawing the attention of the botanical members of our Society to the subject. I shall be only too glad to receive any galls they may meet with in their searches for plants, especially any found upon the Carices and Grasses and also upon the Cruciferæ and Umbelliferæ.

Viola canina, L.—Margin of leaf towards base involutely rolled, and becomes fleshy and purplish-red in colour. Near Milngavie, in September, empty. Mr. Traill (Sc. Nat., I. 124) found dipterous larvæ inhabiting the rolls. Perfect insect unknown.

Lychnis diurna, Sibth.—Calyx slightly inflated at base. A number of larvæ live at base of corolla between it and the calyx. Kenmuir Bank, September. Perfect insect unknown.

Cerastium viscosum, L.—Terminal internodes not developed and leaves become fleshy at base; each gall contains a number of larvæ. Possil Marsh. Perfect insect unknown. Mr. Traill describes similar galls on *C. glomeratum*.

Ulex Europæus, L.—Gall formed of the two sepals of flower-bud, inner whorls having disappeared. It becomes very noticeable when the period of flowering has passed, from still retaining the appearance of an unopened flower bud. Each gall contains one larva of *Asphondylia Ulicis*, Verrall, which passes through its transformations within the gall. I have found it commonly at Milngavie and on the Kilpatrick Hills.

Sarothamnus scoparius, Winn.—Axillary, being altered leaf-bud, elongate with toothed apex, throat leading to cell lined with dense white interlocking pubescence. The cell at base thin-walled, and containing one larva of *Asphondylia Sarothamni*, Loew., which leaves the gall to undergo its transformations. I have found this gall on the broom wherever I have looked for it, Tollcross, Milngavie, &c.

Trifolium repens, L.—Folded leaflet; one, two, or all of leaflets may be affected. Each leaflet is inhabited by one larva—the part adjoining mid-rib becoming swollen and fleshy, often tinged with reddish outside. Common at Possil Marsh, New Kilpatrick, &c. Perfect insect unknown.

Lotus corniculatus, L.—Terminal aborted shoot, forming tuft of leaves, inhabited by a number of larvæ. Near Lambhill in August.

Vicia Cracca, L.—Folded leaflet which becomes fleshy and in time turns reddish in colour. Generally most or all of the leaflets of a leaf are affected, the whole forming a cluster not unlike that of a mass of flower buds. Near Milngavie, &c., common. It is the work of *C. Onobrychidis*, Bremi. Mr. Traill describes also similar galls on *V. sepium* and *sylvatica*, *Lathyrus pratensis*, and *Astragalus hypoglottis*, all probably produced by the same species.

Spiræa ulmaria, L.—Leaf gall, several on each leaf, hemi-

spherical on upper surface, produced into a cone on under surface of leaf. Each gall contains one larva of *C. Ulmariæ*, Bremi. Near Milngavie and other localities.

Rosa canina, L.—Folded leaflet, generally a number in same leaf affected; each leaflet adjacent to mid-rib becomes inflated, forming one, two, or a series of partial cells, each containing one larva of *C. Rosæ*, Bremi. Mr. Traill has observed similar folded leaflets formed by the same insect on *R. villosa*. It is common at Possil Marsh, Milngavie, &c.

Cratægus Oxyacantha, L.—Galls terminal, consisting of a tuft of leaves twisted and curled up with strong green hairs, having reddish rounded or slightly bulbous tips, developed on both surfaces. Each gall contains a number of larvæ of *C. Cratægi*, Winn. Common everywhere.

Galium verum, L.—I have observed five distinct forms of galls on this plant, all possibly the work of one species, the difference being due to its situation on the plant: (1) Situated in axil of whorl, as they enlarge bending down the leaflets, varying in form and figure from a small globular mass situated in axil of one of leaflets, or two placed opposite to each other, to three or more completely encompassing stem, divisions being indicated by more or less distinct grooves; in some a flattened globular mass without any trace of grooves. Several narrow slit-like depressions become visible as the gall matures, which open for escape of larvæ when full grown. Colour pale green with reddish brown cheeks, and surface granular, shining, slightly pubescent, especially in vicinity of clefts. (2) Terminal; a compact mass of overlapping, more or less fleshy leaves, reddish in colour. (3) A terminal spirally twisted tuft of leaves. (4) A projection from the stem—sometimes two opposite—generally immediately above a whorl, conical, laterally flattened, with apex flexed sometimes upwards, at others downwards. They are monothalamous; all those I have seen were empty, but Mr. Traill has found a Cecidomyious larva in them. (5) A flower bud becomes swollen and fleshy, conspicuously larger than the rest in the panicle. Internally it is monothalamous, without a trace of corolla, stamens, &c. It is not described by Mr. Traill. I have taken all these galls in one bed of the plant near Craigmaddie. No. 1 is formed by *C. Galii*, Winn.

Galium palustre, L.—A terminal, occasionally axillary, compact globular mass of altered leaves, not unlike, in external appearance,

the fruit of a *Stellaria* or other Caryophyllaceous plant. Each gall contains one or more larvæ. At Possil Marsh. Perfect insect unknown.

Scabiosa succisa, L.—Mr. Cameron informs me that he has observed, on this species at Cadder, an axillary gall very similar to that found on *Achillæa Millefolium*. I have not seen it.

Hieracium Pilosella, L.—Margin of leaf involutely rolled, and on its inner face the usual long hairs of upper surface are, by irritation of larva, modified into a more or less dense pale white pubescence about one-sixteenth of an inch long. Perfect insect unknown. I have only observed this gall near Craigmaddie.

Achillæa Ptarmica, L.—(1) A compact, terminal, globular, or oval mass of swollen, often fleshy, imbricated leaves, and of a more or less pink or red colour. Each gall contains a number of larvæ of *C. floricola*, Winn. (2) Axillary, an altered leaf-bud similar to that on the broom, more or less reddish in colour when mature; monothalamous, containing a single larva of probably the same species as No. 1. Both forms are common at Possil Marsh.

Achillæa Millefolium, L.—Generally situated low on stem, but in one case a group of them occurred just below flower heads. Axillary, sessile; irregularly rounded or egg-shaped; smooth, glossy, green, brown, or purplish red; and splits open at apex into several blunt points which curve outwards for escape of insect; the exposed surface green, tomentose with white hairs down to throat. Monothalamous, walls fleshy, containing one larva of *C. Millefolii*, Loew. Possil Marsh and Milngavie.

Campanula rotundifolia, L.—Terminal cluster of leaves whose bases have become fleshy; colour green. Produced by *C. Campanulæ*, Müller (?). Near Craigmaddie.

Veronica Chamædrys, L.—Terminal, globular or egg-shaped mass of imbricated leaves, swollen out and covered with a dense woolly pubescence. In the axils of each leaf live a number of larvæ of *C. Veronicæ*, Bremi. This is a common and very generally distributed gall.

Nepeta Glechoma, Benth.—Leaf gall, a number on the upper surface of each leaf; oblong, cylindric, and green, covered with a hoary pubescence. The gall is monothalamous, thin walled, containing each a single larva of *C. bursaria*, Bremi. At Kenmuir Bank and the banks of the Kelvin.

Polygonum Persicaria, L.—Mr. Cameron has observed, by the banks of the Kelvin, the rolled and swollen margins of the leaves of this plant produced by *C. Persicariæ*, L. I have not met with it myself.

Urtica dioica, L.—The galls of *C. Urticæ*, Perris, are very common at Carmyle, Milngavie, and other localities. They are leaf galls, appearing as irregular swellings of mid-rib and principal veins of leaf, mainly on under side of leaf showing but little above upper surface.

Salix Caprea, L., and *cinerea*, L.—(1) Leaf galls, occurring a number on each leaf on mid-rib and principal veins, separate or often more or less coalescent. Each gall is monothalamous, woody, hemispherical above and conical beneath ; the larva emerging when mature by apex of cone. These galls are produced by *C. Capreæ*, Winn. Common in Cadder Wilderness. (2) Swelling of the stem, generally more or less globular, each gall being inhabited by a number of larvæ of *C. Salicis*, Schrank. Possil Marsh, Carmyle, &c. (3) Rosette galls or Willow-roses. A terminal compact cluster of leaves, imbricated, and leaving a central cell inhabited by a single larva of *C. rosaria*, Loew. Cadder Wilderness and the Kilpatrick Hills.

Salix viminalis, L.—Folded margin of leaf, the work of *C. marginemtorquens*, Bremi. Found at Carmyle.

Fagus sylvatica, L.—Leaf galls, a number on the upper surface of each leaf. Cylindrico-conic, pubescent, showing on under surface only as a slight arching of the epidermis. Monothalamous, thin walled, each containing one larva of *Hormomyia piligera*, Loew. Common in Cadder Wilderness.

Pteris aquilina, L.— Rolled margin of leaflets, which changes from green through brown to black, inhabited by the larvæ of *C. Pteridis*, Müller. Very common on the moors in the neighbourhood of Milngavie, and probably wherever looked for.

This completes the list of galls formed by Cecidomyidæ which, up to the present time, I have found in the Glasgow district. It is small, but I hope considerably to increase the number during present and coming seasons.

Outside the Cecidomyidæ the only Dipterous gall-maker which I have noticed in this district is the larva of one of the Muscidæ which lives in gall-like, curled-up, and distorted tips of the fronds of *Aspidium Filix-mas* and *Asplenium Filix-fœmina*. It is not

uncommon in Cadder Wilderness during June and July, but I have not been able to rear the perfect insect.

I would like to offer one remark upon such galls as those just mentioned, and all cases of rolled and folded leaves or their margins, and the superficial resemblances which they bear to similar rollings and foldings formed by Lepidopterous insects like the Tortricidæ; for I believe them to be formed in completely different ways. With the Lepidoptera the leaf is rolled or drawn, and held together by silken threads spun by the larva. With the Cecidomyidæ it is, I think, due to an arrestment, partial or complete, of the unfolding of the young leaf, brought about in some way by the larva. Certainly, so far as my observations go, they do not draw together the parts of the leaf with threads of silk like the Lepidoptera. All the galls which I have examined bear out the supposition, and are plainly the retention, more or less, of the foldings they had in the bud or when unfolding. Take the rolled margins of the leaves of the *Viola canina* and *Hieracium Pilosella:* in the unfolding bud they are naturally rolled involutely; and the leaf of *Salix viminalis* has a folded margin when young. Again, all examples of folded leaflets as the clover, wild rose, &c., are so folded in the bud. I think it right to mention that Mr. Müller ("Ent. Mo. Mag." VII. 88) states that he found eggs in certain folds of oak leaves. This seemingly militates against the supposition that the *larva* causes the arrestment. I therefore at present merely throw it out as a suggestion. Possibly also the Lepidopterous larva may have the faculty of arresting the unfolding in addition to its usual methods.

As to the rearing of the insect from the gall and its preservation for the cabinet, the suggestions given by Mr. Cameron in his paper on the Cynipidæ apply equally to the Cecidomyidæ. The perfect insects, however, appear sorry objects in the cabinet, their bodies shrivelled up, often with their colours gone or changed into uniform browns or blacks—mere shadows of their former beauty. This necessitates descriptions of the midge to be made while in a fresh state, those taken from the dried insect being almost, if not altogether, valueless. To the intending student of the Cecidomyidæ the following works are indispensable:—Bremi, "Beiträge zu einer Monographie der Gallmücken," 1847; Loew, "Die Gallmücken," 1850; and Winnertz, "Beiträge zu einer Monographie der Gallmücken," 1853.

English writers are few and their observations scattered. There is a list of British gall insects (of all orders) by Mr. Müller in the "Entomologist's Annual" for 1872, and also an admirable series of papers on Scottish galls which appeared in volumes I. and II. of the "Scottish Naturalist," from the pen of Mr. J. W. H. Traill, M.A., to which I have more than once referred in the course of my paper. Scattered notes, principally by Mr. Müller, are to be found in the "Entomologist's Monthly Magazine," and also some observations by Mr. Inchbald in the extinct "Entomologist's Weekly Intelligencer."

7th March, 1876.

Mr. James Allan, Vice-President, in the chair.

SPECIMENS EXHIBITED.

By Mr. Adolf Schulze.—A portion of a log of Walnut in which some large larvæ had been found,and also the larvæ themselves.

Mr. R. H. Paterson explained by a diagram the arrangement of the organs of a plant, *Aristolochia Thwaitesii*, which were formed for the prevention of self-fertilisation.

PAPERS READ.

Mr. W. J. Milligan read a paper on "Some of the Flowers mentioned by Shakspeare." The object of the paper was to point out that scientific workers generally, in their papers read before mixed audiences, are apt to be too technical, and to appeal only to the colder intellectual faculties. The essayist pled for a more enlightened and a broader method of treating scientific subjects; that scientific writers in their popular papers should try to educate the imaginations of their hearers and so attract them to a study of nature. He asked men of science not to be content with an isolated description of a bare fact, but to place it before his audience in its relations with other things. As an illustration of the poetical method of treating botanical facts, he selected passages from Shakspeare, and entered upon the legendary plant lore. He also pointed out the desirability of at least indicating the meaning of technical terms with which only a specialist may be supposed to be acquainted, and the pleasure to be derived from tracing the

etymology of the names of plants. By the introduction of similar methods into scientific papers they might be made more pleasant to the reader and far more profitable to his audience.

Foreign Lichens. By Dr. James Stirton.

Schistophoron tenue; Gen. novum.

Thallus pallide cinereus pulverulentus tenuis; apothecia in verrucis firmulis convexis rotundatis, oblongis interdum curvulis, extus albido-farinaceis inclusa (longit. ·3 – 1·6 mm., latit. circiter ·3 mm., altit. ·3 mm), epithecio a massa sporali substituto, extus lineari nigro (longit. ·25 – 1·4 mm., latit. circiter ·03 mm.); sporæ 8næ primo incolores dein fuscæ et nudæ, 4-loculares (loculis mediis sæpius semel divisis), ·012 – ·018 × ·008 – ·01 mm.; paraphyses graciles parcæ. Gel. hym. (sin ulla) iodo haud tincta.

Ad corticem lævem prope Bonny River in Africa occid., lectum a Mr. Grant.

This genus is allied to *Tylophoron* but is distinct in the elongated thread-like apothecia, and in the constitution of the spores. It bears nearly the same relation to *Chiodecton* as the sessile forms of *Tylophoron* to *Thelotrema*.

The following lichens are due to the kindness of the late Rev. G. Brodie, of the Port of Spain, Trinidad, who, amidst the multifarious duties of his profession often diverged from his route to spots where such minute plants were likely to grow. Had he been spared it is more than probable that I should have been favoured with many such packages of the crustaceous lichens, for, without any discriminative knowledge of the subject, he yet had a natural aptitude and love for studies of a kindred nature.

Lecidea gerontoides, sp. nov.

