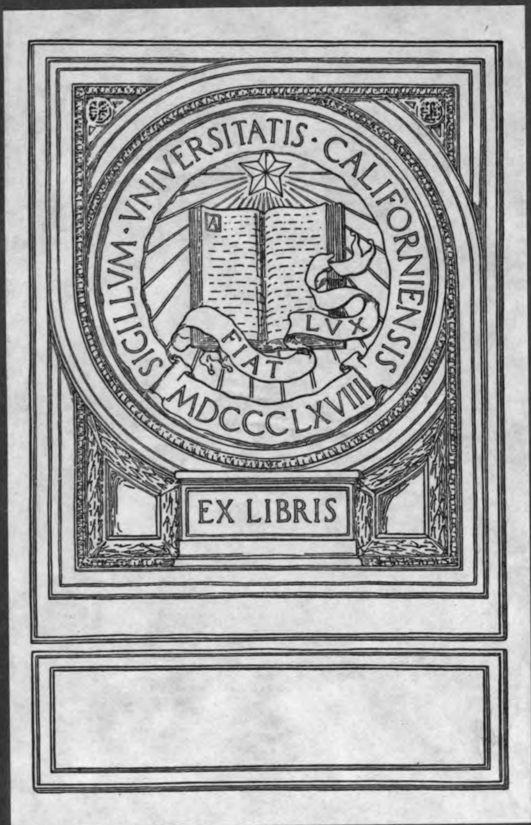
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THE MIDLAND NATURALIST

THE JOURNAL OF THE
ASSOCIATED NATURAL HISTORY, PHILOSOPHICAL,
AND ARCHÆOLOGICAL SOCIETIES AND FIELD CLUBS
OF THE MIDLAND COUNTIES.

EDITED BY
E. W. BADGER & W. J. HARRISON, F.G.S.

"Come forth into the light of things,
Let Nature be your teacher."
Wordsworth.

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WORTHINGTON SMITH DEL.ET SC

PREFACE.

No paper of sufficient merit on an Archæological subject having been sent in for publication, there was no award of the Darwin Prize for 1883. The Darwin Prize is offered in 1884 for a paper on some Botanical subject.

In the coming year the Magazine will be printed in larger type and on better paper. Additional efforts will be made to render the contents interesting to the general reader, while the scientific character of the papers will be carefully maintained.

The Birmingham Natural History and Microscopical Society has decided to purchase a sufficient number of copies each month for the supply of all the members. The proceedings of the Society will be inserted in full, and no separate publication of the proceedings will be made. The Monthly Diary of the Society will also appear each month on the cover.

Secretaries of the various Societies in the Midland Union are urgently requested to secure for publication in the "Midland Naturalist" every really good paper read before the Societies.

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BIRMINGHAM:
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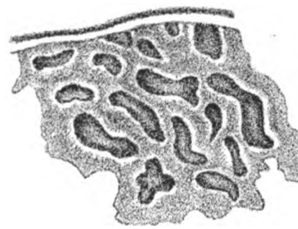

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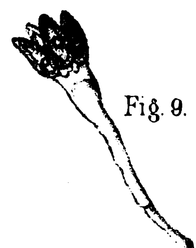

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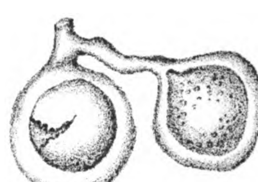
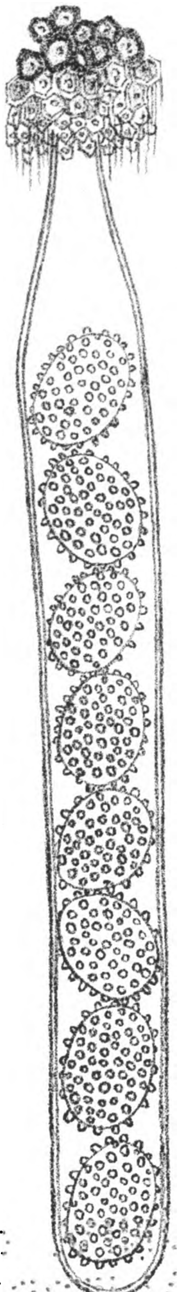


Fig.16.

UNDERGROUND FUNGI.

W.B.G Lith.

Plate II.



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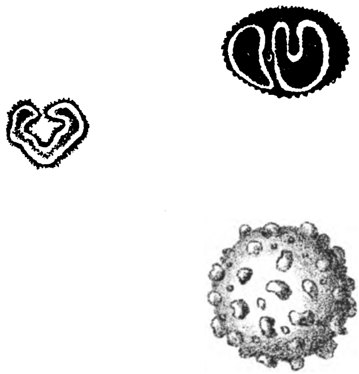


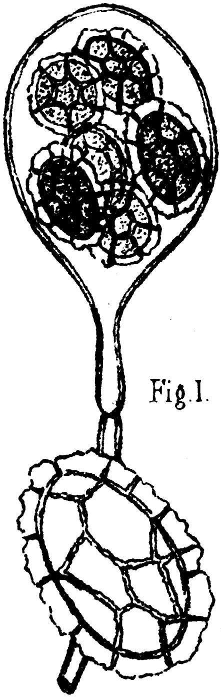
Fig. 7.

Fig. 8.

UNDERGROUND FUNGI.

W.B.G. Lith.

Plate I.



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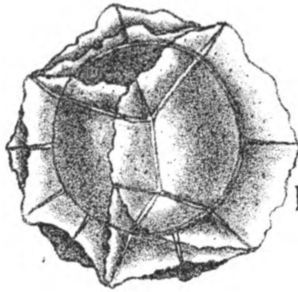

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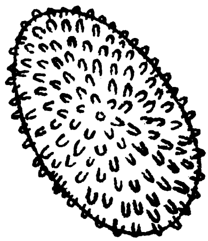

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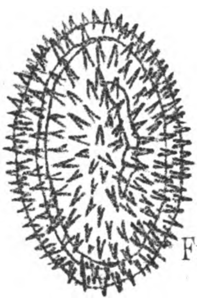

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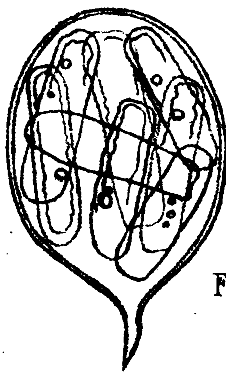

Fig. 5.

UNDERGROUND FUNGI.

W. B G L

THE MIDLAND NATURALIST.

"Come forth into the light of things,
Let Nature be your teacher."
Wordsworth.

ON UNDERGROUND FUNGI (FUNGI HYPOGÆI.)*

BY THE REV. M. J. BERKELEY, M.A., F.R.S.

The most interesting objects in Natural History are often found amongst the most anomalous forms. This is peculiarly the case with the particular group of Fungi which I have chosen for the subject of the present paper, in which I do not profess to make any new observations, but I shall be quite content, should it prove to your members at once interesting and instructive. I should be more able to make it so if I could address you *viva voce*, with power of continual illustration by means of figures drawn at once in your presence, but at my advanced age, now verging on eighty, it would be impossible for me, and I must not attempt that in which I might possibly break down; and I now comply with the request which has been made to me, as far as my powers allow.

The Fungi in question are those which are, as a rule, produced beneath the surface of the earth, or which after a time become

REFERENCES TO PLATES I., II., AND III.

Fig. 1. *Tuber æstivum*, Vittadini, ascus with sporidia and single sporidium.
2. *Tuber Borchii*, Vittadini, single sporidium.
3. *Tuber nitidum*, Vittadini, single sporidium.
4. *Tuber rufum*, Pico, single sporidium.
5. *Balsamia vulgaris*, Vittadini, ascus with contained sporidia.
6. *Genea verrucosa*, Vittadini, section of plant slightly enlarged, and section highly magnified, showing the linear ascus with its contained sporidia.
7. *Genea Klotschii*, Corda, section of plant natural size, and single sporidium.
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9. *Melanogaster ambiguus*, Tulasne, sporophore with spores.
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15. *Endogone pisiformis*, Lk., section of plant slightly magnified.
16. *Do.* *do.* Threads with cysts.

All the figures are copied either from Corda or Tulasne, but the correctness of all has been verified. They are all more or less highly magnified, except where it is otherwise stated.

* Read before the Birmingham Natural History and Microscopical Society, October 4th, 1881.

superficial. They belong to several different types; they abound in calcareous districts, to which many species are restricted, and only a few species can be expected to reward the researches of your local Naturalists. In favourable localities, as the neighbourhood of Bath and Rockingham Forest, many species are abundant. Wiltshire and Kent, and other chalk counties, produce the greater part of what are sold in Covent Garden, but, if properly hunted for, there are parts of Northamptonshire which could yield, as I know by experience, an abundant supply. They, however, in general require a good deal of diligence in research, and some tact in selecting the most fertile spots. It was at one time doubted whether a single species was indigenous; but in "Morton's History of Northamptonshire," published at the beginning of the last century, Rushton Wilderness, formerly in possession of the Tresham family (too well known in history), is mentioned as producing them, yet even then it was doubted whether they had not been introduced with exotic shrubs; but now more than forty species have been found near Bath, and half that number in Northamptonshire. As Truffles are always valuable in the London market, though we do not possess the two species which are most esteemed abroad, one of which is found, indeed, only in Italy, a successful hunt would amply repay the labour of research, and it becomes matter of interest to ascertain means by which they may be found without waste of time and labour. In a particular parish in Northamptonshire they were once so abundant that in a few minutes I could collect as many pounds weight of truffles, some of them of extraordinary size, but this is only the case in favoured spots. The more common way is to train dogs for the purpose, which they answer most effectively. In Germany, pigs are sometimes employed, and there have been cases in which idiots, who could be employed to no other useful purpose, have been found to be first-rate truffle-hunters. The dogs belong to a peculiar breed, between a poodle and a turnspit, and by hereditary descent acquire an especial faculty. They have been trained to such a nicety that Vittadini, who made truffles an especial study, and published an excellent work on the subject, and, indeed, was one of the first to call attention to their real structure, if he wished to get additional specimens of any particular species, had merely to show a specimen to his dogs, allowing them to sniff the peculiar odour, and they would go off into the woods and bring back that species, and that alone. Truffles in that country are a great source of gain to poachers, who send their dogs into the proper localities, who hunt without making the slightest noise, and soon reward their contraband masters. The mode of training is very simple. A truffle is placed within a hollow ball, which is perforated in every direction, and given as a plaything from the earliest age, the dogs thus becoming completely familiar with the scent, which is peculiar, and, as this is very penetrative, they readily detect the spot beneath which a truffle is concealed. But in this country in general the dogs are not so completely trained as to be trusted alone, for they are very fond of the truffles, which they would at once devour. But to prevent this the truffle-hunter carries biscuits, or something which the dog likes better than truffles, and while a portion is thrown down the specimen is secured.

Truffles, as said before, are produced principally in districts which abound in lime. Many attempts have been made at their cultivation, and it was once confidently announced that, like mushroom spawn, truffle spawn would in a few months be on sale. But it ended in utter disappointment. Still, after this result, the late Mr. Disney, of the Hyde, near Ingatestone, made experiments in this direction, and he was so confident of success that I was invited to witness the result of his experiment, the failure of which might indeed have been anticipated, when it appeared that his experimental specimens of truffles were obtained from the Italian warehouses, consisting of refuse slices of truffles, dried by artificial heat. In one case alone something like germination seemed to have taken place. Experiments more rationally conducted were made at the Horticultural Gardens at Chiswick, but the truffles merely rotted without anything like germination. The result was so unsatisfactory that the experiments were not renewed. Better attempts were made by others in more favourable quarters. In the south of France the Viscomte Noé, who was once well known in this country as an emigré, raised truffles in some abundance by enclosing a tract of ground in the forest to keep off the wild boars, which would at once have devoured everything. The ground was then well watered with fluid in which fresh truffles had been grated, and thus he obtained a supply; but this could scarcely be called cultivation. Another plan is adopted with great success in Poitou, which yields the best truffles of Paris. A tract of ground is selected on the downs, and when properly enclosed is sown with acorns, and in a few years, when the seedlings are well established, there is always an abundant supply which continues for several years, when it generally ceases. It was supposed that the young truffles were parasitic on the rootlets of the seedling oaks, but this has not been proved; and in many countries they are by no means confined to oaks, indeed, are most abundant when there is an admixture of beech, hazel, and even of conifers. Their site is sometimes easily detected by the presence of an insect belonging to the genus Leiodes, which hovers about them with the view of depositing its eggs in a favourable situation for their introduction into the fungus, and thousands of specimens are in this way destroyed by the larvæ of the beetle.