Thallus cinereo-virescens vel cinerascens, minute rimuloso-areolatus vel nonnihil granulatus, tenuis nigro-limitatus (C flavens, vel K—C flavens); apothecia sessilia sæpe aggregata, parva vel mediocria (latit. ·3 – ·8 mm.), epithecio plano cæsio-pruinoso (pruina C flavente), margine nigro prominulo sæpe undulato; sporæ 8næ fuscæ oblongæ 1-septatæ, ·014 – ·017 × ·0045 – ·006 mm.; paraphyses pellucidæ graciles satis bene distinctæ, apicibus fusco –

nigris (K flavo-dissolutis); hypothecium fusco-nigrum. Iodo gel. hym. intense cœrulescens.

Ad cortices prope Port of Spain.

Lecidea remensa, sp. nov.

Thallus glaucus vel glauco-virescens crassiusculus, rugulosus vel potius squamuloso-concretus nigro-limitatus (K— C—), medulla alba (K fl. dein rubente); apothecia adnata nigra parva (latit. ·3 – ·4 mm.) marginata dein convexula et immarginata; sporæ 8næ fuscæ ellipsoideæ 1-septatæ, ·012 – ·015 × ·006 – ·007 mm.; paraphyses graciles non bene discretæ pellucidæ vel pallidæ fusco-clavatæ; hypothecium fuscum. Iodo gel. hym. intense cœrulescens fere nigra.

Ad cortices.

This lichen presents, on the one hand, affinities to *L. glauconigella*, and, on the other, to the genus *Pyxine*, the barren thallus of a species of which is often seen contiguous to it.

Platygrapha psaroleucoides, sp. nov.

Thallus albido-glaucescens vel pallidus, crassiusculus, rimuloso-areolatus nonnihil rugulosus et farinaceus nigro-limitatus (K—, C erythrinosus); apothecia lecanorina albido-suffusa, prominula, plana, rotundata vel nonnihil irregularia, margine distincto discisso lævigato cincta (latit. ·5 – 1·0 mm.); sporæ 8næ in thecis pyriformibus arthonioideis, incolores obtuse fusiformes sæpe curvulæ 3-septatæ, ·024 — ·032 × ·005 — ·007 mm.; paraphyses distinctæ filiformes divaricato-ramosæ nonnihil irregulares, apicibus incoloribus non-clavatis: hypothecium crassum fusco-nigrum (in lamina tenui visum). Iodo gel. hym. vinose rubescens.

Ad cortices læves.

This curious lichen has a close affinity to *Pl. psaroleuca*, but differs, *inter alia*, in the much shorter and thicker spores.

Platygrapha punctella, sp. nov.

Thallus chrysogonidicus albidus tenuis nonnihil rimuloso-areolatus, sæpius interruptus aut dispersus; apothecia in verrucis depressiusculis immersa, nigra punctiformia, sæpius seriatim disposita vel collabentes; sporæ incolores fusiformes sæpe curvulæ 3-5-septatæ (septulis valde indistinctis), ·028 — ·04 × ·0035 — ·0045 mm.; paraphyses satis bene distinctæ irregulares, apicibus

incoloribus; hypothecium rufo-fuscum vel pallide fuscescens. Iodo gel. hym. leviter cœrulescens (præsertim partis inferioris hymenii) dein vinose rubens. Corticola.

Arthonia neuridella sp. nov.

Thallus pallidus tenuis (K fl. dein lente fulvescenti-rufus): apothecia sessilia fusca concava oblongo-linearia, recta vel undulata (longit. usque 1·5 mm., latit. circiter ·2 mm.), margine thallino inflexo crassiusculo lævigato cincta et margine proprio tenui laterali; sporæ incolores oblongæ vel fere cylindraceæ sæpe curvulæ simplices, ·008 — ·01 × ·0025 mm.; paraphyses graciles indistinctæ, apicibus fuscescentibus; hypothecium incolor. Iodo gel. hym. cœrulescens (saltem leviter) dein bene vinose rubens. Corticola.

The generic place of this lichen is doubtful, inasmuch as the spores are not matured. It may be referable to the genus *Lecanactis*, but as the latter is very vaguely defined I prefer classifying the lichen as above, more especially as the thecæ are arthonioid. The paraphyses are rendered distinct by K when they are seen as closely set anastomosing slender fibres.

Parathelium Brodiei sp. nov.

Thallus hypophlœodes vel macula pallescente vel pallide rufescente indicatus: apothecia hypophlœodea demum subnuda et prominula (vel partim pellicula epidermidis obtecta), perithecio integre nigro, papilla ostiolari laterali thallodea pallida aut fuscescente: sporæ (4—8)næ incolores demum fuscescentes oblongæ vel oblongo-ellipsoideæ, murali-divisæ aut 7-9-loculares (loculis 2-3 divisis), ·03 — ·042 × ·011 — ·018 mm.: paraphyses distinctæ filiformes. Corticolum.

Parathelium nidificans, sp. nov.

Simile præcedenti sed thallo nonnihil pallidiore et sporis incoloribus dein fuscescentibus 4-locularibus (sicut in V. nitida), ·014 — ·021 × ·008 — ·011 mm. Iodo gel. hym. interdum hinc inde obsolete cœrulescens dein flavescens. Corticolum.

Affine P. induto (Nyl.) sed sporis multo minoribus, &c.

The following curious lichen was communicated by Mr. Paterson of this city, to whom it was sent by Mr. A. Raff, of Brisbane, Queensland.

Lecidea Raffii sp. nov.

Thallus pallide cervinus vel pallide rufescens, rugulosus nonnihil granulatus, tenuis indeterminatus (K flavens dein aurantiaco–rufus, demum rufus); apothecia innata nigra plana, rotunda vel oblonga, interdum nonnihil irregularia, immarginata, intus pallide fuscescentia; sporæ 8næ incolores aciculares 7-17-septatæ (et ultra), ·045 — ·08 × ·003 — ·0045 mm.; paraphyses mediocres, haud distinctæ apicibus fuscescentibus; hypothecium fusco-nigrum vel rufo-nigrum, crassiusculum. Iodo gel. hym. cœrulescens (saltem leviter), thecæ interdum fulvescentes. Corticola.

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OF

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TRANSACTIONS

OF THE

GLASGOW SOCIETY OF FIELD NATURALISTS.

ANDERSONIAN UNIVERSITY.

21st March, 1876.

The Annual Business Meeting of the Society was held here this evening—Mr. James Allan, Vice-President, in the chair. A copy of the Transactions of the Dresden Naturalists' Club was laid on the table.

The Secretary read a summary of the work done by the Society during the past year, from which it was evident that the members took a considerable amount of interest in their different departments, and that the number of members had largely increased, no fewer than eighteen gentlemen having been added to the roll. Regret was expressed at the absence of two valuable members, Messrs. Watt and Watson, who had left this country for India, but it was hoped that records of their work in their new sphere would yet be received. The following gentlemen were then elected to office:—James Stirton, M.D., F.L.S., *President;* J. Harvie and W. J. Milligan, *Vice-Presidents;* R. H. Paterson, F.C.S.S., and J. Renwick, *Secretaries;* George Barlas, *Treasurer;* W. D. Benson, *Curator;* Alex. Noble and Arch. Fawcett, *Members of Council.*

4th April, 1876.

The first meeting of the Summer Session was held this evening—Mr John Harvie, Vice-President, in the chair.

EXCURSION.

High Blantyre.—Mr. W. J. Milligan reported that most of the

commoner fossils and several of those peculiar to the district had been found.

SPECIMENS EXHIBITED.

By Mr. W. J. Milligan.—Specimens of *Productus spiriferus* and *P. longispinus*, the latter showing the spines very well.

By Mr. F. G. Binnie.—A large collection of insects.

PAPER READ.

Mr. James Allan gave a sketch of the life of Karl Linnaeus, the Swedish botanist, and read some extracts from his works. Linnaeus was born on the twenty-fourth of May, 1707, his father being a clergyman in Smalund. From his father he received a taste for the study of Natural History. So backward was he at school that his father was advised to make him a shoemaker. Notice was taken of his early struggles with poverty, often mending his boots with brown paper; his travels in Germany, Holland, France, and England, and his meeting with Dillenius in England. After his return home his life was a continual series of successes. He was made a Professor, then a Knight of the Polar Star, then a Baron, enjoying an intimate friendship with the king and queen, and was so admired by the people that when he and his students were returning from Botanical excursions they were met by the citizens of Upsala with bands of music, as if they had been conquerors.

He found Natural Science in great confusion, without arrangement or system, and left order and system in every branch. Besides Botany, he made Conchology a science, and it has remained till now almost as he left it. He was assisted by his students, who travelled all over the world, and sent him reports. He was much beloved for his amiability of character, and acted up to his motto, "Famam extendere factis." He died in 1778, aged 71.

18TH APRIL, 1876.

Mr. W. J. Milligan, Vice-President, in the chair.

Messrs. David Wood Inglis, M.A., Biggar; John Harrison, Lesmahagow; and Robert M. Cairney, 47 Scott Street, were elected members of the Society.

At this meeting it was resolved that the Society get up lists of the Botany, and as far as possible of the Zoology of the West of Scotland, in view of the approaching meeting of the British Association to the city.

SPECIMENS EXHIBITED.

By Mr. R. H. Paterson.—Several very rare Lepidoptera from Australia, which had been sent by Mr. Alexander Raff, of Brisbane, Queensland, among which were four specimens of *Heteronympha mirifica*, one of the rarest insects found in Australia. There is only half a specimen of this species in the British Museum. There were also specimens of *Papilio Ulysses*, *Mynes Geoffroyi*, and *Delias musus*.

By Mr. Thomas King.—The beautiful fungus *Peziza coccinea*, from Innellan.

By Mr. James Allan.—*Claytonia virginica* and *Eugenia bulbosa* from Kentucky, sent by Mr. Williamson, a corresponding member.

EXCURSION.

Kenmuir and Carmyle.—Mr. Allan reported that at this excursion the usual spring flowers had been found, but none of them were rare enough to be worth recording.

PAPER READ.

Mr. R. H. Paterson read a paper "On the prevention of self-fertilisation of plants."

He drew attention to the fact that similar arrangements were found among plants that were not otherwise closely related. Thus, in the *Primula vulgaris* and *Linum grandiflorum*, we had what was termed a dimorphic arrangement of the male and female organs. In the natural orders, *Orchidaceae* and *Asclepiadaceae*, we had the pollen in masses, springing from a more or less viscid disc, which adhered to the bodies of insects when they visited the flowers. In *Erica* and *Streptocarpus* we had the pollen contained in little boxes, which opened and let fall a shower of pollen when certain parts of the flower were touched. In *Aristolochia Braziliense*, *Ceropegia elegans*, and *Arum maculatum*, we had what might be called a mouse-trap arrangement for the prevention of self-fertilisation. In *Ceropegia elegans* we had the floral envelopes united to form a tube-like corolla. This tube is narrow in the middle, and presents a large trumpet-shaped expansion at its upper end, while below it is dilated into a

little chamber, which contains the reproductive organs. The narrow part of the tube is beset with long stiff hairs, which point down like the wires of a mouse-trap, and give ready access to insects, but prevents their escape. Soon after this the hairs shrivel up and allow the insect to escape. The insect then flies to another flower with the pollen masses attached to its body, passes down the narrow tube as before, deposits some pollen on the stigma, and fertilises the plant. In order to prevent the same flower being visited twice, it is seen that after the pollen is shed the flower that was previously erect falls over and withers. In order to prevent large insects from alighting on the flower, the trumpet-shaped end is provided with long stiff hairs pointing out in all directions. In *Salvia pratensis*, the anthers, as they shed their pollen, shrivel up; and, on the other hand, the pistil increases in length, till it comes to block up the entrance to the corolla. The stamens here are reduced to two, and of those two only one half develops pollen. The barren half is widely separated from the fertile one by the connective. This connective rotates upon its axis upon the filament of the stamen. The lower lip of the corolla forms a good landing-place for insects, and the barren parts of the anthers block up the entrance to the corolla tube. To explain the fertilisation here, suppose an insect were to visit the flower in the male stage, it will, in pushing its head down the corolla tube, come in contact with the barren part of the anther, which, revolving upon its axis, will get pushed into the back part of the corolla, and the fertile half will at the same time be brought down upon the back of the insect, and brush its pollen on to the back of the insect. Now, suppose that the insect were to visit a flower in the female stage, where the pistil had elongated and curved round so as to block up the entrance to the corolla tube, the first thing that it would come in contact with would be the elongated pistil, and as its back and sides were dusted over with pollen, some of that pollen would be sure to be dusted on to the stigma, and so the plant would be fertilised. This last example is certainly the most wonderful arrangement for the prevention of self-fertilisation that is to be found in the vegetable kingdom. The paper was illustrated throughout by carefully-executed diagrams.

2ND MAY, 1876.

Mr. John Harvie, Vice-President, in the chair.

Mr. Hugh Reid was elected a member of the Society.

SPECIMENS EXHIBITED.

By Mr. James Allan.—A stuffed specimen of the Water Rail (*Rallus aquaticus*), which had been sent to the Society by a gamekeeper.

By Mr. John Harvie.—A new Geological Map of the Campsie district, which he described very minutely.

By Dr. Stirton, F.L.S.—Some new lichens which he received from Mr. R. H. Paterson. *Lecidea Raffii* (Strn.) new to science, called after Mr. Alexander Raff of Brisbane; and *Caenogonium implexum*, found for the first time in fruit. This lichen was at one time supposed to belong to the Algae, but now that the fruit had been found it had been classified among the Lichens.

Mr. W. D. Benson exhibited a number of butterflies from various parts of England, among which were specimens of *Colias edusa*, *Gonepteryx Rhamni*, *Apatura Iris*, *Papilio Machaon*, *Hipparchia Sewell*, and *Erebia cassiope*.

By Mr. Andrew A. Hogarth, M.A.—A number of spikes of *Typha latifolia*, gathered in a loch near Crieff. One of the specimens was converted into a double spike.

Mr. R. H. Paterson gave an account of an excursion to Ardrossan. On visiting the remains of the "Chusan," he had found two species of the barnacle clinging to the wreck, *Balanus Scoticus* and *Pentalasmis anatifera*. Five different species of star-fish were found, one being rather rare. Several species of Sertularians were gathered (including some extremely rare forms), also fine specimens of the cow's-pap, *Alcyonium digitatum;* and the sponges, *Halichondrica panicea* and *H. incrustans*. Large quantities of the spawn of a species of Doris were found hanging from the under surface of the rocks on the Horse Island.

By Mr. Taylor.—Fossil teeth and vertebrae of *Rhizodus Hibbertii*.

By Mr. Thomas King.—*Hypnum Schreberi* in fruit from Innellan. This moss was very rarely gathered in fruit till within the last few years. Each year it is becoming more plentiful, however.

By Mr. Richard M'Kay.—A fine skeletonised specimen of the

common cucumber (*Cucumis sativus*), which showed the fibro-vascular bundles.

By Mr. J. Renwick.—A number of fossils from High Blantyre, among which were specimens of *Stenopora tumida, Archœopora nexilis, Edmondia rudis, Productus longispinus, Athyris ambigua, Macrocheilus acutus,* and the vertebrae of *Palaeoniscus.*

EXCURSION.

Brother Loch.—Mr. James Allan stated that nothing of interest was found except the somewhat rare plant *Chrysosplenium alternifolium.* Great numbers of the eggs of the common lapwing (*Vanellus cristatus*) were found on the moors near the loch.

16TH MAY, 1876.

Mr. W. J. Milligan, Vice-President, in the chair.

SPECIMENS EXHIBITED.

By Mr. Richard M'Kay.—A number of fine plants of the Blaeberry *(Vaccinium Myrtillus)* gathered at the excursion to Lochwinnoch, which had nearly all their flowers bitten by insects, to enable them to get access to the nectar.

By Mr. J. Harrison.—A number of uncommon *Hepaticae* from the neighbourhood of Lesmahagow, including *Lepidozea reptans, Fegatella conica, Sphagnaecetis communis, Scapania planifolia,* and *Pellia calycina;* also some species of the very rare fungus *Polysaccum olivaceum* from the Roman Bridge near Bothwell.

By Mr. R. H. Paterson.—A curious variety of the Fern *Pteris aquilina,* which he had named variety *gracile.* This fern was found two years ago near the foot of Glen Rosa, Arran. He also exhibited a number of nature-printed ferns, mosses, and liverworts which had been done by himself. One specimen of *Asplenium bulbiferum,* bringing out the remarkable characters of the plant very well.

By Mr. Alexander Noble.—Several rare butterflies gathered by himself in Arran, among which were *Vanessa Io, Vanessa cardui,* and *Chortobius davus.*

By Mr. James Allan.—The spawn of the fresh-water mollusc *Limnaea peregra.*

A copy of the "Transactions of the Norwich Field Naturalists' Club" was laid upon the table.

EXCURSION.

Lochwinnoch.—Mr. Thomas King mentioned that besides the commoner spring flowers there were found a few more rare ones, such as *Prunus Padus, Valeriana Pyrenaica, Chrysosplenium alternifolium, Trollius Europeaus,* and the fern *Cystopteris fragilis.*

Fin Glen.—Mr. W. J. Milligan said that at an excursion to Fin Glen he had found large quantities of Wilson's Filmy Fern, *Hymenophyllum Wilsoni.*

PAPER READ.

Mr. D. Gregorson read an interesting paper on a Ramble in the Kilsyth District. After discussing the general appearance of the country round about, he gave a short account of its history, with the various legends attached to some of the places. From the top of one of the hills in the district a very extensive view was got, parts of no fewer than sixteen counties being seen. Numerous plants of interest were to be found, such as *Paris quadrifolia* and *Cnicus heterophyllus.* The Carron Glen, in the neighbourhood, was said to be one of the best botanical stations in Britain, and would well repay a careful visit.

30TH MAY, 1876.

Dr. James Stirton, F.L.S., President of the Society, in the chair. Messrs. Lawrence Waddell, William Partington, John S. Jack, Alexander Hogg, George G. Gillon, Alexander Raff, Angus Campbell, Charles M'Kerrow, Donald M'Phail, and Alexander Kyle were elected ordinary members; and Mr. John Ross, Cape of Good Hope, the Rev. John Stewart, Ardrossan, and Dr. Watkins, Plymouth, were elected corresponding members.

SPECIMENS EXHIBITED.

By Mr. R. H. Paterson.—The moss *Leucobryum glaucum* in fruit from Ben Lomond, also several very rare fungi, among them being *Galera sparteus, Hydnum zonatum,* and *Cynophallus caninus.* He also exhibited several fungi new to Scotland, among them being

Dothidea sambuci, Labrella Ptarmica, Peziza palustris, P. rubella, Torula pinophila, Sphaeria fuliginosa, S. dryina, and *Macrospora scirpi.*

EXCURSION.

Finnich Glen.—Mr. M'Kay mentioned that nothing of interest was found at this excursion, with the exception of *Saxifraga granulata* and *Juniperus communis.*

Ben Lomond.—Mr. R. H. Paterson gave an account of an excursion to Ben Lomond, where he had found the moss *Leucobryum glaucum* in fruit. This is the first time it has been found in fruit in Scotland. He also found several rare fungi in the woods at the foot of the hills, such as *Polyporus perennis, P. variegatus, Hydnum niveum, Merulius aurantiacus, Tremella frondosa, Hymenochaete tabacina, Mitrula alba, M. cuculata, M. paludosa, Torula splendens,* and *Ascobolus subhirtus.*

PAPERS READ.

Mr. James Allan gave a short account of the arrival of some of our commoner birds for the last ten years, showing that although the seasons varied greatly the birds arrived about their usual time each year.

Dr. James Stirton, F.L.S., gave an account of some lichens which had been gathered by Mr. R. H. Paterson in Kilfinan last year. Among them he had found six species new to science, but which had yet to be named. There were also three species found for the first time in Britain, viz., *Squamaria chrysoleuca, S. lentigera,* and *Pertusaria velata,* also the rare lichens *Physcia chrysophthalma, Lecanora rubra, Placodium fulgens, Parmelia aleurites, Lecidea Hookerii, Verrucaria glabrata,* and *Dacampia Hookerii.*

Mr. W. D. Benson gave an explanation of a new method of mounting objects for the miscroscope. In illustration of his remarks he exhibited some beautifully prepared specimens.

Dr. Cunningham read a paper on the "Nervous System of the Cetacea." This class of animals belongs to the great order Mammalia, although believed by those who are uneducated to belong to the fishes from the general appearance of the body. Schwann first discovered that they were lung-breathing animals which suckle their young. He then gave a general sketch of the nervous system, reserving the peculiar distribution of the nerves of the tail till the end of his paper. The skin of most of the class is glistening and tough, and is wholly destitute of hairs. Hair in the form of

bristles on the lips is found on some. He then went on to describe the general anatomy, showing how well adapted the animals were for rapid motion in the water. The class is divided into two great groups, viz., the Whalebone Whales and the Toothed Whales. Examples of the first are found in the Greenland Whale and the Rorquals, and of the second in the Spermaceti Whale and the Dolphin. The spinal nervous system consists of a large cord contained in the canal formed by the vertebral column. It is protected from external injury by the neural arches and bodies of the vertebrae. The cord is bound in and supported in this canal. From the canal formed by the bones in this way we have a number of intervertebral foramina or holes for the transmission of the spinal nerves to the anterior and posterior surface of the body. The cord is surrounded by a peculiar tissue called the rete mirabile, consisting of a great number of minute anastomosing blood vessels. This peculiar tissue also partially surrounds the brain and medulla oblongata. The function of this membrane is to keep the parts of a uniform temperature, as it is a warm-blooded animal. There are two swellings at the parts of the cord which go to supply the caudal extremity and flippers or cervical and lumbar regions. The origin of these ganglia from the cord is by two roots, a superior and inferior, which pass out and enter the foramina. Then the superior swells out into a ganglion, and is then joined by the inferior. It then branches into two divisions, the one passing up, the other down. In the cervical region they are placed close together, the upper branches supplying the skin and muscles above, while the lower branches form the cervical and brachial plexuses. The dorsal nerves also branch into two, the superior supplying the skin and back, while the inferior supplies the ribs and abdomen, thus resembling other mammals. He then drew special attention to the peculiar provision for the supply of the four great caudal muscles. In the caudal region the superior division of the spinal nerves becomes united on each side into one great trunk for the supply of the superior caudal muscles, while the inferior divisions were similarly fused into two main nerves, which went to supply the inferior caudal muscles.

13TH JUNE, 1876.

Mr. W. J. Milligan, Vice-President, in the chair.

Dr. Cunningham, Edinburgh, was elected a corresponding member.

SPECIMENS EXHIBITED.

By Mr. Andrew A. Hogarth.—*Paris quadrifolia* from Lennox Castle woods, where it grows in thousands, also the very rare alga *Chaetophora elegans* from pools on the hills above Innellan.

By Mr. F. G. Binnie.—One of the land molluscs, *Vertigo edentula* (Drap.), which he had found near Milngavie. This is the first intimation of its existence in the district.

By Mr. J. Renwick.—*Linaria Cymbalaria, Brassica monensis,* and *Corydalis claviculata,* from Brodick, Arran.

By Mr. J. Harvie.—A number of interesting objects from Wemyss Bay, among which were *Alcyonium digitatum* and *Lima hyans.*

Mr. Adolf Schulze described a species of Polypus found at the excursion to Wemyss Bay. He exhibited a number of drawings in illustration of his remarks.

EXCURSION.

Wemyss Bay (Dredging).—Mr. Harvie said that owing to the large number of members who had turned out at this excursion they were divided into two parties, the one party dredging the ground below and the other the ground above Skelmorlie Buoy. Several interesting objects were found; for instance, some very large specimens of *Alcyonium digitatum,* popularly called Dead men's fingers, from its resemblance to the human hand, also several specimens of the Cloaklet anemone, *Adamsia palliata,* attached to the shell inhabited by the Hermit Crab, *Pagurus Prideauxii.* Large quantities of the nests of *Lima hyans,* with the mollusc inside, with several species of star-fish, were found.

PAPERS READ.

Mr. R. H. Paterson read a short paper on the "Metamorphosis of Plants." He divided metamorphosis into two classes, viz., Regular and Irregular. Regular or progressive metamorphosis is that which is observed constantly and gradually at work, from the development of the first seed leaves to the formation of the fruit, reaching higher and higher like the steps of a ladder through a series of changes to that crowning aim of nature, the propagation of plants by means of male and female organs. Irregular or retrogressive metamorphosis, on the other hand, is growing in a backward direction, for example, in the metamorphosis of a stamen into a petal. Here nature seems to relax and to leave her work in an

unfinished weakly condition, pleasing often to the eye, but intrinsically powerless and inactive. He then gave a short sketch of the development of our higher plants from the simple seed till it had developed into seed again, drawing particular attention to those cases where we had one organ forming another, for instance, a stamen forming a petal. In some plants we have the first seed-leaves simple and undivided; as we ascend in the development of the plant, the leaves gradually show a tendency to divide, till we get the perfect form of the leaf of that plant; as we ascend higher, these perfect leaves again turn to the simple undivided form, as in the bracts, and ultimately form a whorl of leaves outside the flower, as in the calyx, showing that all the various organs of plants are modifications of one and the same organ. This last transformation takes place sometimes very slowly, but at other times the stem at once shoots up from the node at which the perfect leaf was developed, terminating in a whorl of leaves collected round an axis. That these calyx leaves are in reality modified stem leaves, is proved by the occurrence of a number of leaves on some stems being found without the development of the nodes and forming a whorl round the stem. He next treated of the development of the corolla or inner whorl of floral envelopes. Here we have an expansion of the previously contracted whorl. Then we get the corolla gradually passing into the outer whorl of the reproductive organs or stamens; and lastly we have the pistils or inner whorl of reproductive organs formed from the stamens. In illustration of his remarks Mr. Paterson exhibited specimens of a *Caltha palustris*, where the leaves were transformed in two instances into yellow petals; the Wallflower, where the corolla was transformed into stamens and the stamens were transformed into pistils; a species of Sarracenia, where the umbrella-shaped pistil was transformed into a pure white petal; a species of Primrose, where the calyx was transformed into a corolla; the cotyledons of the Beech and Elm, where there were three cotyledons, each with a bud in its axil; a specimen of Ranunculus, with the pistil formed into a petal; and also several flowers illustrating intermediate transformations, such as *Canna Indica*, and a species of Campanula.

Mr. John Harvie then read some interesting notes on Marine Zoology. He first of all drew attention to the stinging properties of the sea-anemone and the common jelly-fish of the sea shore, remarking that although many observers found these animals had the

power of paralyzing their prey, he had as yet failed to notice any such power. He next explained what was termed the Alternation of Generations. He then described some of the objects to be met with by any person who visits the coast in the summer, for instance, *Lima hyans*, a mollusc allied to the oyster or scallop shell, in which the mantle was so large, that the shell did not protect or cover it. In consequence of this it has to build a house at the bottom of the sea, so as to enable it to escape from its enemies. The house is composed of a series of shells, sea-weeds, stones, and sand, grouped and held together by the byssus. It obtains its food by means of a ciliary motion of its tentacles. He mentioned some of the chief peculiarities of the Sand Goby (*Gobius minutus*); and lastly, he described the water vascular system of the star-fish. A good deal of discussion followed the reading of Mr. Harvie's paper, one member stating that while bathing at Ardrossan he had come in contact with a jelly-fish, and was so severely stung by it that he was overpowered for some time after.

27TH JUNE, 1876.

Mr. J. Harvie, Vice-President, in the chair.

Messrs. James Anderson and Robert M'Pherson were elected ordinary members, and Mr. D. Blair, Campsie, as a corresponding member of the Society.

SPECIMENS EXHIBITED.

By Mr. Andrew A. Hogarth, M.A.—The great Bladderwort, *Utricularia vulgaris*, a plant that is exceedingly rare. He had gathered it in Loch Jeorgan, near Ardrossan. This remarkable plant is usually found in ditches containing putrid matter. It floats on or near the surface of the water, and at no time does it possess roots in order to attach it to the ground. The leaves are all submerged, hence they are very finely cut or divided, and destitute of stomata. They are covered with a great number of small bladders (hence the popular name of the plant). These bladders were at one time supposed to be of use in floating the plant, as air was sometimes found in their interior, but as the plant floats quite as well without them, this was found to be a wrong idea. Recent

researches have proved that their chief use is to capture and absorb the smaller animals that frequent the ditches in which they grow. The bladders are about $\frac{1}{8}$ of an inch in length. They are transparent, and of a light green colour. Each bladder is attached to the leaf by a short footstalk, which possesses a peculiar power of movement. They are furnished with a number of cellular prolongations called antennae, which gives them the appearance of some of the lower crustaceans. Below the antennae is the opening to the bladder, which has on either side of it a number of bristles. The entrance to the bladder is closed by a valve which only opens inwards. This valve is covered with a number of glands containing a fluid which holds a large quantity of matter in solution. The interior of the bladder is covered with a number of processes occurring in groups of four, hence the name of quadrifid processes applied to them. The use of the bladders is to capture small aquatic animals, principally entomostracan crustaceans and insect larvae, as it was found that the plants when examined generally contained great quantities of these animals. These animals die, and at length decay, when the plants absorb the product of the decay. They do not possess the power of digesting the animal matter like such plants as Venus' fly-trap, *Dionœa muscipula*. The animals enter the bladders by bending inwards the posterior free edge of the valve, which, from being very elastic, at once closes upon its victim. As this edge is extremely thin and fits very closely, it is evident that it will be difficult for an animal to get out when once imprisoned. The use of the antennae is to guide small animals to the entrance to the bladder, as well as to prevent large animals from trying to pass in, as in doing so they would rupture the entrance, and so destroy the bladder. It is not known what attracts the insects to enter the bladders, unless it be that these small animals are habitually trying to enter every small crevice.