It is time, however, that I should say something of underground Fungi in a scientific point of view.

It is well known to every one who has paid the least attention to the structure of Fungi and their classification that there are two great types, namely, those which produce their reproductive bodies (spores) on the tips of certain privileged cells called sporophores or basidia, and those which are developed *within* certain organisms which are called asci or sacs. The former is considered in general the higher division.

including the large tribe of mushrooms, and their numerous close allies for which we have no general popular name, though most of us know that of the puffballs, and our smell informs us too unpleasantly of the presence or neighbourhood of the stinkhorns, a few, however, of which, especially of exotic species, are extremely beautiful objects. As regards the other branch we have the cup-shaped Fungi, known under the name of Pezizas, some of which attract notice by their splendid colour.

There is a third group to which we shall have to advert presently. As, however, the true truffles of commerce are the objects of most importance in an economical point of view, I shall advert to these first.

The common Truffle, whether under that name we include the French Truffle* (*Tuber melanosporum*), the black-seeded Truffle, or our own most abundant species *Tuber æstivum*, the summer Truffle, presents when divided vertically a number of pallid veins which communicate with the warty surface of a dark brown or black tint, and consist of branched threads, which answer to the hymenium (fructifying surface) of the cup-fungi, as they give rise to the fertile threads which are terminated by the seed-sacs. A common lens is sufficient to indicate their presence, where they appear as dark specks. The further investigation requires a compound microscope, and few objects are more interesting than the enclosed sporidia, of some of the more marked of which I have submitted figures to the meeting. They are in general of a comparatively large size, and their external surface is variously spinulose, warty, or reticulated, often to an extent which does not take place in more aerial Fungi. In a few cases, however, as in *Balsamia*, they are smaller and quite even. Very little is known about the impregnation of Fungi, but in the true Truffles, as in some species of the cup-fungi and the water-fungi, which are the destruction of fish, and especially of young salmon, certain threads swell at the tips and curl round the sacs, to which they impart the male element, the whole process in Truffles being completed beneath the surface of the earth. Spermatozoids or spermatia have not been discovered in these Fungi.

Several species have been found in this country, each of which is distinguished by its own peculiar odour; but most of these are so small that they are at once thrown aside by the collectors. The odour of *Tuber melanosporum* is so penetrating that it cannot escape the prying nose of the exciseman or douanier, however cunningly it may be concealed.

There is, however, a distinct genus *Choiromyces*, known amongst other peculiarities by its pale colour and even surface and globose sporidia, which is esculent, though far inferior to the summer Truffle. The species sometimes grow to a large size, and are met with unexpec-

* We believe that the truffle collectors at Audley End call young *Tuber æstivum* before the seed-sacs are formed by that name.

tedly in the most unlikely spots, but occur occasionally in great profusion, principally in avenues of oaks. We are not aware, however, that they ever appear in our markets, and when fresh they are rather acrid. Either the same genus, or one closely allied, produces in Africa and near Damascus abundance of esculent Fungi, of which I have received a large bag of dried specimens, which proved when cooked perfectly insipid. They occur principally about the roots of several species of Cistus, and are found again in the Canaries. They are quite worthless as far as aroma is concerned. The *Choiromyces*, or white Truffles, have long been known in this country, and are figured by Sowerby. A small Truffle, belonging to the genus *Balsamia*, distinguished by its small, oblong, smooth sporidia, is often rooted up by squirrels under beech trees, the odour, as the name implies, betraying its presence.

One of the most curious and instructive genera, as throwing much light on the structure of Truffles, is that of *Genea*, of which we have more than one species in this country. It is, in fact, a Truffle unravelled, as it were, or turned inside out, so as to expose every one of the veins, so that each has a distinct peridium, the whole having one general aperture, instead of all the veins being enclosed within a single crust. It is foreshadowed, perhaps, by those species of Peziza which are more or less subterraneous in their mode of growth, as *P. geaster*, &c. It is, however, to be remembered that the sporidia have no longer the same hyaline appearance, while the structure of the outer coat resembles that of *Tuber*. In the genus *Sphærosoma*, there is no peridium, and the structure is as near that of Peziza as is conceivable, the hymenium being merely undulated or tuberculated. I might advert to other genera of which we have examples, and of some of which no British species has as yet been discovered, especially that of *Picoa* which will some day reward researches among bushes of Juniper. *Hydnotrya*, like *Sphærosoma*, is entirely without peridium. The genus *Elaphomyces* approaches some of the Puffballs, but has asci, and the sporidia, which are perfectly globose, have more than the two usual integuments. The genus *Scleroderma*, however, which is a true Puffball, is sometimes quite hypogæous in its mode of growth, especially where the soil is sandy; and in some parts of Belgium or the United Provinces, where it is very abundant, it is used when young as a substitute for Truffles, of which it is a sorry representative. It is said it is used especially for the Strasburg terrines. It will, however, be more interesting to proceed to others which are more distantly related in structure to the Puffballs, but in which the veins are not resolved into a mass of threads mixed with the dusty spores. One of these, belonging to the genus *Melanogaster*, is well known at Bath as the red Truffle, but though so far culinary as to be employed to give a dark colour to the sauce of a salmi, it is quite free from any pleasant aroma, and if largely used it is very doubtful whether it is quite wholesome. When fresh, the odour is powerful enough, and in an allied species which occurs sometimes in company with the summer Truffle, the smell is quite overpowering, and approaches that of assafœtida. It was known originally as the Musk Truffle.

The species belonging to the second division, distinguished by the spores being naked and numerous, but most of them of small size, are merely of botanical interest, and may be distinguished as *false Truffles*. *Melanogaster* and *Rhizopogon* are distinguished by the peridium being traversed by creeping branched fibres. The spores in the former are dark, in the latter hyaline. Though a species of *Rhizopogon* sometimes occurs abundantly in sandy soils, its odour in age becomes stercorous, and, perhaps in consequence, no one ventures upon it as an esculent. Many species of the genus *Hymenogaster*, which is without the creeping filaments, occur in this country, but most of them are small, and the larger species are by no means tempting. It is curious that in one or two species the spores, though really terminal, are found occasionally surrounded by a cyst, anticipating a structure which obtains in certain moulds. *Octaviana* and *Hydnangium* have sometimes rough, sometimes smooth, spores. One of the latter is remarkable for its orange colour and its almost superficial growth, as I have seen it in the neighbourhood of Bristol. As if no type was to be without its representative, we have the genus *Hysterangium* whose white cartilaginous peridium separates entirely from the fructifying substance, which resembles in colour that of a *Phallus*, and is inclined in age to become soft, though it does not run away, as in *Phalloideæ*, into a loathsome mass.

Those species of *Hymenogaster* which produce a cyst round the spores lead us to the genus *Endogone*, in which, and in its exotic ally, we have essentially a subterraneous *Mucor*. It would scarcely be interesting to go into further details. The drawings submitted to the meeting will show the peculiarities of structure. We may remark, in conclusion, that, as at present known, we have twenty-six species of Truffles, nineteen of false Truffles, and two of Endogone.

Besides these, Tulasne has figured subterranean forms of a few Fungi, which have generally äerial growth. One or two of these, as the Saffron Fungus, which is so destructive to the Saffron Crocus and the Copper Web, which destroys Asparagus, Lucerne, and Mint, are too well known; but perfect fruit has at present not been detected in these species. Still less has it been found in the large Cocoa Nut Fungus, known under the name of Tuckahoo in the United States, which is really an altered state of certain roots, the whole substance being converted into pectic acid, and is used like that for jelly. The equally large masses called in Australia Native Bread, belonging to the genus *Mylitta*, have not been found with perfect fruit, but as far as it is at present known it belongs to the real Truffles. It is highly nutritious, and when dry so hard that it requires to be grated, and answers the purpose of Sago. In Italy large globular masses of earth impregnated with spawn are known under the name of Pietra Fungaya, and when moistened yield an esculent species of Polyporus. Specimens of the perfect Fungus were produced in this country at the Hammer-smith Nursery in the last century, by the ancestor of the present firm.

I know of no tribe of Fungi which exhibits more various forms, or more natural genera. Many species probably might reward future researches in this country; but the search for Hypogæous Fungi is so laborious, and it may be added so exclusive, when carried on perseveringly, as it was by Messrs. Broome and Thwaites, that they are not likely to be very numerous. *Octaviana compacta* is, perhaps, the most recent addition to our list.

A VISIT TO GLEN CLOVA AND CALLATER.*

BY G. CLARIDGE DRUCE, F.L.S.

To the Botanist the name Clova is one of the most interesting among the many rich and fertile places which still remain in Britain, and I derived such pleasure from a recent visit, that I thought it probable some of the members of this Society interested in Botany might care to hear the results of a few days' botanising in a district discovered, I may say, by Don, a florist of Forfar, who began a rough and hard life's labour by an apprenticeship to a watchmaker, afterwards removing to Glasgow, where he obtained a situation as assistant to the Professor of Botany. He then went to Edinburgh, where he eventually made the acquaintance of Sir James E. Smith, who frequently quotes him in his "English Botany;" but, as with Murchison's friendship with Robert Dick, no pecuniary advantage accrued to Don from it.

Don returned to Forfar and obtained a small piece of ground, which he turned into a botanic garden, and in which he grew a great collection of the rarer alpine plants: this garden he called Dovehill. To obtain the plants he made long excursions over the country, his favourite ground being the hills of Clova, and to these, some thirty miles from Forfar, he would walk with no provisions besides some oatmeal or bread and cheese, and no shelter save his plaid, loaded with his paper and bag.

For living plants he would ransack the rocky glens and bleak moors and spongy morasses, adding to our British flora that most lovely willow *Salix lanata*, with its leaves covered with golden-coloured down, the pretty little pink-flowered *Lychnis alpina* on Culrannoch, the graceful alpine Cotton Grass at Restennet, the rare grass *Calamagrostis stricta*, and *Caltha radicans*, near Carse, which, since 1790, when he found it, had disappeared, till recently it has been refound in the vicinity by my friend Mr. Peter Graham, who kindly showed it me this summer.

Besides the above, Don added a willow, *Salix Doniana*, about which there is some doubt as to its indigenity. With the mosses he was almost

* Read before the Birmingham Natural History and Microscopical Society, December 19th, 1882.

equally fortunate, the little moss *Gymnostomum Donianum*, Sm., being found by him, I am informed, when he was only fifteen years old, *Splachnum tenue*, *S. ampullaceum*, *Didymodon inclinatus*, *Weissia nigrita*, *Bryum trichodes*, and other mosses being added to the Forfarshire flora through his industry.

A life of privation and hard work at length told upon his constitution, and a severe cold, caught on one of his excursions, turned to a putrid sore throat, to which he eventually succumbed, leaving his family in extreme poverty. From the enormous amount he collected, and the few facilities he had for keeping his specimens in order, there is no doubt that occasional mistakes were made in his records; but I do not think he deserves the great contempt which some "arm-chair" botanists, such as Arnott, cast wholesale upon him, since several plants recorded by him and long treated as errors have eventually been rediscovered: for instance, *Hierochloe borealis* was said by Don to be found in Glen Cally,—now that glen, or at any rate the head of it (the least likely part), has been searched unsuccessfully; but then possibly the search had been made too late in the year. At any rate, the *Hierochloe* was treated as one of Don's reputed discoveries, till another poor working botanist, Robert Dick (since rendered famous by Smiles), discovered it near Thurso, thus showing there was no great improbability in the Glen Cally record: and further search may rediscover some of the other plants which now figure only in the list of "ambiguities" or "impositions" in our British list. It is said that his Moss records have all since been verified.

When I started for Clova it was just after revelling in the sylvan glades and sphagnum bogs of the New Forest, gathering in the one the splendid crimson spikes of *Gladiolus*, and the delicately lovely flowers of *Melittis*, while in the other the tiny orchis *Malaxis*, the rare *Rhynchospora fusca*, the *Isnardia*, and other rarities offered a great contrast to the *Gentiana verna*, *Potentilla fruticosa*, *Polygala uliginosa*, *Alsine stricta*, *Helianthemum vineale*, and *Viola arenaria* of that strange sugar limestone district of Teesdale, which had tempted me to linger on my northward journey, and perhaps dulled my appreciation for all but the rarer plants; yet, despite these rich treasures, I longed to get to the little inn at Clova, where it is best to bespeak rooms a week previously, and also to obtain a pass from the owner of Glen Dole—Mr. Gurney, of Norwich—a permission obtainable, I am told, not later than June, since the Dole is unfortunately now a deer forest, and the generosity sometimes shown to botanists by landowners is not, I am afraid, conspicuously developed in the present owner of the Dole.