By Mr. David Wood Inglis, M.A.—*Primula farinosa*, from bogs in Peebleshire. This most beautiful Primrose is pretty rare in Scotland and England. The leaves, which are all radical, are smooth above, while below they are covered with a dense mass of white or orange-yellow meal, hence the name of the plant. It bears a close resemblance to large specimens of *P. Scotica*, but the dimorphic condition of the reproductive organs will at once distinguish it.

By Mr. R. H. Paterson.—The very rare fungi *Agaricus asper*,

A. ramentaceus, A. candicans, A. fimbriatus, A. tremulus, Hebeloma Hookerii, H. sindonius, Coprinus picaceus, C. aratus, Gomphidius gracilis, Hygrophorus obrusseus, Xerotus degener, Lentinus vulpinus, Boletus sanguineus, B. satanus, Craterellus crispus, Cypliella Curreyi, and *Sparassis crispa,* preserved in a strong solution of salt and alum.

By Mr. Adolf Schulze.—A number of beautiful butterflies from China, the scales of which form admirable test objects for the microscope.

EXCURSION.

Kilmalcolm.—Mr. Richard M'Kay gave an account of this excursion. The usual spring flowers were gathered, none, however, of sufficient rarity to require recording.

PAPER READ.

Mr. James Allan read a number of communications which he had received from the various game-keepers of the district in reply to the Society's circular, showing that considerable interest was taken in the work of the Society.

11TH JULY, 1876.

Mr. W. J. Milligan, Vice-President, in the chair.

Mr. James A. Mahony, Ramilton, County Donegal, Ireland, was elected a member of the Society.

SPECIMENS EXHIBITED.

By Mr. R. H. Paterson.—A large collection of rare plants from Arran, among them being specimens of *Epipactis latifolia, Alisma ranunculoides, Rumex pratensis, Centunculus minimus, Atriplex laciniata, Convolvulus arvensis, Hieracium Gothicum, Thrincia hirta,* and *Rosa Sabini.* He also exhibited some rare insects from Australia, among which were *Hyphantidium sericarium,* the larva of which manufactures a beautiful silken web, forming by the united labour of myriads sheets of delicate webbing, some of which extend between 70 and 80 square feet. The silken web is so remarkable for its vast superficial extent, its extreme evenness of structure, and the fineness, delicacy, and beauty of its texture, as to make it worthy of the attention of European entomologists. *Paropsis variolosa,* the

larva of which feeds on the leaves of the Lemon-scented gum-tree, *Eucalyptus citriodora*. These larva bury themselves underground in October, forming very strong cocoons. The perfect insect appears in the following March. The wings are of a brownish bronze colour. The head and thorax have a metallic, dark greenish-red lustre. Abdomen bright shining green, three large orange yellow patches on the upper side, one at base of wings and one over the junction of the thorax and abdomen underneath, similar patches immediately below and between the legs.

By Mr. James Allan.—Living specimens of the stag beetle (*Lucanus cervus*) from England. These beetles, of which there were both male and female, had been sent by Dr. Paxton, Sutton, Surrey. They had been carefully watched, in order to see their interesting habits. The larva of this beetle feeds on rotten wood and mould, preferring the wood of the oak to any other. Although pretty frequent in the south of England, it is exceedingly rare in Scotland, or even the northern counties of England.

By Mr. J. Renwick.—*Silene inflata* var. *puberula*, a very rare plant, from near Milngavie. The occurrence of this plant in a new locality is very interesting, as there is a chance of the plant being found in a number of localities. The close resemblance which it has to *Selene inflata* may account for the plant not being oftener met with. He had also a number of specimens of *Sedum villosum* and *Peplis portula* from the same locality.

EXCURSION.

Blairmore (Dredging).—It was announced that owing to the stormy nature of the day the dredging excursion did not take place.

PAPER READ.

Mr. James Allan read a communication which he had received from Mr. Williamson, a corresponding member of the Society, giving an interesting description of the Botany around Louisville.

25TH JULY, 1876.

Mr. John Harvie, Vice-President, in the chair.

The Secretary read a letter stating that the Committee of the

British Association had given this Society a grant of £50 to enable them to bring out their lists of Fauna and Flora.

SPECIMENS EXHIBITED.

By Mr. James Allan.—*Helianthemum vulgare* from near Tummel Bridge.

By Mr. Richard M'Kay.—*Crambe maritima* from Imacher Point. This plant is supposed to be the origin of all our forms of garden cabbage.

By Mr. Adolf Schulze.—The large moths *Attaccus luna* from India, and *A. cecropia* from North America.

EXCURSION.

Ben Lawers.—Mr. James Allan gave an account of the excursion to Ben Lawers. After arriving at Killin, the members drove to the foot of Ben Lawers, where they stayed for several days. The weather was exceedingly fine, but hot. On beginning to ascend the hill numbers of rare plants were met with, such as *Polytrichum strictum, Blindia acuta,* and *Meesia uliginosa.* Among the rarer plants found near the top were *Saxifraga cernua,* which appears to be increasing, several specimens being found in flower; *Arenaria rubella,* found on the western side of the mountain; *Aspidium Lonchitis,* or Holly Fern, very abundant both among the rocks above Loch-na-Cat and on the western slope; *Cystopteris montana, Saxifraga nivalis,* and *Sagina nivalis.* Search was made for *Gentiana nivalis* and *Woodsia hyperborea,* but neither was found. Among the rare mosses gathered were, *Habrodon Notarisii* on trees at the foot of the mountain, where it was first found by Sir William Hooker in 1830, *Bryum cirrhatum, B. Zierii, Tortula fragilis, Grimmia patens, Campylopus compactus, Dicranum palustre, D. longifolium, Hypnum Starkii, H. umbratum,* and *Pterogonium filiforme.* Of rare lichens the following are almost all confined to Ben Lawers: *Pyrenopsis homoeopsis, Collemopsis fururella, Cladonia sylvatica, Lecidea fusca, L. didymospora, L. Hookerii, L. arctica, L. Breadalbanensis, L. scabrosa, L. Templetoni, Endocarpon rufescens,* and *Verrucaria nigritella.* Mr. Allan stated that after leaving Ben Lawers he went round by Bridge of Tummel and Killiecrankie, where he observed several plants that are not common in the Clyde Valley, among which the rock-rose, *Helianthemum vulgare,* in great profusion.

PAPER READ.

Mr. W. D. Benson read a few notes on the "Fresh-water Hydra." After giving an outline of their discovery and the various experiments made with them by Trembley in 1743, he proceeded to show their place in Nature—their habits, and where found. Remarking that while *Hydra viridis* and *Hydra vulgaris* were common he had never met with *Hydra fusca* in this district. These Hydrae possess extraordinary power of resisting mutilation, and of multiplying artificially when mechanically divided. No matter how many pieces we cut one into, each and all will be developed into a perfect hydra. Reproduction is effected sexually and asexually. In the sexual mode of reproduction the spermatozoa are developed in little conical elevations, while the ova are enclosed in sacs situated near the base of the attached end. Usually there is only one sac containing a single ovum, but occasionally there are two. When mature the ovum is expelled, and is at the same time fecundated by spermatozoa. The embryo is a minute free-swimming animal possessed with cilia. The asexual mode is a process of reproduction by gemmation, a new individual being gradually produced like a bud from a plant. Mr. W. D. Benson then read from a number of notes he had made when observing Hydrae and their parasite "*Trichodina pediculus*" in his aquarium, where he had them constantly under microscopic observation for some months.

8TH AUGUST, 1876.

Mr. W. J. Milligan, Vice-President, in the chair.

Mr. Thomas Boyle, 4 Montrose Street, was elected a member of the Society.

The Chairman stated that it was expected that the lists of the Fauna and Flora of the West of Scotland would soon be out. It was also stated that entrance to the Queen's Rooms, for the purpose of putting in order the Botanical exhibition for the meeting of the British Association, would be obtained on the 29th inst.

SPECIMENS EXHIBITED.

By Mr. James Allan.—A cockchafer, *Melolontha vulgaris*, from Dr. Paxton, Sutton, Surrey.

By Mr. Alexander Noble.—*Saxifraga cernua, Aspidium Lonchitis, Cystopteris montana,* and *Alchemilla alpina* from Ben Lawers.

EXCURSION.

Craignethan.—Mr. Thomas King stated that at this excursion the following plants were found, viz., *Hypericum pulchrum, H. hirsutum, H. quadrangulum, H. perforatum, Campanula latifolia, Calamintha Clinopodium, Origanum vulgare, Arum maculatum,* and *Ophioglossum vulgatum.* Few ferns and no mosses were observed.

PAPER READ.

Mr. S. Macdonald read an interesting paper on Grasshoppers, describing their external form, anatomical peculiarities, and destructive habits. They belong to the class Orthoptera, which also includes the Crickets and Locusts, the whole order being very voracious. The female lays about one hundred and fifty eggs, depositing them in chinks, such as the cracks formed in a sun-dried clayey soil. The young may be seen about the beginning of May, hopping about very actively, having as yet no visible wings, the larva differing from the perfect state or imago only in this respect, and in point of size. In about twenty days it goes through the incomplete metamorphosis by which they are released from their sheaths. The anterior pair of wings are leathery, and form cases (elytra) for the posterior flying wings. The legs are formed for leaping, the hind pair being much longer than the others. On the back, front, and sides the insect is effectually covered with a thick shell-skin binding it round in the form of plates, strong and flexible, and well suited for its active life. The mouth is furnished with a set of "incisors," by which it crops its vegetable food. The gizzard, or second cavity of the stomach, is adapted for crushing the food, having horny plates developed in its walls. The digestive fluids are of a green colour. The paper was illustrated with numerous drawings of the stomach, nervous system, and digestive canal.

22D AUGUST, 1876.

Mr. John Harvie, Vice-President, in the chair.

It was announced that the local Financial Committee of the British

Association had agreed to pay all the expense of publishing the Fauna and Flora of the West of Scotland, on condition that they should get all the copies, with the exception of one hundred and fifty, which will be handed at once to the Society. A copy of the Transactions of the "Dresden Field Naturalists' Club" was laid upon the table, being the second number presented by that Society.

SPECIMENS EXHIBITED.

By Mr. W. J. Milligan.—The mosses, *Blindia acuta, Bryum Zierii,* and *Meesia uliginosa,* from Ben Vhorlich.

By Mr. James Allan.—A large collection of mosses gathered at the excursion to Ben Vhorlich, among which were the following:—*Sphagnum teres, Rhabdoweissia denticulata, Dicranum circinnatum, Campylopus compactus, Grimmia spiralis, Grimmia torta,* and *Bryum crudum.* He also exhibited specimens of mica from Ben Lawers.

By Mr. R. H. Paterson.—The very rare fresh-water alga *Batrachospermum atrum,* from hills at the head of Loch Striven. This is the second station for this rare plant that is known in the West of Scotland, the only other place being in Glen Rosa, Arran. He also exhibited a very large collection of beetles, ants, moths, and butterflies from Australia, among which were specimens of the kangaroo beetle and Goliath beetle, this latter being one of the largest insects of its tribe. Among the butterflies there were several very rare species. He also exhibited nature prints of the following plants, *Aspidium Lonchitis,* var. *bifida, Polystichum vestitum, Aneimia hirta, Mnium undulatum, Plagiochila arbuscula, P. gigantea, Gottschia appendiculata, Trifolium pratense,* and *Lastrea dilitata.* These were all done by himself, by a secret method.

By Mr. J. M'Intyre.—A series of beautifully photographed plants done by himself.

EXCURSION.

Mr. R. H. Paterson gave an account of the excursion to Ben Vhorlich. There was a large turn out of members. The holly fern was again found in abundance on the same spot as it was found last year. When near the summit, one of the party came across a specimen of the golden eagle. A number of rare mosses and lichens were found, and about one hundred and fifty species of the larger fungi, among which was a specimen of *Schizophyllum commune.*

5TH SEPTEMBER, 1876.

Mr. W. J. Milligan, Vice-President, in the chair.

Mr. F. M. Bailey, Curator of the Queensland Museum, was elected a corresponding member of the Society.

SPECIMENS EXHIBITED.

By Mr. R. H. Paterson.—A specimen of the Rose of Jericho *(Anastatica hiero chuntina)*. This remarkable plant is the true "Resurrection Plant." It is an annual belonging to the Nat. Ord. Cruciferae, and a native of the Egyptian deserts and the dry wastes of Arabia, Barbary, and the Holy Land. Its generic name is derived from *anastasis*, "resurrection," in reference to the property it possesses of recovering its original form and green healthy appearance if immersed in water, no matter how dry it may be. It is a dwarf-growing, bushy-habited plant, resembling, when in the fresh green state, a large tuft or patch of green moss; but when deprived of moisture it curls up, then resembling a bunch of dried cedar twigs about four or five inches in diameter. In its native habitat this singular plant grows with remarkable vigour during the rainy season, but as soon as the dry weather sets in, and the heat of the sun begins to dry up the supply of moisture, the plant dries up too, the roots detach themselves from the earth, and the plant is then blown about at the mercy of the wind until the return of a few congenial showers. Immediately the roots receive a little moisture they suck it up, the plants unfold in a few hours, and spread out in flat tufts of the most emerald brightness, and grow away again with renewed vigour. With the return of dry weather the plants again dry up as before, unless they have had time to flower and perfect their seed; of course, when this happens, they die like all other plants of an annual duration.

PAPER READ.

Mr. Alexander Noble postponed the reading of his paper on the "Ferns of Arran," as the work in the Queen's Rooms had to be finished that night.

19TH SEPTEMBER, 1876.

Mr. John Harvie, Vice-President, in the chair.

The Rev. John Stevenson, Glammis, Forfarshire, was elected a corresponding member of the Society.

The Secretary intimated that he had received copies of the "Transactions of the Belfast Naturalists' Field Club" and "Leeds Naturalists' Field Club" from the respective Societies.

Dr. Stirton submitted a request on behalf of Dr. C. E. Lichke, Bonn, Rhine, Germany, for dried specimens of Scotch Ferns correctly named. It was agreed to help him as far as possible with this. He also read a circular from M. Richter Lajos of Budapest, announcing the formation of a Botanical Exchange Club there for plants of the Austrian provinces.

SPECIMENS EXHIBITED.

By Mr. W. J. Milligan.—A number of mosses gathered at the Strathblane excursion.

By Mr. J. Harvie.—A number of star-fishes and crabs gathered at a dredging excursion of the British Association.

EXCURSION.

The excursion to Kilsyth was reported as being most enjoyable. The spot visited was the Hermitage, a most romantic building in the middle of the Carron river, where the surroundings are well suited for botanists, and many good things were got. In the evening the party were hospitably entertained by Mr. Gregorson.

The excursion to Strathblane, being the last of the season, was devoted to sociality more than work, and most agreeably wound up an agreeable series of excursions, in which some good work has been done.

PAPERS READ.

By Mr. James Allan.—Mr. Allan read a paper on "The Habits of the Common Rat." This animal does not appear to be mentioned in Scripture, although the mouse and the weasel are both named, and in Æsop there is no mention of the rat, although almost every common animal is mentioned by him. The origin of the word is evidently Gothic, and may be either from *roth*, red, or *rathe*, meaning wisdom,

or cunning. After giving the distinctive characters, which are principally taken from the teeth, claws, and hair, and the rings of the tail, he gave a sketch of its history. The *Mus decumanus* arrived in this country in 1736, and was called the Hanover or Norwegian rat, because it was said by some to have come with George I., and by others from Norway. But in Norway it was certainly an invader, as Linnaeus says it came from Scythia or India, from whence it seems to have come in vast hordes. It soon exterminated the black rat, *Mus rattus*. The latter was tolerably plentiful in Kincardineshire thirty years ago, but is now extinct. The rats are grain eaters, but will eat almost anything, even taking eggs from under fowls. It has been said by a good authority that the rats destroy the value of one million sterling annually, and that if it were exterminated the saving would keep all the paupers in Scotland.

By Mr. Alex. Noble.—Mr. Noble read a paper "On the Ferns found in Arran," and exhibited a mounted series of those he had obtained there. The Ceterach and holly ferns are not found there, but nearly all the others are.

The lists of the Fauna and Flora published by the Society for the British Association were laid on the table.

3RD OCTOBER, 1876.

Mr. W. J. Milligan, Vice-President, in the chair.

Messrs. Alex. S. Wilson, M.A., B.Sc., and James Lochhead, were elected members of the Society.

A vote of thanks was given to those gentlemen, members of the Society, who had brought forward such a magnificent collection of flowering plants, ferns, mosses, hepaticæ, fungi, lichens, and insects, as was exhibited in the Queen's Rooms on the occasion of the visit of the British Association to this city. If it had not been for the zeal and energy displayed by them, Glasgow would have fallen considerably in the estimation of most of the visitors to the city, and of the public in general. The exhibition was the largest and finest ever brought forward in Glasgow. Nearly every plant, flowering or non-flowering, that has been found in the West of Scotland was to be seen on the various screens placed in the two large halls of the Queen's Rooms.

SPECIMENS EXHIBITED.

By Mr. R. H. Paterson.—Six different species of Brittleworts, found in the Clyde Valley, viz., *Chara vulgaris* from Bute, *Chara fragilis* and *C. flexilis* from Possil Marsh, *Chara aspera* from Loch Eil, *Chara translucens* and *C. hispida* from Bowling Moor. These curious plants were at one time included among the Algæ. They are now, however, placed in a class by themselves — Characeæ, intermediate between lichens and mosses. Some, however, are inclined to rank them as high in the scale as ferns. He also exhibited specimens of parts of the rare Spindle Tree, *Euonymus Europæus* and *Pyrus aria*, var. *fennica*, from Innellan. Also the Algæ, *Melobesia calcarea*, *M. fasciculatis*, *M. verrucata*, and *M. pustulata*, all dredged at Innellan in twenty fathoms of water, and *Melobesia agariciformis*, a very rare and beautiful form, dredged in Roundstone Bay, on the west coast of Ireland, in from eight to ten fathoms of water. He also exhibited some very large specimens of the opercula of a species of mollusc from the Cape of Good Hope, one specimen being several ounces in weight, the operculum of British mollusca seldom weighing more than one or two grains. There was also a fine specimen of the brain coral from the same locality. These were sent by Dr. Watkins, a corresponding member.

By Mr. Richard M'Kay.—Specimens of the plant Good King Henry, *Chenopodium Bonus Henricus*, from the Carron Glen, near Kilsyth.

PAPER READ.

Mr. Taylor then read an interesting paper "On the Vegetable Cell." After defining what was understood by the term "cell" in science, he went on to show how the normal round cell, by pressure in various directions, comes to assume the different shapes found in each kind of tissue. The vegetable cell is a mass of protoplasm surrounded by a cell wall, called the cellulose coat. Various changes take place in this cell, the protoplasm gets replaced by cell sap (vacuolation), air replaces this sap, when the cell is virtually dead. Again we have the deposit of cellulose inside the cell wall, producing a striated appearance like bone cells, or it may be in the forms of rings (annular) or like the steps of a ladder (scalariform), etc. He then pointed out how the various theorists accounted for this striated appearance of cells. At the conclusion, he gave a short

account of the different ways in which cells multiply. The paper was illustrated throughout by a series of carefully executed diagrams.

20TH OCTOBER, 1876.

Mr. J. Harvie, Vice-President, in the chair.

Mr. J. J. King was elected a member of the Society.

SPECIMENS EXHIBITED.

By Mr. J. Renwick.—Specimens of the Hop and Toad-flax from Loch Lomond.

By Mr. R. H. Paterson.—Twenty-six species of star-fish dredged by himself in the Firth of Clyde.

PAPER READ.

"On some Remains of Pre-Historic Man." By Mr. W. J. Milligan.

In this paper it was maintained that all the remains of pre-historic man support the theory of the progressive development of the race; and that the theory of the degeneracy of man is not supported by any of these remains. It was pointed out that traces of primitive man and his flint implements have been discovered in such positions that it may be held as proven that he existed at a very remote period—a period far before the eras of our chronological tables. Then it was shown that if it be true that man's first estate was one of advanced civilization, then it must have taken long ages for his becoming reduced to the level of cave dwellings and flint implements. So that upholders of the degeneracy theory will be forced at last, in support of that theory, to give man even a greater antiquity than the evolutionists will be inclined to allow him! The wonderful remains of cyclopean architecture and vast sculptures found in various parts of the world, and particularly those of Easter Island and Central America, were described at length. These great ruins show that the builders were partially civilized, but it was pointed out, that this kind of architecture, in which great blocks of stones were used, was a primitive one; and that these huge useless monuments could only be raised by the wasted labour of a large population in a lowly grade of civilization. The building of the Pyramids and of the

palaces of Mexico were taken as examples. The profligate waste of labour expended on the Pyramids may be imagined, when we read in Herodotus that 2000 men were employed three years in carrying a single stone from Elephantine to Sais! The people who raised the monuments of Easter Island have degenerated or disappeared. But the theory of progressive development takes into account partial degeneracy; just as the theory of the evolution of animals or plants takes into account the extinction of races unfitted, perhaps, by altered external conditions or modifications of structure, for the battle of life. If a perfect civilization existed at one time, where are the remains of its activity, of instruments more wonderful than our degenerate ones, for piercing space, analysing light, measuring time, or showing the constitution of cosmic gases?

3RD NOVEMBER, 1876.

Mr. W. J. Milligan, Vice-President, in the chair.

It was agreed that a memorial should be drawn up regarding the death of Professor R. Hennedy, who was at one time President of the Society. In him many of the members miss not only an accomplished guide in their studies, but a warm personal friend. He was always ready to assist, advise, and encourage those who applied to him. Mr. Hennedy did more than any other lecturer to spread the knowledge of botanical science in the district; and let it be said to his honour that he worked without expectation of monetary reward. He worked because of a very love of his labour, and he strove by every means in his power to attract others to the same fields of study and research. His enthusiasm stimulated every one who came into contact with him, and some of the best botanists of the district were educated under his eye.

It was decided that an abstract of the minute and an expression of deep sympathy should be forwarded to his son, Mr. David Hennedy.

PAPER READ.

By Mr. R. H. Paterson. "On the three kingdoms of Nature."

17TH NOVEMBER, 1876.

Mr. W. J. Milligan, Vice-President, in the chair.

Messrs. Thomas Todd, Peter Mackellar, Thomas Scott, and Charles Pennell, all of Greenock, were elected members of the Society.

The Secretary presented to the Society a copy of the "Cyclopædia of Botany," a book now very old.

PAPER READ.

The meeting was devoted to a microscopical demonstration by Mr. A. Schulze. There were six microscopes on the table—viz., one large binocular of Ross & Co., with low and high power prisms, complete illuminating, drawing, and measuring apparatus, and with Ross' and Powell's object glasses; one fine binocular of James White's, one binocular of James Swift's, and three monoculars on the Hartnack model. Three of the instruments on the table were kindly lent by Mr. James Brown, St. Vincent Street. There were five of How's, and one of Swift's microscope lamps on the table, as well as a splendid Dallinger lamp having a wick an inch and a-half broad, copper chimney, large bull's-eye condenser and universal motions. Among the objects exhibited in the course of the evening were the following:—The circulation of the blood in the web of a frog's foot, under a power of 330 diameters; the rotation of the chlorophyll in the cells of *Anacharis Canadensis*, under a power of 800 diameters; the yeast plant 900 diameters; human blood, 1200 diameters; living infusoriæ, animal parasites, and a number of beautifully injected preparations of human kidney, spleen, and lung. Among the more remarkable preparations exhibited were the following:—Moller's Typenplatte, containing 160 diatoms, the name of each species being photographed on the slide; several beautiful slides of diatoms, arranged by Arthur C. Cole, of Liverpool; a splendid cornucopia and flowers, arranged from the scales and hairs of butterflies and from diatoms. There were also a splendid set of botanical and entymological preparations exhibited.

A vote of thanks was given to the gentlemen who had brought forward such a fine series of microscopes and slides.

9th December, 1876.

Mr. J. Harvie, Vice-President, in the chair.

Messrs. Fred. Grierson, Peter Grant, Arch. Grant, and Dr. John Glaister were elected ordinary members of the Society. Prof. Dittmar was elected an honorary member.

SPECIMENS EXHIBITED.

By Mr. James Allan.—A curious variety of the common oak fern (*Polypodium dryopteris*), an abnormal specimen of the moss (*Hypnum triquetrum*), and a peculiar fungus from the hills above Campsie.

By Mr. R. H. Paterson.—Five eggs, and a cabinet specimen of the Emew (*Dromanius Novae Hollandiae*), from Australia. This peculiar bird belongs to the class Cursores or runners, a wingless tribe of birds, in which we have also the Ostrich and Apteryx. The far interior of Australia must be visited in order to see this bird in its wild state, and unless attention is paid in rearing them, the time is not far distant when this noble bird will have met the fate of so many of the wingless tribe, and become extinct. The natives call the Emew "Gorin" and "Berberine." It is valued by them for its oil, which is of a clear bright golden yellow colour. The bird possesses great keenness of vision. It crops the grass like a cow, and also feeds on various fruits, preferring the quandong or native peach (*Fusanus acuminatus*) to that of all other fruits. The settlers hunt them with dogs, going out early in the morning, when they can be surprised while feeding. They are exceedingly swift of foot, and as soon as the dogs reach them, they turn round and strike out with their legs, trying to disable their enemies. The usual result, however, is, that they are overpowered and killed. The entire plumage of the bird is of a dark brown mottled with a dirty grey. The female lays from nine to eleven eggs, which are of a beautiful bluish green colour. They are hatched by incubation. Their nest is of the most simple character, and is usually built on the edge of some dark wood. He also exhibited specimens of the rare Australian Jabiru (*Mycteria australis*) and the brush turkey (*Tallegalla, sp.*) The brush turkey possesses very extraordinary habits. Instead of hatching its young by the warmth of its body, as is the ordinary method of incubation, it constructs a natural eccalcobion, by heaping together a mound of vegetable matter, in which it deposits its eggs,

waiting patiently for the fermentive process to hatch them. The mound is scraped up by the male bird to a height of five or six feet; and the eggs are placed among the heated mass in a ring at regular intervals, with their smaller ends pointing downwards, at least eighteen inches below the surface. Lest the temperature of the mass become too great, the male bird is constantly giving them air during the day, and keeping an aperture open in the middle to prevent any increase of heat. The eggs of the brush turkey cannot be hatched by the warmth of other birds, neither can they be hatched by the artificial method which is so successful with nearly all other birds. These facts go to prove that there is some condition of heat which the fermentive process is alone capable of producing.

Mr. J. Harvie mentioned that the Leipoa and the Megapode (*Megapodius tumulus*), also natives of Australia, deposit their eggs in similar mounds; but instead of placing them at intervals in the mound, they make deep holes, from five to six feet, at the bottom of which the eggs are deposited. The mounds are enormously large, the height of one being fifteen feet, and its circumference at the base about sixty feet.

PAPER READ.

Mr. Thos. King then read a paper on "Early botanists before the time of Reay." The first whose name is known in the history of botany is Hippocrates, who described two hundred and forty plants. Then came Theophrastes and Dioscorides, who described six hundred plants. These three men are the authorities for all the Greek names up to the Christian era, (*e.g.*), Anchusa, Orchis, and Aconitum. The first century of the Christian era is especially memorable, for it was then that the great Pliny arose. Galen was the only botanist of note in the second century. His teaching ruled for one thousand years. After Galen's time there was no one of note till the beginning of the eighth century, when arose the celebrated Arab Physicians, so called, not because they were all Arabians, but because they wrote in the Arabian language. After this there is a total blank in the history of botany, but after the invention of printing and the subsequent discovery of America, it revived. The first to come into note was Brunsfels, who wrote a book on botany with plates. Next comes Brock, who wrote a history of plants. Then came such illustrious men as Cordus, Fuchs, Gesner, Mathiola, Lonicer, and Lobel, whose names appear in the names of our common plants—

fuchsia, and lonicera, the honey-suckle. The names then become so numerous that Mr. King only gave an outline of all their work. Botany was first studied in Britain in the 16th century—the father of British botany being Turner, a clergyman, who wrote the first good English Herbal. Gerard, who was born in 1545, wrote an herbal containing the properties of all the known plants of his day. Then arose Johnson, who wrote the first local Flora; Parkinson, who wrote the first book on gardening; and Evelyn, who wrote on forest trees. Caesalpino was the first to try and classify plants. In the early part of the seventeenth century, arose the great Reay, whose system of classification forms the basis of that adopted at the present day. Mr. King closed his paper by giving a short sketch of the classifications of Caesalpino and Reay.

15TH DECEMBER, 1876.

Mr. W. J. Milligan, Vice-President, in the chair.

SPECIMENS EXHIBITED.

Mr. R. H. Paterson, F.C.S.S., reported the discovery of a moss new to science. It was found growing on rocks in Argyllshire in the summer of 1875. It has been called *Stereophyllum Patersoni* by the Rev. John Fergusson, of Brechin, in honour of Mr. Paterson. It is the only British representative of the genus *Stereophyllum*. He also exhibited the following new species of fungi:—*Septoria Patersoni*, *Ustilago Candollea*, *Tympanis pinastri*, *Uredo alchemillæ*, *Trichobasis rumicum*, and *Æcidium phaseli*. All these fungi were gathered in woods near Ballimore, Argyllshire.