After leaving the train at Kirriemuir, sixteen miles south of Clova, a conveyance was hired, and a pleasant drive it was up to the kirktown of Clova. Once there, the first walk was by the river side to gather *Carex aquatilis* var. *Watsoni*, which occurs about half-a-mile from the inn. Turning eastwards from the river the road is soon met with, fringed here with that lovely Umbellifera *Meum athamanticum*, while the turf is besprinkled, as in Teesdale, with the pretty *Viola lutea*, varying from the richest purple to the palest yellow. A short walk brings one to the little stream that flows out of Loch Wharral, and following up this, at an altitude of about 2,000 feet, the little Highland loch appears, bordered on the north-east side by steep rocky corries, while its south side slopes into green woodlands. Down the corrie a little stream runs into the lake, and above this may be gathered *Saxifraga stellaris*, *Epilobium alpinum*, *Juncus triglumis*, *Hieracium anglicum*, *Veronica alpina*, and the foliage, if not the flower, of that rare grass *Alopecurus alpinus*.

From the moorland (altitude 2,500 feet) a short walk brings one to the top of the Green Hill (2,837 feet) whence a good view of the East Forfar Hills may be had. A descent from this of 800 feet, in a northerly direction, brings one to Loch Brandy, where, on skirting the south side, quantities of the cloudberry *Rubus Chamæmorus*, in flower or fruit, will be met with, as also of *Arbutus uva ursi*, and *Empetrum nigrum*. In the north-west corner of the lake grow *Subularia aquatica*, *Nitella opaca*, *Isoëtes*, *Lobelia Dortmanni* and a variety of *Ranunculus Flammula* which flowers under water; this lake, like Wharral, has the same high cliffs on the north and east, and on the stony débris may be found *Lycopodium annotinum*, and a few plants of *Aspidium Lonchitis* still survive the depredations of Dundee excursionists, to whom this loch is the Mecca of their pilgrimage. Higher up the corrie occur *Hieracium argenteum*, *H. pallidum*, *H. eximium*, *H. melanocephalum*, and *Rhodiola*, while in the water-course some fine plants of *Cerastium alpinum* may be gathered. On the moorland near *Lycopodium complanatum*, recently added to the British flora was obtained. On attaining the top of the corrie, the summit of the Snub is reached (about 2,500 feet), here covered with *Loiseleuria procumbens*. The Snub itself is partially separated from the corrie by a narrow rift a few feet wide and about seventy deep, of recent origin, which the yearly frosts widen perceptibly. Looking north-east Lochnagar may be plainly seen, while the western sky is filled up with the summit of the Bassies and the Driesh, which separate Glen Clova from Glen Prosen. Northwards is the fine front of Craig Mellon, north-westward of which is the entrance to the Dole, the north-eastward road leading up to Glen Muick or Bachnagairn. A short walk takes one to Ben Reda, whence the descent may be made into the glen. On one of the many ruined shielings (there being ninety-four in this glen alone) *Gnaphalium margaritaceum* occurred, and ascending up the most southward turn from Loch Brandy a strange variety of *Gentiana campestris* was gathered, with *Habenaria albida*, *Polygonum viviparum* and *Veronica humifusa*.

The next day was of course spent in the Dole. I began my work at Craig Maid, a high mass of rocks (about 2,250 feet) on the west side of the Dole, about eight miles from the hotel, and on this historic rock, magnificent in outline, a rich field for work presented itself: steep rocky cliffs with grassy ledges, on whose rich micaceous soil grew at some considerable height the rare *Erigeron alpinus*, the lovely perishable flower of *Dryas octopetala*, the beautiful *Veronica saxatilis*, the rare sedge *Carex rupestris*, and *Gnaphalium norvegicum.* Still higher occurs *Mulgedium alpinum;* and here too Professor Graham first found *Astragalus alpinus* in Britain. By the stream sides grew *Cerastium alpestre*, *Juncus biglumis*, *Hieracium Lawsoni*, and *H. calenduliflorum;* and now again on the ledges, on one occasion so narrow that progress could only be made crab-like (sideways) on one's knees, we gather *Carex Leesii*, *Hieracium eximium*, *Carex atrata*, *Salix reticulata*, etc. All about the Dole were splendid fronds of *Aspidium Lonchitis* varying from two inches to two feet in length, while *Salix Lapponum*, *S. petræa*, *S. Andersoniana*, *Gnaphalium supinum*, *G. sylvaticum* var. *alpestre*, *Juncus trifidus*, and *Carex atrata* were again and again met with. Coming to Craig Rennet, at about 2,000 feet a quantity of *Linnæa borealis* was met with in fragrant flower, growing near that lovely moss *H. crista-castrensis.* Ascending again on to steep ledges *Oxytropis campestris* was gathered, in its only British locality, and close by this that rare British fern *Woodsia hyperborea*, for which so many botanists have hazarded life or limb. Close by grew *Avena alpina*, *Aira alpina*, *Aira brevifolia*, and other rare alpine plants; then, searching the rocks of Craig Rennet, which form the north boundary of Glen Phee (itself a western prolongation of the Dole), at the head of which a burn comes sprawling down some three or four hundred feet, and climbing up the wet shelving rocks on the south side of the burn another series of alpines was gathered, including the sweet heliotrope scented *Saussurea*, white and pink flowered *Saxifraga oppositifolia*, large flowered *S. hypnoides* and *S. sponhemica*, *Epilobium alsinifolium* and *E. anagallidifolium*, *Cochlearia alpina*, sweet-scented *Pyrola rotundifolia*, large plants of *Asplenium viride*, *Pseudathyrium alpestre*, *Salix herbacea*, that smallest British shrub, *S. reticulata*, with abundant capsules, *S. Myrsinites*, *S. procumbens*, *S. arbutifolia*, *S. Stuartiana*, *Poa alpina*, *Vaccinium uliginosum*, mimicking the willows in habit (here I saw it for the first time in flower), *Sagina saxatilis*, *Silene acaulis* var. *alba*, *Carex vaginata*, *C. rigida*, *C. capillaris*, *C. flava*, *C. pallescens*, large *C. atrata*, *Rhodiola* in profusion, *Sibbaldia* and *Rubus saxatilis*, while on the moorland (above 2,600 feet) *Carex aquatilis*, *C. vitilis*, *Caltha minor*, *Tofieldia*, etc., occurred; in fact, of all the plants recorded for the Dole and Phee, I only missed *Carex Grahami.*

Another day was occupied in walking from the kirktown up Glen Clova to Braedownie, turning eastward by Craig Mellon, and on to Bachnagairn shooting lodge (1,500 feet). Ascending moorland to north-west up to Loch Esk (2,500 feet), thence ascending to western ridge (2,750 feet), and descending to the White Water, I found *Phleum alpinum*, *Caltha minor*, *Carex aquatilis*, *C. vitilis*, etc. Keep by the side of White Water till it reaches the base of Tolmount, ascend it (3,140 feet), and then stretching out before is the fine Glen Callater, Lochnagar, and the Broad Cairn on the east, Carn-y-Glasha and Glas Mheal to the west, while northwards, over Braemar, rise the Aberdeenshire Alps, Ben Avon, etc., with the snow-fields shining on their southern slopes, still unmelted by the August sun. Descending the cliffs of

Tolmount (about 500 feet), and then keeping on the west side of Glen Callater, a gathering almost as rich as from the Dole was made, a list of which I will not now detail, but simply enumerate some of the special finds:—*Salix lanata*, in magnificent condition, overhung the steep rock of a small waterfall (at about 2,500 feet), and near this a single plant of *Mulgedium alpinum*. Here too *Carex vaginata*, and *C. Leesii*, the latter only an acute-glumed variety of *pilulifera*, with *Cerastium alpestre* were gathered, *Poa Balfourii*, *Aira alpina* and *Juncus castaneus*, the latter nine inches high, *J. biglumis*, etc., were found. Descending to Loch Callater (1,600 feet) *Carex ampullacea*, *Subularia*, *Isoëtes*, *Callitriche autumnalis*, etc., were gathered.

The next day was employed in walking up Glen Callater on the west side of the loch, where the rich profusion of *Saxifraga aïzoides* and strongly stunted *Veronica Beccabunga* were admired; then ascending Tolmount (3,140 feet), descend to White Water, where *Cornus suecica* was gathered, ascend Tom-y-Buide (3,400 feet), descend to moorland (2,750 feet), and walk across to Little Culrannoch (3,200 feet). Here there was a great profusion of *Lychnis alpina* in splendid flower, growing with *Armeria duriuscula*, *Cochlearia alpina*, and *Cerastium alpestre*. A fine view was had of Glen Caness and Glen Caenlochan, the white quartz veins at its head marking the locality of *Gentiana nivalis*. Descending to the White Water by the Fenlah burn *Carex rariflora* was gathered, and then a rough and toilsome journey was made up the valley of the White Water to Carn-y-Glasha (3,484 feet), and thence to the corrie of Loch Ceander. From the rocks above a fine view was had of the east side of Glen Callater, the polished rocks showing the glacial friction most plainly. By the stream above the corrie grew *Alopecurus alpinus*, *Phleum alpinum*, *Equisetum nudum*, etc., and in the corrie itself (from 2,600 down to 2,000 feet) a rich gathering was again made. In addition to the plants before mentioned occurred *Hieracium chrysanthum*, *H. cæsium*, *H. nigrescens*, *Carex rupestris*, *Pseudathyrium alpestre*, *Salix glauca*, *Carex vaginata*, *Polygala grandiflora*, etc., ; and then down came the rain (which had been threatening all day) in thick sheets, while the mist came rolling over the cliffs, shutting out rock after rock from vision, till the descent became risky. But at last, one reached the boggy ground at the foot of Loch Ceander, where *Carex pauciflora* was gathered, and then a squashy walk was made down to Braemar with little besides *Nitella opaca*, *Chara fragilis*, *Pyrola rotundifolia*, *and Listera cordata* to cheer the way.

The following day proved but little better, heavy clouds hanging over the mountains, rendering the glen still more gloomy; but still Lochnagar had to be ascended, the intention being to descend by the great precipice to the lake and thence to Balmoral and Ballater. Near Braemar *Hieracium prenanthoides*, *H. murorum*, *Salix phylicifolia*, *Campanula rotundifolia* var. *montana* were gathered. By Loch Phadrig (2,000 feet) is a plentiful growth of *Betula nana*, and on the ascent to Lochnagar *Hieracium chrysanthum*, and *Trientalis Europæa*, may be gathered. On the moorland (3,250 feet) overlooking Loch Dhu is the locality for *Carex rariflora* and *C. lagopina*, but the latter this time I could not see, for here the clouds came down so thick as to render anything beyond ten yards invisible, distorting and magnifying objects till a poor unforunate sheep became the size of a deer. Here in a ravine *underneath* a snow wreath I sat sheltered from the rain for three hours, and then was obliged to retrace my steps to Braemar.

The foregoing will show what a rich spoil of plants may be gathered even in indifferent weather, and as I have already exceeded the space I originally intended filling, I am obliged to omit any account of the plants gathered at Loch Park, Deeside, and the sands of Barry, and of my doings during a most interesting day occupied in dredging Lochs Rescobie and Balgavies, and botanising in the bog of Restennet.

THE FLORA OF WARWICKSHIRE.

AN ACCOUNT OF THE FLOWERING PLANTS AND FERNS OF THE COUNTY OF WARWICK.

BY JAMES E. BAGNALL.

(Continued from page 257.)

SAXIFRAGACEÆ.

SAXIFRAGA.

S. tridactylites, *Linn.* *Rue-leaved Saxifrage.*
Native: On walls, roofs, &c. Locally abundant. April, May.
I. Wishaw; Coleshill; Fillongley; Nuneaton; Arley; Whitacre; Middleton; Kingsbury; Erdington.
II. Harbury! *Y. and B.* Wall near Newbold and at Morton, *R. S. R.*, 1877; Brailes; Honington!; Shipston, *Newb.;* Tysoe and Compton Wynyates, *Rev. J. Gorle;* Salford! *Rev. J. C.*, Henley-in-Arden, &c.

S. granulata, *Linn.* *White Saxifrage.*
Native: On banks, and in fields and pastures. Locally common. May, June.
I. In the garlick meadows, Penns Mill! *With.*, ed. 5, ii., 498. Sutton Park; New Park; Middleton; Minworth; Meriden; Hampton-in-Arden, &c.
II. Between Leamington and Warwick; Pigwell quarry, Warwick; roadside at Guy's Cliff, *Per. Fl.*, 39; Warmington, *Bolton King;* Honington, *Newb.;* Bilton, *R. S. R.*, 1877; near Tysoe, *Rev. J. Gorle;* Allesley; Stratford-on-Avon; Alcester, &c.

CHRYSOSPLENIUM.