By Dr. Nairne.—The dental arch of the white shark, also specimens of fossil wood, from Carmyle, and a number of fossil shells, etc., from the London clay. He also exhibited a number of specimens of fossil teeth, and a small specimen of a stalactite.

By Mr. R. H. Paterson.—Five species of fungi new to Britain, which he had gathered in the Glasgow Botanic Gardens. (See "Scottish Naturalist," January, 1877).

PAPER READ.

Dr. Nairne then read an interesting paper on Infusoria and

the life problem, which caused a good deal of discussion, in which nearly all present took part.

5TH JANUARY, 1877.

Mr. J. Harvie, Vice-President, in the chair.

SPECIMENS EXHIBITED.

By Mr. R. H. Paterson.—Three states of the alga, called the Irish Moss, *Chondrus crispus*, from Innellan. One from deep water, where the plants were long and very delicate; one from shallow water, where the fronds were very broad and coarse; and one, from rocks about mid-tide. This latter is the ordinary state of the alga. The dried plant, when mixed with milk and boiled, forms admirable food for infants. He also exhibited a number of fungi, mosses, and liverworts, from the hills about Innellan, some of them being rare.

By Mr. James Allan.—A number of specimens of fungi and products derived from Cryptogams in illustration of his paper on Economic Cryptogamy.

PAPER READ.

"On Economic Cryptogamy," by Mr. James Allan. In this paper he treated of the uses of Cryptogams in nature, and of the products derived from them in commerce. He noticed the fact that diatoms secreted silica, and have probably been the first cause of the great beds of silica frequently found; as foramenifera have perhaps been of lime. He stated that the great beds of nitrate of soda in South America, nitrate of potass in India, and muriate of potass in Germany, have probably been derived from algae. He also noticed the quantities of soil laid down by lichens decaying, forming a suitable pabulum for higher races of plants, the uses of fungi as scavengers, the beds of soil and peat formed by mosses, and the small effect ferns have had in moulding the world into its present shape, although the spores may sometimes form the inflammable part of coal. He described the inflammable clay of the Island of Réunion, which had been found to consist altogether of the spores of ferns. He then noticed the products useful to man derived from cryptogams, and exhibited specimens of potasses, iodine, bromine, kelp, crotal,

litmus, Amanita muscaria, ergot of rye, dry rot, the morell, and chantarelle, and briefly noticed a few of the edible fungi. It is strange that although tons of good meat lie rotting in our woods, the poorer classes will rather feed on garbage than eat either Agaricus, Lycoperdon, or Boleto fungi. He drew attention to the strange fact that some fungi are poisonous in one country and edible in others, of which our common mushroom is an example, in Italy being regarded as a poison. He stated that up to the present time no useful product had been derived from mosses, ferns, or jungermanniae, which seem intended to beautify the world.

19TH JANUARY, 1877.

Mr. W. J. Milligan, Vice-President, in the chair.

SPECIMENS EXHIBITED.

By Mr. Arch. Fawcett.—A very large collection of ferns from St. Helena, among which were the following:—*Hymenophyllum capillaceum, Polypodium Helenæ, P. marginellum, P. rugosum, Dicksonia arborea, Pteris paleacea, Asplenium gemmiferum, A. erectum, Acrostichum furcatum,* and *A. subdiaphanum.*

By Mr. R. H. Paterson.—The following species of British fungi—*Agaricus subcavus, A. maritimus, Polyporus sanguineus, P. carnosus,* and *Geaster cryptorrhynchus.* He also reported the discovery of *Lycopodium inundatum* and *Potentilla Salisburgense* on Benlomond. This is the first time that these plants have been found in the West of Scotland.

PAPER READ.

"On the probable reasons why certain plants occur most frequently in the vicinity of human dwellings," by Mr A. S. Wilson, M.A., B.Sc. It is a fact worthy of remark that in nature we often find the most dissimilar organisms mutually dependent on each other. The curious phenomena of animal commensalism, as seen in the pilot-fish, the buffalo guardian bird, or the honey guide, are not without a parallel in the vegetable kingdom. The nettle, pellitory, dock, borage, and henbane exhibit markedly a predilection for the abodes of man; and the same tendency is shown by

a large number of plants, as their botanical or even popular names indicate. For example, agrestis, muralis, tectorum, urbica, murinum, parietaria, wallflower, etc., are terms significant of this peculiarity. The same thing is seen, although in a less degree, in the case of those species whose habitat is a stony or dry waste place. The number of such in the British flora is very great; our common thistles, whins, brambles, and scraggy hedge plants generally, belong to this class. The explanation usually given, is, that in the neighbourhood of towns, nitrogenous and calcareous matters abound. To this it may be objected that these materials are useful to vegetation generally, and it is not at the spots where such matters are accumulated that these plants occur in greatest numbers. It is questionable, moreover, whether plants have such a range of choice in the matter of location, since owing to natural competition, it is only fair to suppose that each species has some peculiar adaptation for its usual abode.

A close study of the more important examples of plants showing this peculiarity, reveals the fact that they usually possess one or more of the following provisions, the aggregate character of which proves unmistakably, that, viewed as a class, such plants bear the impress of a desert flora.

Table of Provisions enabling a plant to withstand

1. Drought.
   - (*a*) Succulent leaves; sempervivum, sedum.
   - (*b*) Succulent tap-roots or tubers; dock.
   - (*c*) Hairs; borago, lamium.
2. Attacks of animals.
   - (*a*) Stings; nettle.
   - (*b*) Prickles; brier, bramble, thistle.
   - (*c*) Thorns and spines; whin, hawthorn, wild pear tree.
3. Nocturnal cold.
   - Aromatic leaf-glands; sweet brier.
4. Sea water.
   - Scales, scurf, and bloom; chenopodium, silene.

In addition to the foregoing, it is not improbable that inconspicuous flowers may be advantageous to plants growing near houses, while others may have their chances of cross-fertilisation

favourably affected by man's influence directly, or through his domestic animals indirectly, as in the case of *Trifolium pratense.*

I. Under the first heading in the table, we may take the well-known instance of the house-leek *(Sempervivum tectorum)*, so called from its growing almost exclusively on thatched roofs. This plant has thick succulent leaves, and such leaves have comparatively few *stomata* on their surface, so that their power of exhaling watery vapour is limited. For this reason many succulent leaved plants succumb to a damp climate ("Origin of Species"), but are specially fitted for a dry one. Dr. Livingstone has recorded that the Kalahari desert, when first taken possession of by the Boers, was covered with a coating of grass, but that subsequent droughts, proving too much for this form of vegetation, it has disappeared, and its place has been taken by a crop of Mesembryanthemums, and that these are now cultivated largely by the Boers, as fodder for their sheep and goats, in place of grass. These Mesembryanthemums or ice-plants resemble the house-leek in possessing thick succulent leaves and few stomata. On a thatched roof the latter probably finds the conditions of its primitive home pretty closely imitated: thus, it is exposed to the full force of the sun's rays, and excess of rain is rapidly drained off. For this reason the house-leek flourishes, whilst the grass upon the house-top, to quote the Psalmist, "withereth afore it groweth up."

II. Tap-roots and stem-tubers, there can be little doubt, are organs, the primary intention of which is to contain a supply of water to enable the plant to live through a long rainless period. That this is so, is shown by the large proportion of plants which bear such roots and tubers, occurring in the periodically parched districts of Africa visited by Livingstone and Schweinfurth, as well as by the great size attained by such structures in these regions of periodic drought ("Heart of Africa"). Many shore plants possess roots capable of succulent development under the influence of stimuli; indeed, our carrots, turnips, beets, and even the potato itself, were originally shore plants. The possession of these roots would enable the plant to take a supply of water, when that was to be had, before the rain had all filtered off through the gravel. Under cultivation, from the large percentage of water these roots contain (turnips 91 %), and from the great perfection

attained in light soils, we have a confirmation of the views here advanced. The tap-root of the dock constitutes its title to a place in this division.

III. Speaking generally, plants growing in dry situations are more freely supplied with hairs than those which frequent wet places. According to Haeckel, if a plant be removed from moist to dry soil, it becomes more hairy; the end gained by these hairs being to obtain a supply of moisture from the atmosphere, for which there is greater need in a dry locality. The dead-nettle, borage, mint, and rock-rose are familiar examples of this. Some species of poppy, too, become covered with stiff hairs, particularly on the seed vessel, and their leaves become cut up into segments in a pinnatifid manner, simulating thistle leaves, if grown in dry soil. *Papaver hybridum* and *P. argemone* exhibit this markedly; the setose character of the seed vessel coming of use also to help in disseminating the seed, by catching the fur of passing animals, so that the seeds are shaken out of their capsule. Similar hairs, correlated to a liking for dry situations, are observed in many species of Fumariaceae, Cruciferae, Boraginaceae, Solanaceae, Caryophyllaceae, and Malvaceae. Many of the last named order are remarkable for their curiously forked hairs. They grow in dry soil. To this order the cotton plant belongs, and it is not improbable, in view of such facts as we have been considering, that the hairs on the seed of this plant, and the hairy pappus on the fruit of many compositae (down of thistle, seed of dandelion, etc.), may have been acquired during long habituation to arid conditions, although in the present condition of the plants, these processes of hairs are directly related to disseminating the seed. The fact that the cotton plant is not now confined to hot, dry regions, the wet habitat of the cotton-grass, and a few other facts, would appear, however, to render this theory doubtful.

In the second class are placed those plants which, from being provided with formidable weapons of defence, are best capable of maintaining their ground against man; thorny, prickly, and stinging plants, abounding near the haunts of mankind in spite of man's enmity; probably doing so in virtue of those qualities which recommend the thistle as the national emblem of Scotland, viz., that no one touches them with impunity. But there is a reason why plants in poor soil should be of this jaggy character.

Passages might be quoted from the works of Livingstone, Wallace, and Darwin, to prove that thorns are characteristic of dry, stony soils, whilst well watered districts are remarkable for the almost total absence of such defensive weapons. The common pear tree, if allowed to grow wild, exhibits many branches which ordinarily bear leaves aborting into spines. The little Scotch rose (*Rosa spinosissima*), which grows in dry sandy places, becomes much less prickly if grown in moist garden soil. The common bramble, when grown on stony waste places, possesses prickles both on its stem and leaves, but when growing high up on moist mountain sides is entirely devoid of them. The inability of the wild pear tree to produce leafy branches is to be explained by the difficulties the roots experience in obtaining a sufficient supply of mineral matter from the stony soil; for, since a much larger amount of inorganic matter is required for leaf-formation than for the production of wood, we should expect that poor soil would have the effect of diminishing the number of leaves. Possibly this may also be the reason for leaves splitting up in dry soil.

IV. In his address to the Biological section of the British Association in 1876, Mr Wallace, when discussing the distribution of plants and animals in oceanic islands, was led to speculate on the object attained by the presence of aromatic leaf glands in plants, in connection with the observed absence of conspicuously coloured and scented flowers from insular floras, as determined by the paucity of insect life. He cited Mr. Darwin's opinion, that leaf glands bearing essential oils are a protection against the attacks of insects where these abound, and would thus not be required in countries where insects were scarce, but took exception to this view on the ground that highly aromatic plants are characteristic of deserts all over the world. He also gave numerous examples and quoted many authorities proving aromatic plants to enjoy no immunity from insect attacks; neither did Mr. Wallace consider that scented leaves could be much in the way of attraction, supplementary to that of a scented corolla, so he leaves us in doubt as to the original office of these aromatic leaf glands.

It is to the physicist rather than the biologist we must turn for a solution of this difficulty. Professor Tyndall has made an important series of experiments on the absorptive power of different gases for radiant heat, from which it appears that under

given conditions carbonic acid absorbs 972 times, and ammonia 5460 times as much heat as air or oxygen. Similar experiments with perfumes show that these possess the power of arresting the passage of calorific rays to a remarkable extent. Thus, air scented with thyme arrested 33 times, with peppermint 34, spearmint 38, lavender 32, wormwood 41, cinnamon 53 times as much heat as air did. The temperature of dry air is not affected by the passage of the sun's rays through it. It is transparent and diathermous. The capacity of the atmosphere for heat is therefore in proportion to the aqueous vapour it contains. In a region subjected to the rays of a hot sun through the day, the heated soil would at night speedily cool down by rapid radiation through the dry atmosphere, which would not itself be sensibly affected by this heat, the result being a great fall of temperature, such as would doubtless be injurious to plant life. The perfume shed by aromatic glands may, by supplying the deficiency of aqueous vapour, present a curtain, so to speak, which would obviate the injurious loss of heat, on the principle that a clear night is colder than a cloudy one. As a matter of fact, we know that the flow of sap from the Maple is much larger on a cloudy evening than on a clear one, and the flow of sap is an important factor in vegetable growth. Confirmatory too, of this view, aromatic plants are most odoriferous at night or before dawn, the coldest period. Such, then, would appear to be the original intention of odours like that of the Sweet-brier, and we have already seen the probability that its thorns should be traced to a similar origin, viz., a dry hot climate and poor stony soil.

V. This class should perhaps have been included in the second, as the epidermal scales on shore plants, (Chenopodium, Eringo, Silene, etc.) are the representatives of hairs, on the sea margin hairs being objectionable, on account of their collecting salt from the sea water; scales, scurf, or bloom, serving to run it off, as the oil on the feathers of aquatic birds does.

From these and similar reasons we have been led to ascribe the remarkable liking for human abodes which many species of plants possess, to man's influence on the soil and climate, who, by cutting woods, draining, etc., renders these drier and so more suited to members of a flora—settlers which came originally from a less moist country than our own, and which may possibly have formed

part of the miocene flora, during which age, according to Wallace, the climatal conditions of Europe simulated that of Central Africa at the present day.

The Curator of the Society, Mr. W. D. Benson, intimated that he had to resign his office, as he required to leave Glasgow, having to remove to Richmond, Yorkshire. After a hearty vote of thanks had been awarded to Mr. Benson for the admirable manner in which he had filled the office, Mr. J. J. King was unanimously appointed to fill the vacant Curatorship.

2ND FEBRUARY, 1877.

Mr. J. Harvie, Vice-President, in the chair.

Mr. W. D. Benson was elected a corresponding member.

SPECIMENS EXHIBITED.

By Mr. R. H. Paterson.—Two abnormal specimens of the sweet scented violet, which he had gathered at Helensburgh. Also specimens of a number of fungi from Cadder Wilderness, some of which were very rare.

PAPER READ.