C. oppositifolium, *Linn.* *Opposite-leaved Golden Saxifrage.*
Native: In marshes, swamps, damp woods, &c. Local. April, May.
I. Sutton Park; Erdington; Plant's Brook; Marston Green; lanes about Arley; abundant in Hartshill Hayes; lanes about Fillongley.
II. Sambourne; Great Alne, *Purt.* 210: Crackley Wood, near Kenilworth! near Leek Wootton, *Per. Fl.*, 38; Honily Brook! *Y. and B.;* Dripping Well, Milverton! *H. B.;* Allesley, Coventry, *Bolton King.*

C. alternifolium, *Linn.* *Alternate-leaved Golden Saxifrage.*
Native: In marshes, swamps, damp woods, &c. Rather rare. May.
I. Temple Balsall, *Bree*, *Purt.* i., 211; Sutton Park; Plants Brook; Minworth: Marston Green; Elmdon.
II. Crackley Wood! *Per. Fl.*, 38; Honily Brook; *Bromwich*, *Herb. Brit. Mus.;* meadows, Rounshill Lane, Kenilworth! *H. B.*

PARNASSIA.

P. palustris, *Linn.* *Grass of Parnassus.*
Native: In bogs and marshy ground. Rare. July, August.
I. Coleshill Bog! and Knowle! *Purt.* i., 163; in meadows at Penns Mills, near Erdington; *With.*, ed. ii., 465, near Stonebridge; in meadows between Bradnock's Marsh and Berkswell, *Per. Fl.*, 27; Sutton Park! *Freeman*, *Phyt.* i., 262; between Olton and Elmdon, *Rev. J. Gorle;* abundant near several of the pools in Sutton Park, 1880.
II. Norbrook; Fern Hill, *Per. Fl.*, 27; boggy meadows near Warwick, *Bree*, *Purt.* iii., 350; meadows, Rounshill Lane, Kenilworth, *H. B.*

UMBELLIFERÆ.

HYDROCOTYLE.

H. vulgaris, *Linn.* *Marsh Pennywort.*
Native: In bogs, marshes, and swamps. Local. June to Sept.
I. Sutton Park, abundantly; Middleton Heath; Coleshill Pool and bog; sand quarry, Cornell's End; Olton Reservoir; marsh near Packington.
II. Near Hasler Fields; near Hoo Mill, *Purt.* i., 152; Bagington Park, *Per. Fl.;* Rugby district, *R. S. R.*, 1867; Kenilworth Heath; Hasley Common, *H. B.*

SANICULA.

S. europæa, *Linn.* *Wood Sanicle.*
Native: In woods, copses, and shady banks. Locally common. May, June.
I. Sutton Park; New Park; Fillongley; lanes about Arley; Hartshill Hayes; near Solihull; Elmdon; Kingsbury Wood.
II. Honington, *Newb.;* Combe Woods; Prince Thorpe; Cubington; Wootton Wawen; Alveston pastures; Salford Priors; Red Hill; Edge Hills.

APIUM.

A. graveolens, *Linn.* *Wild Celery.*
Native? Near streams, and canals in Lias soils. Very rare. July.
I. Bishopton Spa, near Stratford-on-Avon; *Cheshire*, *Herb. Per.* "Near Honington in one spot, with *Samolus Valerandi*, the wild form, July, 1880," *Newb.*

HELOSCIADIUM.

H. nodiflorum, *Koch.* *Procumbent Water Parsnip.*
Native: In streams and ditches. Common. June to August. Throughout the country.
b. repens, R. "Moist boggy places. Rare. June to August. Cookhill, near Alcester." *Purt.* iii., 25.
Var. *pseudo-repens*. Streams. Rare.
I. Sutton Park; marsh near Escoles Green.
II. Woodloes, near Warwick; Rounshill Lane, Kenilworth, *H. B.*

H. inundatum, *Koch.* *Least Water Parsnip.* *Water Honewort.*
Native: In marshes and near pools. Rare. June to August.
I. Coleshill Pool! *Freeman, Phyt.* i., 262, Sutton Park; Springbrook, near Earlswood.
II. Near Sambourne, *Cheshire, Herb. Per.* Arbury Hall.

PETROSELINUM.

P. sativum, *Hoffm.* *Common Parsley.*
Alien: On walls and old ruins. Rare. July.
II. "Walls at Spon End, Coventry; in a deep, rocky cutting on the London and North Western Railway, near Whitley Common." *Kirk, Phyt.* ii., 970; naturalised on an old wall at Warwick; *Dr. Lloyd, Herb. Brit. Mus.;* Kenilworth.

P. segetum, *Koch.* *Corn Parsley.* *Corn Honewort.*
Native: On banks in Lias soils. Rare. July.
II. Warwickshire, *Bree, N. B. G.*, 1835; Bardon Hill; Mont Piers Hill; *Cheshire, Herb. Per.;* Whitnash; Tachbrook, *Y. and B.;* Myton, *H. B.;* Tredington, Whatcote, *Newb.;* banks at the Cape and Stank Hill, Warwick; *H. B., Herb. Brit. Mus.*

SISON.

S. Amomum, *Linn.* *Hedge Stonewort.* *Hedge Honewort.*
Native: By roadsides and on banks in Lias and marly soils. Locally abundant. August, September.
II. Whitnash, Tachbrook, *Y. and B.;* Newbold-on-Avon, *Blox., N. B. G.;* Honington! Tredington! Tysoe; Shipston; Halford, *Newb.*, near Stratford-on-Avon; Alcester; Wixford; Bidford; Ipsley; Studley; Ullenhall; Tanworth; Lapworth Street.

ÆGOPODIUM.

Æ. Podagraria, *Linn.* *Common Goutweed.*
Denizen: On hedge banks near villages. Rather common. May to July. Area general.
Fruiting freely in many situations. I have never seen this plant very remote from villages.

CARUM.

[**C. Carui,** *Linn.* *Common Caraway.*
Alien or Denizen: On waysides and railway banks. Rare. June, July.
I. Near Hampton-in-Arden, *T. Kirk;* on waysides near Oscott College for several years, *Rev. J. C.*
II. I have picked the *Carui* on the banks of the L. and N. W. Railway at various spots between Hampton and Brandon, a length of fourteen or fifteen miles. Curiously enough a policeman at Hampton informed me that he recollected a package of Caraway Seeds being injured whilst on a truck, and he supposed the seeds would be scattered all the way up the line, *T. Kirk; Compend. Brit.*, 519. Willenhall railway bank, *Kirk;* footpath to Lawford and railway bank, Brandon, *R. S. R.*, 1877-80.]

BUNIUM.

B. flexuosum, *With.* *Common Earth Nut; Pig Nut.*
Native: On banks, waysides, heaths, and in woods. Common. May, June. Throughout the county.

PIMPINELLA.

P. saxifraga, *Linn.* *Common Burnet Saxifrage.*
Native: On banks, heathy waysides, &c. Rather local. June to September.

I. Sutton Park; Marston Green, with long styles and broader leaflets; Elmdon; Solihull; Middleton; near Hartshill.

II. Tredington; Honington; Shipston-on-Stour, "mostly the large plant figured as *dissectum*," *Newb.;* Harborough Magna; Salford Priors; near Barnmoor Green; near Bearley Cross.

P. magna, *Linn. Great Burnet Saxifrage.*

Native: On banks and waysides, in marly and calcareous soils. Locally abundant. July to September.

I. Waysides between Ansley and Over Whitacre; lanes about Arley and Shustoke; abundant on the road between Nuneaton and Atherstone.

II. Rugby, *A. Blox., N. B. G.*, 1837. Allesley! Meriden! &c. *Bree, Mag. Nat. Hist.* iii., 164; Counden, *T. Kirk, Herb. Brit. Mus.;* Harborough Magna; Wyken Lane, Coventry; abundant in Banner's Lane and Broad Lane, Tile Hill; Wixford, Alcester, &c.

SIUM.

S. angustifolium, *Linn. Lesser Water Parsnip.*

Native: In ditches, pools, and streams. Local. June to September.

I. Sutton Park; Middleton; lane at Minworth; Coleshill Pool; near Knowle; Hampton-in-Arden, &c.

II. Harborough Magna, *Rev. A. B.;* Honington; St. Dennis, *Newb.;* Myton, near Warwick; Chesterton, *H. B.;* Rugby district, *R. S. R.*, 1877; Southam, *Y.* and *B.;* canal near Wooton Wawen, &c.

[*S. latifolium, Linn. Warwickshire, Bree, N. B. G.* 38 Warwickshire insufficiently vouched. *Top. Bot.*, 186. Recorded also from near Rugby. *R. S. R.*, 1868.]

BUPLEURUM.

B. rotundifolium, *Linn. Common Hare's-ear. Thorowax.*

Native: In cultivated fields, in Lias and marly soils. Local. June, July.

II. Bidford! Haslor! Grafton! *Purt.* i., 148; Wootton, near Warwick. *Countess of Aylesford, B. G.*, 634; near Brinklow Railway Station, *Rev. A. B., R. S. R.*, 1874; Tachbrook, Harbury, *Y.* and *B.;* Kineton, Chadshunt, *Bolton King;* Morton Morrell; Red Hill; Oversley; Wilmcote.

ŒNANTHE.

Œ. fistulosa, *Linn. Water Dropwort.*

Native: In pools and marshes. Local. June, July.

I. Marston Green; Coleshill Pool; Duke's Bridge; Meriden Marsh; Hampton-in-Arden; Bedlam's End, near Knowle; Withybrook, &c.

II. Whitnash; Kenilworth, *Y. and B.;* Honington, *Newb.;* old canals near Clifton Mill! between Newbold and Harboro'! near Little Lawford! *R. S. R.*, 1877.

Œ. Lachenalii, *Gmel. Parsley Water Dropwort.*

Native: In marshes and drains. Rare. July to September.

II. Near Honington, *Newb.;* marshes and drains near Stratford-upon-Avon, in abundance, 1882.

[*Œ. pimpinelloides, Linn.*, is placed among the Warwickshire plants in Perry's herbarium; the locality given, viz., "3½ miles from Stratford, on the Banbury Road," belongs to Worcestershire. I have not seen this plant in or from any Warwickshire station.]

Œ. silaifolia, *Bieb.* *Sulphurwort-leaved Dropwort.*
Native: In ditches. Very rare. August.
I. (*Œ. peucedanifolia.*) In a gorsy field by Small Heath House, near Birmingham; *With.*, ed. 7, ii., 384.
II. (*Œ. peucedanifolia.*) Not rare. Great Alne, Grafton, Bidford, *Purt.*, i., 150; near the footroad to Bishopton Spa, near Stratford-on-Avon, *Cheshire*, *Herb. Perry.*

Œ. crocata, *Linn.* *Hemlock Water Dropwort.*
Native: On banks by rivers and streams. Rare. July.
I. Witton, abundantly on the banks of the Tame; Gravelly Hill; Castle Bromwich; Water Orton.

Œ. Phellandrium, *Lam.* *Fine-leaved Water Dropwort.*
Native: In rivers, ditches, and pools. Rare. July.
II. (*Phellandrium aquaticum.*) In an old gravelpit full of water at Eden Way, *Purt.* i., 156; the Avon at Rugby Mill; and other places, *Rev. A. Blox, N. B. G.*; near Stratford-on-Avon, *Cheshire*, *Herb. Per.*; Compton Verney, *H. B.*; river in Brownsover Fields, at Little Lawford Mill, *R. S. R.*, 1877; Chesterton Mill Pool.

Œ. fluviatilis, *Coleman.* *Floating Water Dropwort.*
Native: In rivers. Rare. July.
II. Emscote, Birdingbury, *Y.* and *B.*; In the river beside the footpath to Brownsover, *R. S. R.*, 1878; in the Leam, near Leamington! and Offchurch, *H. B.*; Harborough Magna, *Rev. A. Blox.*

ÆTHUSA.

Æ. cynapium, *Linn.* *Common Fool's Parsley.*
Native: In fields, on waysides, waste heaps, &c. Common. June to October. Area general.

FŒNICULUM.

F. vulgare, *Gaertn.* *Common Fennel.*
Casual: On railway banks. Rare. June.
II. Abundant on the railway banks between Warwick and Emscote, *H. B.*
So far as my knowledge serves this is the only station for this plant in the county. Mr. Bromwich informs me that it is well established here.

(*To be continued.*)

Reviews.

The Sun: its Planets and their Satellites. By the Rev. E. Ledger, M.A. 432 pp., 94 woodcuts, 8 plates. Price 10s. 6d. Published by E. Stanford.

In this well-printed and excellently illustrated book, the Gresham lecturer gives a very clear account of the members of the solar system, and of the laws by which they are controlled. The author appears to have sought most diligently for information, and has successfully incorporated in this book the most recent results of the study of astronomy. He treats chiefly of the physical side of the subject, and this is one great factor of his success, for astronomical mathematics are "caviare to the general." The illustrations are very good, the plates, executed by the Woodbury process, being especially successful. A chart of the planet Mars, from drawings made at Madeira in 1877 by that enthusiastic astronomer Mr. N. E. Green, forms a capital frontispiece to the book. W. J. H.

Rudimentary Astronomy. By MAIN and LYNN. Third edition, 1882; pp. 176; woodcuts. Published by Crosby, Lockwood, and Co. Price 2s.

THIS is pre-eminently a book for the practical astronomer. Written by the late Radcliffe Observer, and revised by a Greenwich Observatory assistant, the descriptions of astronomical instruments and their methods of use are accurate and precise. In addition to chapters on the Moon, Planets, Fixed Stars, Spectrum Analysis, etc., there is an admirable account of the (to young astronomers) puzzling phenomena of refraction, parallax, aberration, precession, and nutation.

W. J. H.

The Botanical Exchange Club of the British Isles; Report for 1881, pp. 45—60. Manchester: Jas. Collins and Co.

How are the mighty fallen! This report contains the verdicts, passed by certain authorities, on the specimens gathered by the members of the Club during 1881. The minute study of varieties, now called species, of many plants occupies the attention of our British botanists at the present time, and develops so many differences of opinion, bluntly expressed, that the study of these pages reminds one, in parts, of a Billingsgate scolding match. There is no doubt that a great deal of light can be thrown upon the process of evolution generally, and upon the means whereby existing species of plants have been developed from their ancestral forms in particular, by the diligent comparison of the interminable varieties of Ranunculus, Viola, Rubus, Rosa, Pyrus, Carduus, Hieracium, Euphrasia, Erythræa, Mentha, Rumex, Salix, Potamogeton, Chara, etc. A few attempts to glean in this field have already been made. But what can be gained by such intellectual diversions as the following (p. 52):—"*Hieracium sp.*, A. LEY. 'I hesitate between *gothicum* and *crocatum*,' J. G. Baker. 'I believe *boreale*,' C. C. Babington. 'This is *H. corymbosum*,' J. T. Boswell." Or this (p. 55):—"*Symphytum sp.*, A. LEY. '*Orientale*,' J. G. Baker. 'It looks like *peregrinum* in a weak state,' C. C. Babington. '*S. asperrimum*,' J. T. Boswell." Again, but not quite so bad, because one of the disputants is missing (p. 51):—"*Helosciadium Moorei* ?, S. A. STEWART. 'The *Moorei* which I place under *inundatum*,' C. C. Babington. This is not at all like my *H. inundatum*, var. *Moorei*. It is a luxuriant state of *ochreatum*, approaching the normal form of *H. nodiflorum*,' J. T. Boswell." Such a *reductio ad absurdum* of "critical" botany must soon work out its own cure. What that cure is has been already indicated in these pages; it is, to recognise that the vast and abounding fertility of nature will not be tied down by our hard and fast lines. It is, to acknowledge that, however many "species" we may describe, we can still discover numerous specimens which will accord with none of them. It is, to give up the vain idea of inventing a name for every plant we find, and to remember that many of our modern definitions of species are merely descriptions of a group of individuals from some particular locality or kind of habitat. The "splitting fever" is now, perhaps, approaching its height; the crisis past, reaction will set in, and recovery will be slow, but sure. It must not be supposed, however, that the whole of this pamphlet is like the extracts which have been made above. There is some interesting information about British plants, with records of new localities, but it is too evident that, if it were not for the recent intense development of the craze for the minute subdivision of species, the Botanical Exchange Club of the British Isles would have little left to do.

W. B. G.

METEOROLOGY OF THE MIDLANDS.

THE WEATHER OF NOVEMBER, 1882.

BY CLEMENT L. WRAGGE, F.R.G.S., F.M.S., ETC.

Great and unusual disturbances, both atmospheric and magnetic, marked the month of November. Generally it was very stormy and wild, with an abundant rainfall and resulting floods. Thunderstorms took place on the 4th and 8th, with hail; snow on the 15th and 16th, and more hail on the 27th. Strong winds and gales were frequent. Brilliant and continuous displays of aurora with co-existing earth currents of great strength, causing the partial collapse of the working of the telegraph system, occurred, especially during the third week. The existence of a tremendous sun-spot at the same time—which, as my sketches show, marked a region of extraordinary activity and disturbance in the solar atmospheres—proves, I think, conclusively the close correlation existing between the great solar storms and terrestrial magnetism. The auroræ were well observed at Fort William. A smart shock of earthquake occurred in the west of Scotland on the morning of the 12th. In Central England the highest reduced barometric reading was about 30·137, and happened on the 30th; the lowest, 29·110, took place on the 8th. Mean temperature was about 41·3; amount of cloud only 5·7 (scale 0 to 10), and relative humidity 88 %. Westerly winds prevailed. The absolute maximum temperature in sun's rays (reported) was 105·3 at Hodsock on the 5th; and the absolute minimum on grass was 11·7, on the 18th, at Aspley Guise. Some 19 ground frosts were noted. Bright sunshine 72·9 hours, at Hodsock, or 29 %; 78·5 at Strelley, 72·4 at Aspley Guise, 81 at Oxford, and 53·3 hours at Blackpool. The mean temperature of the soil at a depth of one foot was 42·9 at Hodsock, 40·9 at Strelley, and 41·7 at Cardiff. The mean amounts of ozone were 1·8, 2·2, 5·0, and 6·8—values for Oxford, Cheltenham, Carmarthen, and Blackpool respectively. Solar halos were observed in the Midlands on the 21st and 28th; a very fine lunar halo on the 23rd; and a beautiful lunar corona at Fort William on the 25th.

STATION.	OBSERVER.	RAINFALL. Total for M.	RAINFALL. Greatest fall in 24 hours.		RAINFALL. No. of rainy d.	SHADE TEMP. Absolute Maximum.		SHADE TEMP. Absolute Minimum.	
		In.	In.	Date.		Deg.	Date.	Deg.	Date.
OUTPOST STATIONS.									
Fort William (a)	C. L. Wragge, Esq., F.M.S.	8·83	1·40	7	25	56·5	1	26·0	12
Spital Cemetery, Carlisle	I. Cartmell, Esq., F.M.S.	5·26	0·90	8	18	56·3	6	22·6	15
Scarborough (a)	W. C. Hughes, Esq., F.M.S.	3·86	0·53	15	25	58·2	5	32·5	18, 20
Blackpool (a)—South Shore	C. T. Ward, Esq., B.A., F.M.S.	5·55	0·52	21	23	55·7	5	25·9	12
Llandudno (a)	J. Nicol, Esq., M.D.	3·91	0·41	21	23	56·1	5	30·2	15
Lowestoft (a)	H. E. Miller, Esq., F.M.S.	3·48	0·39	6	22	59·5	5	29·8	18
Carmarthen (a)	G. J. Hearder, Esq., M.D.	6·66	0·78	21	25	58·0	1	24·9	15
Cardiff (a)	W. Adams, Esq., C.E.	6·26	0·90	7	21	59·8	5	28·1	18
Babbacombe (a)	E. E. Glyde, Esq., F.M.S.	3·98	0·85	12	24	58·8	5	30·1	18
Sidmouth (a)	W. T. Radford, Esq., M.D.	4·07	0·80	6	26	59·0	5	30·3	18
Les Ruettes Brayes, Guernsey (a)	A. Collenette, Esq., F.M.S.	7·95	1·40	12	30	58·7	5	33·3	18
MIDLAND STATIONS.									
HEREFORDSHIRE.									
Burghill (a)	T. A. Chapman, Esq., M.D.	2·87	0·82	6	22	60·2	23	23·8	18
SHROPSHIRE.									
Woolstaston	Rev. E. D. Carr	5·20	0·63	28	26	57·0	5	29·0	15
Stokesay (a)	M. D. La Touche	3·99	0·51	6	22	58·7	23	21·1	18
More Rectory	Rev. A. S. Male	5·00	0·47	28	26	55·0	23	24·0	18
Dowles, near Bewdley	J. M. Downing, Esq.	3·84	0·65	16	27	58·0	23	16·0	18
WORCESTERSHIRE.									
Orleton, near Tenbury (a)	T. H. Davis, Esq., F.M.S.	3·99	0·58	6	23	61·5	5	22·0	18
West Malvern	A. H. Hartland, Esq.	4·64	1·08	6	25	55·0	5	29·0	17
Evesham	T. J. Slatter, Esq., F.G.S.	3·96	1·22	6	24	55·0	5	23·7	18
Pedmore	E. B. Marten, Esq.	4·08	0·59	8	23	55·0	1, 4	24·0	14, 30
Stourbridge	J. Jefferies, Esq.	3·93	0·50	6	22	58·0	5	25·0	14, 17
STAFFORDSHIRE.									
Rowley Regis	C. Beale, Esq.	4·01	0·68s	15	19	55·0	5	28·0	30
Dennis, Stourbridge (a)	C. Webb, Esq.	3·69	0·50	6	21	59·0	5	22·0	18
Kinver	Rev. W. H. Bolton	4·09	0·68	15	22	59·0	5	23·0	17
Walsall	N. E. Best, Esq.	4·18	0·54	6	25	56·0	6	26·0	17
Lichfield	J. P. Roberts, Esq.	3·60	0·48	6	24	59·0	5	22·0	17
Burton-on-Trent (c)	C. U. Tripp, Esq., F.M.S.	3·67	0·55	28	25	60·0	5	20·0	18
Wrottesley (a)	E. Simpson, Esq.	3·97	0·50	23	22	57·8	5	24·5	18
Heath House, Cheadle (a)	J. C. Philips, Esq., F.M.S.	4·93	0·60	23	24	56·4	5	25·1	18
Tean (c)	Rev. G. T. Ryves, F.M.S.	5·48	0·63	28	25	57·0	5	20·0	18
Oakamoor, Churnet Valley (a)	Mr. Williams	6·57	0·67	24	25	58·2	4	23·5	29
Beacon Stoop, Weaver Hills (a)	Mr. James Hall	5·88	—	—	—	53·5	—	24·0	—
Alstonfield	Rev. W. H. Purchas	7·22	0·71	23	22	54·2	5	16·6	19
DERBYSHIRE.									
Stony Middleton	Rev. U. Smith	5·52	0·54	3	—	55·0	4, 5	20·0	29, 30
Fernslope, Belper	F. J. Jackson, Esq.	4·59	0·60	23	24	57·0	5	23·0	18
Spondon	J. T. Barber, Esq.	3·63	0·53	23	24	—	—	—	—
NOTTINGHAMSHIRE.									
Park Hill, Nottingham (a)	H. F. Johnson, Esq.	3·12	0·47	6	23	62·4	5	22·9	18
Hodsock Priory, Worksop (a)	H. Mellish, Esq., F.M.S.	2·68	0·39	3	23	58·4	5	20·7	18
Strelley (a)	T. L. K. Edge, Esq.	3·68	0·44	28	24	57·9	5	21·0	18
Tuxford	J. N. Dufty, Esq., F.G.S.	3·19	0·55	23	18	55·0	5	22·0	18
RUTLANDSHIRE.									
Uppingham	Rev. G. H. Mullins, M.A., F.M.S.	3·21	0·89	6	24	57·9	5	25·1	18
LEICESTERSHIRE.									
Loughborough (a)	W. Berridge, Esq., F.M.S.	3·08	0·42	6	25	59·0	5	22·9	18, 19
Syston	J. Hames, Esq.	2·92	0·48	6	24	57·0	5	25·0	19
Town Museum, Leicester	J. C. Smith, Esq.	3·18	0·57	6	17	58·5	5	22·0	18
Ashby Magna	Rev. Canon Willes	3·31	0·84	6	22	56·0	5	—	—
Waltham-le-Wold	Edwin Ball, Esq.	3·85	0·52	6	24	52·0	2	26·0	18
Coston Rectory, Melton (a)	Rev. A. M. Rendell	3·57	0·74	6	24	58·5	5	18·0	18
WARWICKSHIRE.									
St. Mary's College, Oscott	J. W. Brown, Esq.	3·31	0·52	6	23	58·2	5	25·0	18
Henley-in-Arden	T. H. G. Newton, Esq.	3·91	0·47	23	23	55·5	1	20·0	18
Kenilworth (a)	F. Slade, Esq., C.E., F.M.S.	4·11	0·96	6	22	58·3	5	19·6	18
Rugby School (a)	Rev. T. N. Hutchinson	4·11	1·05	6	22	58·6	5	20·2	18
NORTHAMPTONSHIRE.									
Pitsford, Northampton	C. A. Markham, Esq.	3·66	1·07	6	18	60·0	5	28·0	18
Towcester	J. Webb, Esq.	4·13	0·96	6	21	—	—	—	—
Kettering	J. Wallis, Esq.	3·53	0·99	6	22	59·0	6	29·0	12
BEDFORDSHIRE.									
Bedford (a)	H. J. Sheppard, Esq.	3·21	0·80	6	22	60·1	5	23·9	18
Aspley Guise	E. E. Dymond, Esq., F.M.S.	3·77	0·88	15	21	58·6	5	20·5	18
OXFORDSHIRE.									
Radcliffe Observatory, Ox. (a)	The Staff	3·34	0·58	6	18	59·7	5	22·7	18
WILTSHIRE.									
Marlborough (a)	Rev. T. A. Preston, F.M.S.	4·30	0·77	6	23	58·8	5	22·2	18
GLOUCESTERSHIRE.									
Cheltenham (a)	R. Tyrer, Esq., B.A., F.M.S.	3·86	0·79	6	22	58·6	5	23·0	15

(a) At these Stations Stevenson's Thermometer Screen is in use, and the values may be regarded as strictly intercomparable. (c) Glaisher's pattern of Thermometer Screen employed at these stations.
The total rainfall at Park Hill, Nottingham, for September was 2·55 inches, not 4·09.
The Stafford observations not to hand at time of sending to press.