Mr. F. G. Binnie read an interesting paper "On Dipterous Gallmakers and their Galls," in continuation of one previously given before the Society. In the present paper he treated of the collecting, rearing, and preserving of the galls and their workers (the *Cecidomydae*), giving the results of his own experience with the group. He stated that in so far as collecting in the fields was concerned, the perfect insect was of secondary consideration, and attention had mostly to be directed to the gall. The apparatus required, and the best times, localities, and situations were indicated. He advised collecting the galls as near their maturity as possible, mentioning the danger of collecting them immediately after rain when still covered with moisture, with other suggestions for the guidance of the student. The rearing of the maker from these galls was fully treated, and the methods which he had found most

successful were given. He then passed on to consider the preparation of the perfect insect and its gall for the cabinet. In conclusion, he enumerated the principal points which require to be noted in a perfect and complete description of the development and economy of the species, dwelling on the importance of the last or anal segment of the larva, from the tubercular prominences often found upon it, a character often overlooked by previous students. In the imago he pointed out the extreme value of the characters of the antennæ, not only from their importance in fixing the genus, but also because a good specific character existed in them. He urged upon the students the necessity of descriptions of the imago being taken from the living insects, and that those made from dead and dried examples were valueless. The paper was illustrated with diagrams and drawings of the principal forms of galls, and also of the larva, pupa, and imago of the insect.

16TH FEBRUARY, 1877.

Mr. W. J. Milligan, Vice-President, in the chair.

Mr. George M'Kinlay was elected a member of the Society.

SPECIMENS EXHIBITED.

Mr. Allan exhibited a collection of mosses from Brazil, made by Mr. John Weir, formerly of the Glasgow Botanic Gardens. A few of the species are identical with British mosses, but the great majority are not only specifically but generically distinct.

PAPER READ.

Mr. James J. King read a paper entitled, "Notes on the Micro-Lepidoptera," in which he brought before the Society several of the most interesting species that occur near Glasgow, and announced the addition of three genera, and twenty-three species to his list in the "Fauna and Flora of Clydesdale." The new species are as follows :—

Paedisca profunda, S. V. Barrochan Moss.
Paedisca sordidana, Hub. Near Milngavie. By beating Alder.

Eupoecilia maculosana, Hw. Clober Moor.
Tinea ganomella, Tr. Barrochan Moss.
Swammerdamia comptella, Hub. Common near Hamilton. Mr. Lang.
Depressaria arenella, S. V. Mugdock Woods. Larva feeds on leaves of knapweeds and thistles.
Depressaria angelicella, Hub. Mugdock Woods. Larva feeds on leaves of angelica sylvestris.
Depressaria pulcherrimella, Stn. Mugdock Woods.
Gelechia acuminatella, Si. Mugdock Woods and Barrochan Moss.
Oecophora fuscescentella, Hev. South side of Clyde, opposite Kenmuir Bank.
Argyresthia nitidella, F. Very common. Almost in every hedge-row.
Argyresthia arcevthinella, Z. Clober Moor. By beating Juniper.
Cedestis farinatella, D. Barrochan Moss. By beating Scotch Fir. New genus.
Coleophora caespititiella, Z. Mugdock and Barrochan.
Coleophora laricella, Hub. Barrochan Moss.
Laverna helerella, Dup., var. atra H. W. Clober. Beaten out of Hawthorn.
Elachista biatomella, Stn. Barrochan Moss.
Elachista subochreella, Db. Clober.
Lithocolletis caledoniella, Stn. Near Glasgow.
Lithocolletis klemannella, Fab. Clober Moor.
Opostega crepusculella, Fisch. Barrochan Moss. New genus.
Bucculatrix crataegifoliella, Dbl. Barrochan Moss. New genus.
Nepticula tityrella, Dg. Cadder Wilderness and Clober.

He also recorded new localities for the following :—

Phoopteryx biarcuna, S. A few specimens at Clober.
Argyresthia semitestacella, Curt. Cadder Wilderness.
Chrysoclista flavicapitella, Hev. Milngavie.
Lithocolletis irradiella. Cadder Wilderness.

Mr. King exhibited specimens of all the species he mentioned.

2ND MARCH, 1877.

Mr. J. Harvie, Vice-President, in the chair.

SPECIMENS EXHIBITED.

By Mr. R. H. Paterson.—The jaw of a shark from the South Seas.

PAPER READ.

Mr. W. C. Crawford read the first of two papers on the "Spectroscope in Biology." The author gave an account of the general principles of spectroscopy as applied to the examination of absorption bands produced by coloured liquids. He mentioned the instruments generally employed for obtaining both prismatic and diffraction spectra. The changes on the appearance of radiation spectra from variations in pressure and density were then noticed, and similarly the effect of the thickness of a coloured solution in modifying the amount of absorption, as well as alterations that arise from temperature, was shown by means of graphic curves. Investigations of this kind seem surrounded by peculiar difficulties, and the results obtained from them are at present rather unsatisfactory.

After the paper was read a number of characteristic spectra were shown under the micro-spectroscope.

16TH MARCH, 1877.

Mr. W. J. Milligan, Vice-President, in the chair.

It was agreed that the Society should give a contribution to the Hennedy Memorial.

SPECIMENS EXHIBITED.

By Mr. R. H. Paterson.—A number of rare mosses collected by himself, among which there were two new to science, which had been called by the Rev. John Fergusson of Brechin, *Coscinodon Patersoni* and *Hypnum Scoticum*. Both of these were gathered in the summer of 1875. There were also specimens of the following mosses from Kilfinan, Argyleshire: *Neckera pennata*, *Hypnum pulchellum*, *H. trifarium* and *H. Halleri*. See "Scottish Naturalist," April, 1877.

He also exhibited a number of rare fungi, *e.g.*, *Sphaeria pardalota*, *S. strigosa*, *S. aquila*, *Lactarius acris*, *L. rufus*, *Cantharellus lobatus*, *C. tubæformis*, and *Russula sardonia*, which he had gathered in the Botanic Gardens, and an immense specimen of *Polyporus giganteus* from India.

PAPER READ.

Mr. Adolph Schulze read a paper on the resolution of test objects for the highest power of the microscope, and stated at the outset that test objects for the microscope were such microscopical objects which require for the revelation of their outlines, their surface-markings, or their internal structure, objectives which possess either or all the essential good qualities of a high class lens. After explaining that for different purposes object glasses of different capacities, and generally of different angles of aperture are required, he noticed the limit of microscopical vision, which according to Hemholtz and Abbe was at half a wave length of that light used for the illumination of the object, so that for violet light, the limit of microscopical vision with perfect glasses would be 115,000 lines per inch. It appeared, however, that in these theories certain properties of light had not been taken sufficiently into account, as it had been demonstrated that lines far closer than the $\frac{1}{115,000}$ of an inch had been seen by several of our best observers. The physiological limit of microscopical vision is fortunately wide enough to allow of the complete exhaustion of the optical limit.

The value and use of monochromatic, especially of blue and violet light, for the resolution of the closest lines, was next referred to, as well as microphotography as the greatest aid for demonstrating the markings on the most difficult tests. The importance of a careful correction of the object glass for different thicknesses of covering glass and different mounting media was next insisted upon. The second part of the paper treated of microscopical illumination, and the various methods to obtain such under the highest powers of the microscope. After the lecture he exhibited a number of beautiful objects under one of the highest object glasses yet manufactured, namely, one fiftieth of an inch.

30th March, 1877.

Mr. W. J. Milligan, Vice-President, in the chair.

Mr. W. C. C. M'Donald, Mary's Place, Maryhill, was elected a member of the Society.

SPECIMENS EXHIBITED.

By Mr. R. H. Paterson.—Some beautiful specimens of corals from Brisbane, and a number of insects collected in Northern Queensland; some of the latter were very rare. He also exhibited a number of beautiful sections of fossil wood from America.

The Secretary having read the Annual Report, which showed an increase of forty members to the Society, Dr. Stirton, F.L.S., proceeded to give his Annual Address.

Additions to the Lichen Flora of South Africa.

By James Stirton, M.D., F.L.S.

The materials from which this paper has been elaborated have been lying beside me for some time, but want of leisure, and, more especially, want of authentic allied specimens with which to compare some of the more critical species, have had mainly to do in delaying my decision. As it is, I am still in doubt in one or two instances, as the desiderata have not been secured.

To Professor P. MacOwan of Gill College, South Africa, I am chiefly indebted for the supply of specimens, generally in fine condition, and, for the most part, in fruit. Dr. John Shaw, now of Cape Town, and Mr. J. H. M'Lea, have also contributed from other districts of South Africa, the former from the region of the diamond fields, the latter from the neighbourhood of Port Elizabeth. In addition, I have inserted the diagnosis of a curious and unique species of Pannaria from the Bonny River, in Western tropical Africa, gathered by Mr. Grant, to whom, also, I am indebted for many other species, several of which are new to science.

With three exceptions, all the new species are from Professor MacOwan, the others are in common, unless where mention is made to the contrary.

Leptogium tremelloides (L.)

Leptogium Hildenbrandii (Nyl.)

Forma thallo subtus hine inde rhizinoso, alibi nudo et ruguloso. Corticola.

Leptogium Menziesii (Mnt.)

Two forms. The one minutely rugulose above, the other smooth, and, in part, glistening.

Leptogium bullatum (Ach.)

var. dactylinoideum (Nyl.)

Leptogium phyllocarpum (Pers.)
and var. isidiosum (Nyl.)
„ macrocarpum (Nyl.)
„ dædaleum (Flot.)
Leptogium adpressum (Nyl.)

Cladonia fimbriata, var. tubæformis.

Usnea articulata (Ach.)
ceratina (Schaer.)
This lichen seems to grow in great luxuriance. I have certainly never seen finer specimens.

Ramalina Yemensis (Ach.)

Stictina fuliginosa (Dicks.), c. fr.

Sticta damæcornis (Ach.). Dr. J. Shaw.
Sticta aurata, var. pallens (Nyl.)

Ricasolia Ravenelii (Tuck.)

Parmelia caperata (Ach.)
Parmelia Texana (Tuck.)
Parmelia amplexa (Stn.), sp. nov.
Thallus flavescenti-virescens, centro rugulosus, ambitu planus lobatulus vel breviter laciniatus, parvus, arcte adpressus (K virescenti-flavens), medulla alba (K— C—), subtus nigricans; apothecia carneo-pallida vel pallide flavescentia mediocria (latit. 2–6 mm.), receptaculo lævi plerumque incurvo; sporæ 8næ, ·012—·016 × ·006—·008 mm. Corticola.
This may be *P. adpressa* (Krph.), but the latter has only been found in a barren state, and I have not seen specimens of it.
Parmelia perforata (Ach.), c. fr.
Parmelia revoluta (Flk.)
Parmelia austro-africana (Stn.), sp. nov.
Similis P. hypoclystæ (Nyl.), sed medulla (supra), K—, dein C. addito, leviter et sordide erythrinosa, at C. seorsum —. Thallus pallide flavescens vel pallide flavescenti-virescens, subtus totus

pallidus vel versus ambitum obscurior aut etiam nigricans, parcissime albido-rhizinosus et hinc inde rugulosus.

Prope "Diamond fields," Dr. Shaw et saxicola prope Kyln Vischrivier (P. MacOwan).

It is rather remarkable that the reactions of the lower surface of the medulla are indicated by (K— C—). Those of the upper surface are characteristic and constant throughout a large series of examples. In my specimens of *P. hypoclysta* from near Rome, as well as in the present lichen, K has little or no reaction on the upper surface of thallus.

This is evidently distinct from *P. mutabilis* (Tayl.), in the colour of the thallus, etc.

Parmelia subæquans (Nyl.)

Parmelia laceratula (Nyl.)

* phricodes.

Similis P. laceratulæ sed thallo densissime coralloideo-isidiato et apotheciis majoribus (latit. 13 – 20 mm.)

Iodo gel. hym. non tincta, sed ea thecarum (præsertim apicium incrassatorum) cœrulescens.

Ad truncos arborum Montis Boschberg, prope "Somerset East," legerunt MacOwan et Tuckerman.

Parmelia Owaniana (Stn.), sp. nov.

Thallus pallidus, flavescenti-pallidus vel etiam nonnihil pallido-cervinus, tenuis, læviusculus hinc inde reticulatim rimulosus (sicut in P. perforata), lobato-laciniatus, ambitu crenatus vel plerumque anguste crenato-incisus et nigro-ciliatus (K e flavo intense rubens fere sanguineus), subtus niger, rhizinosus ambitu spadiceus; apothecia fusco-rufa (latit. 3 – 9 mm.), receptaculo elevato ruguloso vel foveolato-impresso; sporæ 8næ, ellipsoideæ, ·012 – ·014 × ·008 – ·01 mm.; paraphyses graciles in gelatina firma involutæ ut in P. laceratula.

Spermogonia extus nigra plana; spermatia recta exacte cylindrica, ·01 – ·013 × (vix) ·001 mm.

It is difficult to guess what is the colour of this lichen in a living state, but if one may judge by analogy, it should present much the same appearance as *P. perforata*. In a dry state the colour may be said to be a pale fawn, such as *P. perforata*, at times, assumes.

Parmelia thamnidiella (Stn.), sp. nov.

Thallus pallide flavescens vel flavido-virescens (K flavens)

nitidiusculus, fruticulose divaricato-multifidus, laciniis teretibus vel tereti-compressis, dichotome cervicorni-divisis (latit. ·2–·4 mm.), subtus concolor vel interdum (basi) pallidor; medulla alba (K flavens dein interdum et serius aurantiaco-rubens). Sterilis. Terricola?

The laciniæ are very rarely seen in an expanded condition. The apices of the laciniæ, where they fasten to small pebbles, are the only points expanded, and the under surface is then seen pale or occasionally brown and radiculose, the radicles being generally concolorous. The length of a stem with its branches is half an inch or less, at least in the specimens seen. This lichen seems closely allied to *P. molliuscula*.

Parmelia synestia (Stn.), sp. nov.

Another lichen very similar to the preceding has been sent by Mr. J. H. M'Lea from "Cave Mountain," and detected on "Mossy Stones."

Thallus pallide flavescens stenophyllus, multifido- et divaricato-laciniatus, laciniis convexis vel incurvis et etiam convolutis angustis (latit. ·3–1·2 mm.), subtus nigris vel nigricantibus et nigro-rhizinosis, apice obtusis bi- vel trifidis; apothecia fusca mediocria; sporæ 8næ, ·007—·01 × ·0055—·0065 mm., Medulla K flavens dein cito intense rubens vel sanguinea.

As the spores are those of *P. conspersa*, this lichen is excluded from association with *P. sinuosa:* its colour beneath, as well as the radicles and narrower laciniæ, forbid identification with *P. congruens*. The smallest laciniæ are never terete nor concolorous beneath.

It may be a form of *P. constrictans* (Nyl.), but the description of this given in Journ. of Botany, No. 157, p. 19, is quite inadequate for purposes of discrimination.

The species of the Parmelia of the stirps, *P. conspersa*, are very plentiful in South Africa, and they shade off almost indefinitely into one another. How far lichenologists are warranted in splitting up forms and elevating them into the rank of species, is a question for future consideration. Meanwhile a record of such forms may prove useful.

Parmelia phæophana (Stn.), sp. nov.