C. L. W.

Correspondence.

New British Species of Mucorini.—I have had the pleasure of finding on some specimens, which I was cultivating, of *Thamnidium elegans*—itself one of the Mucorini, the *Ascophora elegans* of the Handbook—a parasitic species, *Chætocladium Brefeldii*, Van Tieghem, not hitherto recorded in Britain.—W. B. Grove, B.A.

Heneage Gibbs' Mode of Staining the Germs of Bacillus tuberculosus.—Obtain fresh sputum or phlegm, coughed up in the morning; spread a small portion upon one surface of a thin cover glass and dry in the air. Filter a few drops of the magenta fluid into a watch-glass and place the cover with the sputum downwards upon its surface. Leave for thirty minutes and then wash in nitric acid (diluted with distilled water, 1 to 3) until all colour perceptible to the eye has disappeared. Wash in distilled water to remove all traces of the acid, then float the glass, sputum downwards, for two or three minutes upon a few drops of filtered chrysoidin. Again wash in distilled water and immerse in absolute alcohol for a few minutes to remove all trace of water. Dry thoroughly in the air. When dry place a drop of pure Canada balsam on the cover glass and lay it carefully on a glass slide. When set, it may be considered finished.—F. H. Collins.

The Transit of Venus.—The transit of Venus was observed by me on December 6th, at Fort William, under very favourable circumstances, considering the low altitude of the sun and the effects of atmospheric refraction. The weather was very fine, and an uninterrupted view was obtained from the external contact until the planet had well advanced upon the sun's disc. I employed a telescope of 2¾ inches clear aperture. The external contact took place at 2h. 3m. 15sec., Greenwich mean time, and the internal contact at 2h. 22m. 40sec. At this time I observed and sketched a small dark ligament stretching from the edge of the planet to the sun's limb. At 2h. 23m. 47sec. separation had taken place between the edges of Venus and the sun. Mr. Livingston, of the Public School, was observing near my station independently, and we both agree to the very second that 19m. 25sec. elapsed between external and internal contact. The spectroscope in the morning showed a fairly dry atmosphere. For my full account, with six sketches, see *Nature*, of December 14th.—Clement L. Wragge.

Ben Nevis Observatory, 1882.—The conditions of weather by November 1st had become such as to render it hazardous and impracticable to continue satisfactorily the daily observations on the mountain. I therefore judged it best to discontinue them, after a very successful season, under the auspices of the Scottish Meteorological Society, of five months—June 1st to November 1st inclusive—without the break of a single day. Observations were taken every half-hour on the summit from 9 till 11 a.m. inclusive, and at fixed times during the ascent and descent at six intermediate fixed stations. Simultaneous readings were of course taken at the base or sea-level observatory at Achintore, Fort William, where the times of observation were nearly every half-hour from 5 a.m. to 3 p.m. inclusive, with extra sets also at 6 p.m. and 9 p.m., the latter being in connection with a self-recording clock-work hygrometer fixed on the Ben—a most valuable instrument, kindly placed at my disposal by Messrs. Negretti and Zambra.

Observations were also taken in connection from 9 till 11 a.m. inclusive, at the Peat Moss, two miles from Fort William and about fifty feet above the sea. The elements of observation of the entire system consisted of pressure by mercurial and aneroid barometers, temperature of air, earth, lochs and wells, moisture; direction, force and velocity of wind; kind and amount of cloud, movements and apparent elevation of the various strata of cloud, hydrometeors, ozone, &c. I must mention, as special features in the work of the past season, simultaneous observations on the actinism of light, by entirely new apparatus kindly supplied by Dr. Angus Smith, F.R.S., the eminent chemist of Manchester; and observations of the rain-band, by Browning's spectroscope—a most valuable adjunct to my instrumental equipment. The very heavy work of "entering up" from the rough observation books is now progressing, and the work will in due course be discussed by the Scottish Meteorological Society. I am keeping up observations at Fort William. —Clement L. Wragge.

Phragmidium on Bramble.—The two species of Phragmidium which occur on the bramble have long been confounded in England. They are both put down as *Ph. bulbosum.* More than eighty years ago, however, Persoon distinguished one of the forms as *Puccinia mucronata* var. *Rubi* (Dispos., p. 38); in Grevillea, iii., p. 171, M. C. Cooke adopts the name *Phragmidium mucronatum*, var. *Rubi*, but says nothing about Persoon. He adds:—"On living leaves of *Rubus cæsius*," but it is not confined to that species, being in fact, I believe, commoner than the form which has been usually meant by *bulbosum*, but which now, in order to avoid mistake, it will be better to call *Ph. violaceum*, retaining the name *Ph. Rubi* for the former species. The following are their diagnoses:—

Ph. Rubi (Pers.): Spots small, brownish, with a reddish edge. Sori small, crowded, often covering nearly the whole leaf. Spores mostly with five or six cells, and having a long, pale, conical papilla at the apex. On *Rubus cæsius* and *R. fruticosus*.

Ph. violaceum (Schultz): Spots large, thickened, purple, at least at the edge. Sori large, usually *isolated*. Spores mostly four-celled, with a short, conical, or hemispherical papilla. On *Rubus fruticosus*.—W. B. Grove, B.A.

Gleanings.

Midland Union—Annual Meeting at Tamworth in 1883.—The Committee of the Tamworth Natural History, Geological, and Antiquarian Society have fixed on Tuesday and Wednesday, June 12th and 13th, as the days for the annual meeting of the Midland Union of Scientific Societies in 1883. Mr. Egbert de Hamel has been chosen as President of the Tamworth Society for the coming year, and therefore becomes *de facto* President of the Union. Mr. de Hamel has ably served the Union as treasurer from the time of its formation, and we are convinced that he will no less worthily fulfil the duties of the high and important office to which he now succeeds.

Dorset County Museum and Library.—The new buildings which have been erected at Dorchester, at a cost of £6,620, to receive the antiquities, local collections, books, &c., in which the county of Dorset is so rich, will be ready for opening early in the new year.

THE WEALDEN FORMATION.—Professor Linares has lately discovered strata of the age of our Wealden beds (Lower Cretaceous) in the north of Spain. Visitors to Hastings should examine the hard, stony bands in the Wadhurst Clay, from which Mr. J. E. H. Peyton has just obtained several beautiful specimens of ferns, several of which are new to Britain, though previously found in the Wealden beds of North Germany.

THE PYRAMIDS OF EGYPT.—Mr. R. A. Proctor's latest work (*The Great Pyramid*, 324 pp., eight woodcuts, published by Chatto and Windus, price 6s.) gives the only satisfactory explanation with which we are acquainted as to the cause which led to the erection of these wonderful structures. He points out that each pyramid was not only intended to serve as a tomb for the person for whom it was erected, but also during the lifetime of that person it furnished an observatory from which the astronomers, or rather astrologers, of the period could study the heavenly bodies, and, as they believed, determine their influence upon the life and fortunes of the individual for whom they were concerned. Like everything that Mr. Proctor has written, this book is eminently readable, while its conclusions are sound and scientific.

THE OPTICAL LANTERN.—The fine lantern recently presented by Messrs. R. and G. Tangye to the science department of the Birmingham School Board, was constructed by Mr. J. Place, of Bull Street, Birmingham. It is a bi-unial of the latest type, made of mahogany and rosewood, with 4in. condensers, brass telescopic fronts, and every improvement. The lantern is now very largely used in scientific lectures; but it is often difficult to obtain just the slides which may be required. Mr. Burton, of 50, Portland Road, Nottingham, has recently prepared for it some excellent transparent photographs of diagrams contained in various scientific books, at a very moderate price. Where the diagrams are of a very simpie nature, or where they are required in a hurry, it is best to copy the lines on finely ground glass by means of a hard lead pencil, and then to render the glass transparent by pouring over it a varnish made of one ounce of Canada Balsam mixed with two or three ounces of turpentine. Ground-glass plates of the proper size are supplied by Messrs. Forrest and Son, Lime Street, Liverpool, at 10s. 6d. per gross.

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—GEOLOGICAL SECTION, November 28th.—Mr. T. H. Waller, B.A., B.Sc., in the chair. A lecture was delivered by Mr. W. Pumphrey, entitled "The Camera in Switzerland," in which he described a tour in Switzerland and North Italy. His remarks were illustrated by a large number of very fine photographic views, taken by himself *en route*. These were exhibited by Mr. C. Pumphrey by means of the oxyhydrogen lantern. December 5th—GENERAL MEETING.—Mr. W. B. Grove exhibited two Sphæriaceous fungi—*Diatrype stigma*, on hawthorn; and *Hypoxylon concentricum*, on dead wood; both from Sutton. Mr. Pumphrey referred to the occurrence of *Dreissena polymorpha* on logs, in Newhall Street, Birmingham, on which Mr. R. M. Lloyd made some remarks with reference to its original habitat in the Baltic, and the mode of its introduction into Britain. Mr. W. H. Wilkinson then gave a series of notes on his tour in America, exhibiting a number of plants which he had collected, and other objects of natural history obtained on the journey. He compared the flora of the United States, in certain respects, with that of England, referring especially to the total absence of the common daisy, of which he did not see a single specimen, and also to the comparative rarity of the meadow buttercups. One remarkable fact he noticed: while he was at Washington, on the 3rd of May, the lilac and the chestnut trees were just in bud, and during his whole journey northwards to Montreal he kept pace with the advancing spring, finding everywhere the same trees just in the same stage. In New York State, at Au Sable chasm, a phenomenon interesting to a geologist was noticed. The cliffs between which the river flows are there over 100ft. in height, and the path travels along them about half way up. At one point he observed a kind of well, by the side of the path, about 15ft. deep and 5ft. wide, evidently a pot-hole, scooped out by an eddy of the water, and still bearing on its sides the marks of the stones which the water had whirled round. In the river below could be seen a whirlpool, which was evidently engaged in making a similar pot-hole in its present bed, while on glancing to the top of the cliff above could be seen half a similar well, evidently formed by the action of the water at that higher level. It is but rarely that the proof that a river has itself formed the chasm through which it flows was so plainly obvious. The lecture, which was much applauded, was illustrated by limelight views, especially by a series which gave an excellent idea of the Niagara Falls from every point of view. December 12.—BIOLOGICAL SECTION—Mr. Morley exhibited Swift's college microscope. Mr. Bagnall exhibited two fungi, *Polyporus rufescens*, new to Warwickshire, from Alveston Heath, and *Lenzites betulina* from Hartshill; also a moss, *Scleropodium cæspitosum*, very rare in fruit, from near Preston Bagot. Mr. S. Walliker exhibited a species of Polyporus, probably *P. nigricans*, the "Black-hoof Polyporus," from Vossevanger, Norway, in which was enclosed a piece of Schistose rock; also dried flowers, ferns, etc., beautifully mounted on cards by Sisters of Mercy, Damascus. Mr. F. H. Collins exhibited two slides of *Bacillus anthracis* and *B. tuberculosus*. The former is the germ of "splenic fever" or carbuncular disease, a complaint very common on the Continent among cattle, under the name of Charbon or Pustule maligne. The slide showed a section of the lung of a guinea-pig, which had died of that disease in forty-eight hours after a hypodermic injection of the virus, and proved how the rod-like germs had, from the injection, completely permeated the lung of the animal (the kidney and liver being equally infested), and thus caused its death. The latter is the reputed germ of consumption. Exhibited under a power of 750 diameters, it clearly showed the rod-like form, but not the minute globular spores within the rods, by the disintegration of which they are set free, and then continue the species when they reach an appropriate position such as the human lung. The rods themselves multiply by subdivision, at a very rapid rate. These Bacilli were prepared by Heneage Gibbs' method, the excellence of which is that, even if there should be other bacterial germs present, they will not be affected by the staining fluid (see p. 20. The Rev. W. Houghton then gave an interesting and amusing lecture on his "Trawling Excursions in the North Sea and Torbay, with especial reference to our Sea-fish and Fisheries," an abstract of which will appear in a future number. December 19th.—MICROSCOPICAL GENERAL MEETING—Mr. W. R. Hughes exhibited the wing of *Empusa gongylodes*, the walking leaf, from Wangaratta, Victoria, Australia. Mr. W. B. Grove exhibited three fungi from Sutton, *Hypoxylon coccineum*, *Diatrype disciformis*, and *Valsa aglæostoma*, (very rare and new to the county;) also from Mr. Soppitt, of Saltaire, Yorks, *Phlebia vaga*, *Hirneola auricula Judæ*, *Orbicula cyclospora*, *Geoglossum difforme*, *Torrubia capitata*, *Œcidium periclymeni*, and *Œ. quadrifidum*, all from Yorkshire; and a moss, *Tetraphis pellucida*, in fruit (rare in that state). Mr. J. Bagnall exhibited *Bryum cuspidatum*, Bry. Eur., from Fillongley (new to the county), illustrated by microscopical preparations, and *Polytrichum commune*, var. *perigoniale* (not before recorded), from Sutton Park; also for Mr. C. B. Plowright, of King's Lynn, a series of specimens of the plants upon which he had experimented in his trials of the heterœcism of the Uredines (see *Grevillea*, xi., pp. 52-57.) Mr. G. C. Druce, F.L.S., hon. sec. of the Oxfordshire Natural

History Society, then read a paper upon his visit to Glen Clova and Callater, which appears at page 7. A discussion followed, in which Mr. Bagnall called to mind the fact that in Don's days all botanists were more careless as regards the specimens they distributed than would now be permitted, mentioning the names of Drummond and Bree, and expressed the belief that, though Don fell into occasional mistakes, yet he was not guilty of intentional imposition. Mr. Morley concurred, pointing out that, with regard to one reputed instance, *Lychnis alpina* grows in the Lake district.

OXFORDSHIRE NATURAL HISTORY SOCIETY.—November 7th.—Professor Westwood, M.A., F.L.S., President, in the chair. F. T. Richards, Esq , M.A., read a paper on "The Flora of Mullion Island," a small islet lying off the south-west coast of Cornwall, interesting on account of the extreme poverty of its flora, only nine species of plants being found by Mr. Richards during his visit to the island. These included three grasses, *i.e.* two species of Agrostis and a form of *Festuca ovina*, an Atriplex, the Tree Mallow (*Lavatera arborea*), very fine, a dock (*Rumex crispus*), Sea Beet (*Beta maritima*), and *Spergularia marina;* no Composite plant was noticed. The paucity of species, considering the close contiguity to the mainland, on the cliffs of which were a large number of species, was very striking. Mr. Richards next drew attention to the bracts of the Cornish *Lotus hispidus*, which he found reduced to one in number. In the discussion which followed, Mr. Bolton King remarked that many of the Cornish plants were different from inland plants of the same species, as the variety of Broom, of Schœnus, and of *Genista tinctoria*, which were stunted and of different habit. Some species of the Lotus exhibited by Mr. Druce showed the variability described by Mr. Richards. The Rev. A. Robertson, M.A., read a note on some specimens of Herniaria. Referring to the divergent characters which the leading writers on botany assign as marking off the British species, he attempted to verify them in detail by a minute characterisation of numerous specimens which were exhibited. He concluded with the hypothesis that the forms generally ranked as species in Britain may be the imperfectly differentiated descendants of a type most closely represented among existing forms by *H. hirsuta*. This was confirmed by the irregular but very general occurrence of a few *ciliæ* or bristles on the glabrous organs of the other species. Mr. H. Boswell next gave some notes on the Sphagna, or Bog Mosses, noting their chief characteristics and their use in filling up morasses, etc. He exhibited a number of specimens in perfect condition, and described one which he lately found in Shropshire, *S. Torreyanum*, for the first time recorded as a European variety, it previously having been found in America only. The locality was such a one as to leave no doubt as to its being indigenous. Mr. Bolton King gave a *resumé* of his work in the New Forest, which resulted in his rediscovery to the British Flora of *Eriophorum gracile* in three separate localities, over a range of about two miles. *Isnardia palustris*, and the splendid Gladiolus, the latter of which Mr. King thought was indigenous from its being widely spread in the forest, *Utricularia intermedia*, *Carex limosa*, *Malaxis paludosa*, and *Rhyncospora fusca* were also met with. In the south and west of Ireland Mr. King found *Viola Symei*, and a fern which is probably *Woodsia hyperborea;* if so, it is an addition to the Irish Flora, as is also his discovery of *Erythræa littoralis*, and *Cerastium holosteoides*, which he found had a wide range along the west coast. Besides the foregoing, he had collected many of the Saxifrages, which, with some Trefoils, etc., had still to be worked out. November 22nd.—Professor Westwood, M.A., F.L.S., in the chair. Professor Westwood exhibited for the Rev. — Elton, of Wheatley, a specimen of the Shearwater (*Procellaria griseus*), which had been shot at Bridlington by his nephew. This is one of the very few records of the occurrence of the bird in Great Britain. Mr. Druce exhibited for Mr. H. A. Macpherson a specimen of the Sandwich Tern, captured at Clifton Hampden a few years ago. The President then briefly introduced E. B. Poulton, Esq., M.A., who proceeded to give an account of the Natural History of Oxfordshire as studied in the seventeenth century, taking as the text for his lecture Plot's book on the subject.

NOMAD FUNGI: THE RECLASSIFICATION OF THE UREDINEÆ.*

BY W. B. GROVE, B.A., HON. SEC. OF THE BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.

In choosing the title "Nomad Fungi" for my paper, I was thinking chiefly of what are called the heterœcious species—that is, those which wander during their annual life-cycle from one plant to another, as will be afterwards detailed. But it occurred to me also that the words would bear another and very apposite meaning in reference to the travels of these fungi in their book-classification, for the species of some genera have been handed about from one place in the scheme to another in such a way as fully to justify their claim to the name of experienced travellers. You will perceive that I shall have again to treat of the subject of classification, which is generally considered a very dry one. In the notes which I had the honour of reading before this Society on the Myxomycetes, the central point of interest was as to the position which those organisms should occupy—*i.e.*, whether they should be placed in the animal or the vegetable kingdom, and you may perhaps remember that, as might be expected, I ventured finally to decide in favour of the latter. Now I think all who have studied that particular point, and the evidence bearing upon it, will admit that the question, though it be merely one of classification, was of surpassing interest, partly derived no doubt from the fact that the border-land between the animal and vegetable kingdoms, though it has been the battle-ground of many a long-decided controversy, is still as uncertain as that which separates Greece from Turkey. The scene is now shifted; we have to deal with a series of fungi, about whose vegetable nature not even the most ardent zoologist could doubt. But though the interest is different, it is, it appears to me, even greater than before. At least, to one who has not previously studied these leaf-fungi, the search reveals almost as many surprises, as unexpected conclusions, as startling transformations as any other branch of Natural History could furnish.

Classification of the Group.

To make the subject of our discussion clear, it will be as well to begin by giving an outline of the classification of this group in the famous Friesian system, which has been hitherto adopted in England. Of Fries' six great classes one is the Coniomycetes, or *dust-fungi*, so called from the fact that the dust-like spores form its principal feature. I have already pointed out on one occasion how artificial this system is in some respects, and described one modification of it—in respect to the Myxomycetes—which it is now undergoing in England. In this much needed reform English cryptogamists linger, I am sorry to say,

* Read before the Birmingham Natural History and Microscopical Society, October 17th, 1882.

far behind their brethren of the Continent. We are now concerned with another reform as pressing, and of course as hesitatingly accepted on this side of the Channel, and it is safe to say that one still more important will have to be made in the not distant future.

But, though most of these six classes appear to require revision, there is not one which contains such a heterogeneous collection of odds and ends as the Coniomycetes. It may truly be said that the only point in which they agree is in the vast predominance of the spores over the other parts of the fungus In any other point of view they are widely and irreconcilably unlike. Some produce enormous quantities of minute spermatiform spores in receptacles, more or less perfectly formed, in or upon dead or dying leaves and stems, or underneath the bark of twigs and branches, as, *e.g.*, that army of obscure species which form little dark spots on fading leaves, and which are probably all mere phases in the life-history of a so-called higher fungus, known under another name. Others produce their spores freely on the outer surface of dead stalks, bark, and leaves; such as the common Torula, which—I may be excused for reminding you—has nothing to do with what a mistaken analogy led us formerly to call the Torula or yeast-plant, and which is now called Saccharomyces. This latter does not belong to the Coniomycetes.* The third and last division—the one with which we have now to deal—grows upon living plants, and includes the majority of those species which are usually known under the name of leaf-fungi. It was divided into three orders—the Pucciniacei, the Cæomacei, and the Œcidiacei; and the following genera :—

PUCCINIACEI.

Xenodochus.	Triphragmium.	Gymnosporangium.
Phragmidium.	Puccinia.	Podisoma.

CÆOMACEI.

Tilletia.	Urocystis.	Cystopus.
Ustilago.	Uromyces.	Uredo.
Thecaphora.	Coleosporium.	Trichobasis.
Tuburcinia.	Melampsora.	Lecythea.

ŒCIDIACEI.

Rœstelia.	Œcidium.	Graphiola.
Peridermium.	Endophyllum.	

The Pucciniacei or "Brands" were distinguished by having compound spores—that is, spores divided by septa into two or more cells; the Cæomacei or "Smuts and Rusts" were distinguished by the free spores being mostly simple or one-celled; while the Œcidiacei or "Cluster-cups" were characterised by their simple spores being contained in a cellular envelope or *peridium* of various forms. A beautifully simple plan, well adapted for the purpose which it has hitherto served and will continue to serve, as a kind of Linnean system in

* The group of the Torulacei should be absorbed among the Hyphomycetes, into which it passes insensibly. There will then be no Coniomycetes left.

miniature, an index in which the names of one's finds may be readily discovered, but not representing in any way the natural relations of the objects. In the first place the system was broken—even in England—by the admission of a large number of the Cæomacei among the Pucciniacei, as when the "rust" of corn, *Trichobasis rubigo-vera*, was set down under *Puccinia graminis*, the "corn mildew," of which it was considered merely an early phase; or again, when the round simple spores of the early stage of Phragmidium are classed with the long three to six-septate spores of the later form. But the condition of the Cæomacei was worse. It included the bunt and smut of corn which have simple spores; the Buttercup smut and other allied species (Urocystis) which have compound spores; the Coleosporia and Melampsoræ, each of which produces spores of two distinct kinds, just as Puccinia does, and demands, by every rule of classification, to be ranked with it; and, finally, it contains a genus (Cystopus) which has absolutely nothing in common with the others, and is, in point of fact, closely allied to a genus, Peronospora, the Potato-fungus, which is itself classed with dissimilar species in another group, the Hyphomycetes. The Œcidiacei was the only order which approached the requirements of a rational system.

It is true that a great deal of what is now known was unknown fifty years ago, while some facts have only recently been discovered; but it nevertheless remains that British mycologists must plead guilty to clinging obstinately to an obsolete system, which has long been abandoned on the Continent. The true interpretation of the facts has been published for many years, but we in England have heard nothing (at least among mycologists) but murmurs about "mad fancies for change," "startling vagaries in vogue in certain quarters," "pandering to the desire of novelty," etc., with an intimation that the writer retained a preference for the steady old British jog-trot, though it land him far in the rear of the rest of the world. To suppose that, though a few hundreds of Continental physiologists all unite in testifying to their belief, founded upon experiments,* in the necessity of a total change in the classification of the leaf-fungi, yet we in our island shall continue to regard the facts as unproved, is conceited, not to say absurd. What do we want? Can we not trust biologists, other than Englishmen, to make their experiments carefully and record their conclusions truthfully? The progress, and especially the manner of the progress, of other branches of science certainly does not warrant such a conviction. Are we to regard all their testimony as doubtful, and possibly *untrue*, until some British experimenter deigns to bestir himself.