Thallus pallide ochro-leucus vel albido-flavescens vel pallide virescens (K flavescens dein fuscescens), lævis, nitidiusculus (latit. 3-5-pollicaris), laciniato-divisus, laciniis planis marginibus sinuatis,

subtus pallidus vel versus ambitum obscurior, fuscescens vel etiam nigricans, parce pallido rhizinosus et rugulosus; apothecia fusca (latit. 3–7 mm.); receptaculo lævi margine fere integro; sporæ 8næ, ·008—·01 × ·005—·006 mm. Terricola?, frequens.

The reactions, as stated above, are constant throughout a large series of examples, and are very characteristic.

This lichen has evident affinities to *P. limbata* (Laur.), but the peculiarities enumerated under the latter are entirely absent in this, while the chemical reactions of the two differ to a slight extent.

Parmelia phæophana (Stn.)
var. stenotera;
laciniis angustioribus et sæpissime tenuiter nigro-marginatis.

Besides these two Parmeliæ so nearly related, I possess specimens of *P. molliuscula* in fine fruit, with the same thick stock-like pale rhizinæ, but in which the reactions of K on the medulla are yellow, then a deep red.

Parmelia hottentotta (Ach.)
et var. pachythalla (Spr.)
etiam var. diachrosta (Stn.),
thallo plerumque pallide rufescente et medulla nonnihil rufescenti-colorata.

Physcia chrysophthalma (DC.)
var. capensis (Ach.)
Physcia fibrosa (Fr.)
Physcia leucomela (Mich.)
Supra terram muscosam in Cave Mountain (J. H. M'Lea).
Physcia speciosa (Fr.)
var. hypoleuca (Ach.)
var. granulifera (Ach.)
Physcia cæsia (Fr.)
Physcia parietina (DN.)

Pannaria phlœodes (Stn.), sp. nov.

Thallus albidus vel pallidus vel pallide cervinus, minute rugulosus quasi leprosus, adpresso-stellaris, laciniato-lobatus, lobis contiguis interdum imbricatis et margine undulatis, subtus pallidus rhizinosus passim nudus, rhizinis breviusculis pallidis vel nigricantibus vel nigris; apothecia rufa conferta mediocria

(latit. circ. 1 mm.), margine thallino tenui crenulato cincta; sporæ 8næ incolores simplices ellipsoideæ ·012—·016 × ·007—·01 mm.; paraphyses satis bene distinctæ. Iodo gel. hym. cœrulescens dein sordida. Gonimia mediocria plerumgue oblonga cœrulescentia in glomerulis majusculis contenta. Ad cortices vetustiores vel emortuos in Boschberg.

This lichen is one of a group having close affinities, and is nearly allied to *P. sublurida* (Nyl.)

Pannaria pityrella (Stn.), sp. nov.

Thallus pallide plumbeus vel glaucescens squamulosus, squamulis tenuibus adscendentibus imbricatis parvis (longit. ·3–·6 mm.), hirsutulis quasi tomentellis cuneatis radiato-dissectis et leviter vel obsolete radiato-striatulis, subtus concoloribus; apothecia carnea vel carneo-pallescentia biatorina, parva (latit. ·2–·4 mm.) plana, tenuiter vel (interdum) vix marginata, conceptaculo subtus plerumque pallido-ciliato; sporæ 8næ incolores globosæ, simplices sæpe nucleatæ, diam. ·004—·0055 mm.; paraphyses parcæ pellucidæ fere conglutinatæ apice fere incolores; hypothecium incolor. Iodo gel. hym. cœrulescens dein fulvescens. Gonimia plerumque sirosiphoidea cœruleo-virescentia latit. circ. ·008 mm. Corticola, prope Bonny River in Africa occid. (A. Grant). Affinis, ut videtur, P. asterellæ (Nyl.)

Occasionally the squamæ become decolorized to a pale or pale yellow colour.

Lecanora Domingensis (Ach.)
Lecanora aureola (Tuck.)
Lecanora punicea (Ach.)
* collata (Stn.)

Thallus albidus vel partim pallide virescens vel pallide flavescens rugulosus; apothecia coccinea (thalamii parte supera cum epithecio K persistenter violaceo-tincta); sporæ 8næ bacillares, 9-16-septatæ, ·054—·08 × ·0045—·006 mm. Corticola.

This is evidently an intermediate link between *L. punicea* and *L. hæmatomma* (Ach.). I have not been successful in detecting spermogonia in the only specimen in possession, and so far there remains a doubt as to the side towards which the cape plant tends.

Pertusaria elatior (Stn.), sp. nov.

Thallus pallidus vel pallide cinerascens crassiusculus, rimoso-areolatus, creberriter papillato-rugosus, late expansus (K flavens dein intense rubens); apothecia in verrucis thallinis albidis, truncato-prominulis majusculis (latit. usque 1·8 mm.) inclusa, lecanorina (1—5 in quavis verruca) carnea, albido-pruinosa (latit. ·3 – ·6 mm.); sporæ 8næ plerumque uniseriatæ, incolores ellipsoideæ, simplices, ·02—·032 × ·01—·014 mm.; paraphyses distinctæ graciles undulatæ apicibus incoloribus. Iodo gel. hym. cœrulescens dein intense vinose fulvescens. Corticola.

Arcte affinis P. ambigenti (Nyl.) sed notis allat[illegible] satis distincta.

Phylctis Boliviensis (Nyl.)

Corticola.

Phlyctis capillaris (Stn.)

Similis Ph. Andensi sed thallo pallide olivaceo, ambitu albo et fibrillose byssino-radiante (K—); sporæ 8næ incolores crescenticæ vel nonnihil spiraliter contortæ, 7-septatæ, ·034—·05 × ·005—·0065 mm. Iodo gel. hym. non tincta, sed gel. sub-hym. cœrulescens. Corticola.

Lecidea parvifolia, var. fibrillifera (Nyl.)

Lecidea thaleriza (Stn.), sp. nov.

Thallus cinereus vel lurido-cinerascens vel cinereo-virescens rugulosus, concreto-squamulosus crassiusculus late expansus, ambitu pallidus fibrillose byssino-radiatus (K— C—); apothecia intus pallida vel in sectione crassiuscula fulvescentia, sessilia conferta rufo-fuscescentia vel fusco-rufa, mediocria plana, margine pallidiori vel pallido obtuso cincta, demum convexa et fere immarginata; sporæ 8næ incolores simplices cylindraceæ, ·01—·016 × circ. ·003 mm.; paraphyses crassiusculæ non bene distinctæ conglutinatæ apicibus concoloribus non clavatis; hypothecium lutescens vel lamina crassiuscula pallide rufescens. Iodo gel. hym. cœrulescens dein vinose fulvescens. Corticola. Affinis L. mauritianæ (Tayl.)

Lecidea styloumena (Stn.), sp. nov.

Thallus albidus vel pallidus vel pallide cervinus (K fl. C fl.) lævigatus, glomerato-congestus aut cerebriformi-convolutus, a columellis vel stipitibus extus hirsutulis confertis (alt. 4 – 12 mm.) sustentatus; apothecia nigra primum innata demum sessilia,

mediocria convexa et immarginata intus obscura; sporæ 8næ incolores oblongæ simplices vel sæpe 1-septatæ vel spurie 1-septatæ, ·012—·018 × ·0045—·0055 mm.; paraphyses distinctæ crassæ (crassit. ·003—·004 mm.) apicibus cœruleis clavatis interdum ramosis; hypothecium incolor. Iodo gel. hym. cœrulescens (saltem leviter) dein obscurata vel obscure violacea præsertim thecæ.

The stipites are composed entirely of fibres closely compacted, and arranged generally in a direction parallel to the length of the stipites. There is no outer gonidiac layer nor cortex.

Concerning this plant Mr. MacOwan remarks:—Curiosissima. In rimis rupium brecciatarum ad ripas aridas Kl. Vischrivier.

Lecidea peltasta (Stn.), sp. nov.

Sat similis L. decipienti sed thallo K sordide purpurarcenti. Squamæ rotundatæ umbilicato-adfixæ (latit. 1·5–4 mm.) margine planæ, subtus pallidæ; sporæ oblongæ, ·01—·014 × ·0045—·006 mm.; paraphyses haud distinctæ apicibus late fuscescentibus; hypothecium incolor. Iodo gel. hym. cœrulescens dein obscure et intense vinose violacea. Terricola.

As I cannot lay hands on my specimens of L. decipiens from Ben Lawers, I depend on Mr. Leighton's decision with reference to the chemical reactions of the thallus in British specimens, viz., K— C—.

Lecidea stictella (Stn.), sp. nov.

Thallus vix ullus visibilis; apothecia nigra plana rugosula marginata minuta (latit. ·1–·2 mm.); sporæ 8næ incolores oblongæ vel fusiformi-oblongæ, 1-septatæ, ·008—·01 × ·003—·0035 mm.; paraphyses graciles distinctæ apicibus sordide violaceis crasse clavatis (clavæ latit. ·003–·005 mm.); hypothecium incolor. Iodo gel. hym. cœrulescens dein sordide violacea. Corticola, cum Physcia fibrosa immixta.

Forte affinis L. lenticulari (Ach.)

Lecidea luteola (Ach.)

var. conspondens (Nyl.)

var. chlorotica (Ach.)

Corticola.

The latter may be *L. chlorophæata* (Nyl.), as the apothecia are often conglomerate.

Lecidea millegrana (Tayl.)

Thallus ambitu nonnihil byssinus. In this respect it approaches L. subluteola (Nyl.)

Lecidea proposita (Nyl.)

Arthonia hormidiella (Stn.), sp. nov.

Thallus pallidus tenuis hinc inde rimulosus; apothecia fusca vel fusco-nigra, innato-sessilia convexula parva (latit. circ. ·2 mm.) segregata vel conjuncta vel moniliata et tunc linearia flexuosa vel ramosula, sæpe margine thallino circumscisso cincta; sporæ (4—8)næ incolores dein fuscæ, oblongæ vel fusiformi-oblongæ nonnihil ovoideæ 3-septatæ interdum 1-septatæ et e regione septorum sæpe constrictulæ, ·02—·029 × ·008—·01 mm., epithecium fuscescens; hypothecium incolor. Iodo gel. hym. vinose rubens, gel. sub-hym. cœrulescens. Corticola. Gonidia oblonga mediocria chroolepidea, i.e., extus hirsutula, virescentia.

No other gonidia than those described have been detected, and they are often seen invading the hymenium. The thallus is nevertheless crustaceous, and none of the chroolepoid threads can be detected on the surface by means of a Codington lens. The spores recall those of some of the Stictæ.

Arthonia melanopsis (Stn.), sp. nov.

Thallus fusco-niger rugulosus; apothecia fusco-nigra vel nigra (latit. ·3 – ·7 mm.) sessilia vel elevato-sessilia rugosa convexa et immarginata, sparsa vel sæpius aggregata vel fere conglomerata, intus obscura; sporæ (4—8)næ in thecis ellipticis, incolores oblongo-ovatæ, medio sæpius constrictulæ, nebulose murali-divisæ vel (5—8 × 2—3)-loculares, ·024—·035 × ·009—·013 mm.; paraphyses nullæ. Iodo protoplasma thecarum juvenilium vinose rubescens, ea maturatarum vinose rubens, cæteroquin hymenium non reagens. Corticola.

A very curious lichen, if indeed it is such. The thecæ are imbedded in a dark coloured stroma, composed of largish cells mixed with granules. There is, otherwise, no appearance of a hymenium, properly so called. At times, indeed, a few large green coloured gonidia are seen in connection with the apothecia, and as there is no other lichen visible on the bark, the presumption is they belong to this. This fact, along with the reactions by Iodine on the thecæ, which in a young state, especially, have thick pellucid walls, is in favour of classification with the Arthoniæ.

Forsan affinis A. Huegelii (Krph.)

Verrucaria leucanthes (Stn.), sp. nov.

Thallus albus vel albidus tenuis; apothecia tota pallida prominula mediocria, epithecio minuto poriformi vel papillato; sporæ 8næ uniseriatæ incolores ellipsoideæ, 1-septatæ, ·013—·017 × ·0075—·009 mm., paraphyses confertæ graciles filiformes. Iodo protoplasma thecarum rubescens. Corticola.

Owing to the pale colour, it cannot be well determined whether the perithecium is entire or dimidiate, probably the latter.

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Henry Leask, 326 Gairbraid Street, Maryhill.
David Ligat, Jun., Hillside, Barrhead.
James Lochhead, 17 Arlington St.

Allan M'Anlay, 7 Calder Street, Cathcart Road.
Stuart M'Donald, 274 Bath Street.
W. C. C. M'Donald, Mary Place, Maryhill.
William M'Ilvridge, 36 Lancefield Street.
Alexander M'Indoe, Kelvinbank Terrace, Maryhill.
John M'Intyre, 52 Weaver Street.
James M'Ewan, 43 Old Dumbarton Road.
Richard M'Kay, 26 George Street.
Peter M'Keller, 33 Brisbane Street, Greenock.
Charles M'Kerrow, Mauchline.
John M'Glashan, 114 Candleriggs Street.
George M'Kinlay, 97 West George Street.
Donald M'Phail, Hill Street.
George M'Pherson, College.

James A. Mahony, Ramilton, Donegal.
John Mathie, M.D., 33 Monteith Row.
Walter S. Middleton, 33 Kelvinhaugh Street.
W. J. Milligan, 11 Stonefield Terrace.
James Morton, 446 St. Vincent Street.
Andrew Muir, 79 Kent Road.

J. S. Nairne, M.D., 11 Winton Terrace.
A. Niven, 32 Ashfield Terrace, Hillhead.
Alexander Noble, 9 William Street, Greenhead.

R. H. Paterson, 6 Windsor Place, Sauchiehall Street.
William Partington, Lennoxtown.
James Paton, Kelvingrove Street.
D. Pearson, 215 Sauchiehall Street.
Charles Pennell, 23 Partick Street, Greenock.

Hugh Reid, Jun., 124 North John Street.
John Renwick, Mary Place, Maryhill.
George Russel, Auchentiber, Neilston.

William Sandison, 20 Rutland Crescent.
Adolf Schulze, 1 James Place, Hillhead.
Thomas Scott, 7 Caudlehill Street, Greenock.
Thomas Shand, 132 Renfrew Street.
W. Steven, Sauchiehall Street.
James Stirton, M.D., 15 Newton Street.
George Sturrock, 18 Willowbank Crescent.

James Taylor, Jun., 129 High John Street.
Thomas Todd, 34 Union Street, Greenock.
Robert Turner, 122 Hospital Street.
John Thomson, Deaf and Dumb Institution, Crosshill.
James Thomson, Crossford Mills, Harwood, Paisley.

Dr. A. R. Waddell of Rosemount, Airdrie.
Dr. Laurence Waddell, Cumbernauld.
Robert Walker, 6 Nelson Terrace, Hillhead.
Robert Wight, 134 St. George's Road.
A. S. Wilson, M.A., 124 Bothwell Street.
Rev. A. F. Woodbridge, 18 Albert Drive, Crosshill.