Happily, the question need no longer be asked. The British experimenter has bestirred himself, and to one of our leading mycologists, Mr. C. B. Plowright, of King's Lynn, belongs the high honour of being the first to remove this stain from British science. His words

* See "Comptes Rendus," 1880, and "Botanische Zeitung," *passim*.

are, in the light of the past, so remarkable that I cannot do better than quote them in full. "So far as I know," he says, "no one in this country has taken the trouble to put the matter to the test of experiment. For my part, it may be said that, having conducted upwards of a hundred cultures during the past two years, I have no doubt whatever upon the subject. We are putting ourselves in a hypercritical position if we refuse to believe what competent observers assert, simply because we have not ourselves actually seen it."* And let me add that the state of the case is not improved when the "competent observers" are of a foreign race, and the unbelieving spectators belong to this favoured nation. We are often reproached for our insularity, and it is certain that we have often fallen behind the science of the age by incredulous contempt for foreign observers. I rejoice, therefore, to see Mr. Plowright strike the first blow at that body of errors which has hitherto passed for knowledge about leaf fungi in Britain—that house of cards which now, at the touch of Ithuriel's spear, falls "like the baseless fabric of a vision."

The Revised Classification.

You will best appreciate the extent of the change if I place before you Dr. Winter's revised classification, so far as it relates to British species, and compare it with the one now obsolete :—

USTILAGINEÆ.

Ustilago	Tilletia	Urocystis
Sorosporium	Entyloma†	

UREDINEÆ.

Uromyces	Triphragmium	Cronartium { II. III.
I. Œcidium	II, III { Triphragmium	Melampsora
II. { Uredo or Trichobasis	Phragmidium	II. Lecythea
III. Uromyces	I., II { Lecythea or Uredo	III Melampsora
Puccinia	III. Phragmidium	Coleosporium
I. Œcidium	Gymnosporangium	I. Peridermium
II. { Uredo or Trichobasis	I Rœstelia	II, III } Coleosporium
III Puccinia	III Podisoma	Endophyllum

The triple division, into Pucciniacei, Cæomacei, and Œcidiacei, has ceased to exist, because these three orders typify only three stages in the life-history of one and the same fungus. The Ustilagineæ comprise such of the Cæomacei as are found to differ remarkably from the others in the mode of germination of the spores; with these we have nothing further to do. The genera which enter into the other group, the Uredineæ, are nearly all characterised by what is known as *Pleomorphism*—that is, they pass in their annual cycle through several distinct phases, which are so different that, prior to experiment and extended observation, they were placed—and rightly too—in distinct genera or orders. An exactly similar case is well known to zoologists

* "Science Gossip," September, 1882, p. 196.

† The species of this genus discovered in Britain are recorded in the pages of Grevillea under the name of Protomyces.

in regard to the classification of the Entozoa. In the table given above the names placed underneath the genera, with I., II., or III. prefixed, are the names of those pseudo-genera of the Handbook which now represent mere stages of growth.

Description of a Uredinous Fungus.

To show the position in which the problem stands, let us suppose that we are a band of students just setting out on the study of the leaf-fungi. Let us go into the country on some day in early spring, and gather a few leaves of the common violet. We shall find some of them marked with pale yellowish spots, and looking underneath the affected leaves we shall see a slightly swollen roundish patch, on and in which is seated a cluster of cup-like bodies, filled with orange spores. The fringe or brim of the cup consists of the ragged edges of the covering (called a *pseudo-peridium*) by which the spores were enclosed, when the fungus was in a less advanced state. Similar clusters of cups, only elongated in form, are found on the petioles and stems, in fact on all the green parts of the plant. The spores are roughly spherical or polygonal, orange-yellow, covered with fine warts, and bounded by a very thin cellulose membrane. These spores are given off in chains by a process of budding from the ends of delicate threads, called *hyphæ*, with which the bottom of the cup is clothed, in such a manner that the spore which is at the free end of the chain is the oldest, while that which is at the end of the hypha is the youngest, and has in the process of its growth pushed the whole chain of those previously formed up towards the mouth of the cup. A fungus, which possessed characters similar to these used to be called an Œcidium, and the particular one of which we are speaking was called *Œcidium violæ*. This Œcidium is found on the violet in May and June.

But, later on in the year, we find on the leaves of the same plant a fungus of a very different character. There is no cup, no chains of spores; the spores are collected in loose rounded heaps, resembling the sori of ferns, apparently resting lightly on the epidermis of the leaf, not usually combined in clusters, but scattered over the surface. Instead of the beautiful white fringe which surrounds the Œcidium, we have here merely the ragged edge of the ruptured epidermis, showing that the fungus originated just beneath the epidermis, and in its growth burst it open. The oval spores are brownish, and each is formed singly by a constriction of the end of a hypha, but otherwise they are very similar to those of the Œcidium. This fungus used to be known as *Trichobasis* or *Uredo violarum.*

At the same time, or later, we can find on the same leaves still another fungus of a different kind. In this case the spores grow, as in the Uredo, from the ends of the branches of the hyphæ, and frequently, if not always, from the same mycelium which has hitherto produced the Uredo-spores. The sori are surrounded, in the same way, only by the ruptured epidermis. But the spores are very different in character. While the Uredo-spores are easily detached from their support, these often remain firmly fixed to the hypha from which they originated, which breaks off with them as a kind of stalk; each spore consists of two cells, separated by a transverse partition, or rather two spores are produced on each hypha, for each cell of the compound spore is capable of independent germination. The greatest difference of all is, however, in the cuticle of the spore, which in these is greatly thickened and strengthened, in the same way as the outer surface of the epidermal cells of many leaves is cuticularised, in order to enable it the better to resist the attacks of the weather. This last form of fungus is called a Puccinia, and our species is known as *Puccinia violarum.*

Now undoubtedly the first impulse of the student, on seeing these various kinds of fungi, would be to class them as three distinct species, belonging to three distinct genera, and placed respectively in the three orders which have been mentioned above. But this impulse, though natural, could not stand the test of a more careful examination. Our student would find the same sequence of phenomena on other species of plants. The common Epilobiums would provide him with three fungi, successively making their appearance on the leaves, in the same way and in the same order, viz., *Œcidium epilobii*, *Trichobasis epilobii*, and *Puccinia pulverulenta.* The species of Allium, of Primula, of Mentha, of Galium, of Sanicula, and many others, all tell the same tale. This should have awakened suspicion, but at first apparently did not. Moreover, the Uredo and Puccinia-forms appear, as I have said, often on the same leaves at the same time, and are obviously seen to spring from the same mycelium, not only in the species which I have mentioned, but in very many others. This fact, when fully brought to light, was so far conclusive; and the phenomenon was known under the name of Dimorphism. Those who have read Mr. Cooke's useful little book on Microscopic Fungi will remember that he devotes a chapter to the exposition of this theory of Dimorphism, and in his Handbook the theory is practically followed up by the arrangement of the various forms of Uredo with the species of Puccinia to which they belong, so far as that was known. It is true that Cooke calls most of these Uredos *Trichobasis*, and professes to distinguish between the two genera by assigning to the spores of the latter the possession of a foot-stalk, while the spores of Uredo, he says, "have no foot-stalk at any stage of their existence." In fact, in the generic character of Uredo he seems to assert that the spores of Uredo are developed by a kind of segregation of the contents of certain hyphal cells, that is, by free cell-formation. But this is totally untrue. The spores of Uredo are formed by constriction from the end of a hyphal filament, which, when thus engaged, is called a *basidium.* There is no difference between Uredo and Trichobasis, except that in the latter case, in a few instances, a small fragment of the basidium remains attached to the spore.

But while the Dimorphism of these fungi was admitted, the fact which still remained behind, namely their Trimorphism, was as yet undiscovered. If the case had been with all the Uredineæ as with those which I have mentioned above, no doubt the fact would soon have forced itself upon the mind. No one could long contemplate the orderly procession of the three forms on the same plant without being compelled to acknowledge the probability of their genetic connection. But, unfortunately for the mycologists of the past, the case was by no means so simple. Many species of Œcidium were, and still are, known which are not succeeded by a Uredo or a Puccinia on the same plant. Many Uredos were, and a few still are alone, unaccompanied by either an Œcidium or Puccinia; while there is a considerable number of species of Puccinia with which no Œcidium or Uredo was or is even now known to be associated. Still another fact complicated the matter. Allowing that a Puccinia is preceded by an Œcidium, it seems that we must not always look for the Œcidium upon the same or even upon an allied plant. Sometimes we shall find the Œcidium upon a Dicotyledon, while the Uredo and Puccinia luxuriate upon a Monocotyledon. This, which is known as *heterœcism*, is a curious fact, and is especially the case with those species such as *Puccinia graminis*, *P. coronata*, *P. poarum*, *P. magnusiana*, and *P. caricis*, which grow upon grasses and sedges in their final stage. These are called *heterœcious* species, and their Œcidia are found respectively upon Berberis, Rhamnus, Tussilago, Rumex, and Urtica.

(To be continued.)

GEOLOGY OF WYRE FOREST.

BY A. H. ATKINS, B.SC.

In a former number of this Magazine an article appeared by Mr. Blatch describing an entomological ramble in Wyre Forest. As this place is one of the most beautiful still left to us in the Midland Counties, I have written this brief sketch not as a complete scientific description, but merely as an outline of the chief geological features, sufficient, I hope, to show that in this branch of Natural History also much may be found to interest and instruct.

The forest covers an undulating district, and is drained in great part by Dowles Brook, a little tributary of the Severn, which it joins about a mile above Bewdley. Up this rivulet we may wander for five or six miles through a valley bordered by hills, covered not, however, by the mightier monarchs of the forest, but by groves of saplings, which, crowded thick together, give a picturesque appearance, especially when the light of the setting sun is seen creeping up the slopes till the verdant summits above are tinged with the departing rays. The trees are felled every seven years, and are used—the trunks for supports in mines and sewers, and the branches for charcoal.

Geologically, the forest lies almost entirely on sandstone belonging to the Coal Measure series, and forms part of Wyre Forest Coalfield.

Coal seams occur beneath, but are worked only in a few parts, as the coal is said to be of an inferior quality. It is as well perhaps for the lover of nature that this is so, for if it paid to extract the coal the beautiful glades and valleys would soon be converted into an unsightly array of collieries and cinder heaps. Some of our loveliest English scenery occurs on the coal measures, and our Staffordshire Black Country was no doubt not less beautiful till its aspect was marred by the sinkings for the rich treasures beneath.

The beds which appear at the surface in Wyre Forest consist of white and brown sandstone, interbedded with thin layers of brown shale. Since their deposition they have been subjected to much disturbance, and in many places very contorted sections may be seen, and in walking along the railway, which runs through the forest, the beds shown in the cuttings often appear bent up and down like huge waves. In the north part of the district volcanic forces have been in action; at Shatterford, for instance, near Arley, a long dyke of basalt has broken through the sandstones and is quarried for road-metal. It is very similar to the Rowley Rag of our pavements, and is known by the local name of *Dhu Stone*. This name, derived from the Celtic word for black, is no doubt given to it on account of its colour. I have, however, seen it written Jew Stone and Dew Stone, but I think the one I have given is the most correct. A similar mass is found in the coal measures of the Titterstone Clee Hills to the west of the forest, where it is known by the same name.

The sandstones occur all over the forest, but I do not know of any outcrops of the coal itself, or its accompanying black shale or clay.

The fossils found in these rocks consist almost entirely of vegetable remains of the same species of plants as coal itself is composed of, showing that the forests which formed the coal seams could not have been far away when these rocks were deposited as sediment, and that the rivers running through them bore on their waters leaves, branches, and ferns, which sunk down with the sand and mud. The best collecting grounds are the thin bands of soft shale, which are found on the banks on the side of the road which runs along Dowles Brook from the main road to Cooper's Mill. This bed is absolutely full of plant remains, principally consisting of ferns and calamites. The ferns (*Neuropteris* and *Pecopteris*) have their vein markings as perfect and distinct as when alive.

The calamite was a reed, similar to our modern Equisetum or Horsetail, which flourished in the Coal Period. Vast numbers of their flattened stems are found in these shales, together with their characteristic foliage of narrow-leaved whorls.

In the coarser sandstone the plants are rarer but larger, consisting of thick calamite stems, and of another common coal plant—the Lepidodendron. This was a tall tree, allied to our humble club moss, and the diamond-shaped leaf-scars have caused it to be called by people of the neighbourhood "Nail rod." It seems evident that the heavier trunks and branches sank down with the coarser sand which would be first deposited, while the finer mud with the leaves and twigs would sink down more slowly and in thin layers. The only other remains I have found there are a few fossil fruits and some fish scales.

The brook, at a place just above Cooper's Mill, shows a fine illustration of the lateral change which river beds are constantly undergoing. At this spot the brook is eating away the bank at a rapid rate—so fast, in fact, that though a wall was built seven years ago to resist its action, it has broken it down and advanced beyond it for several feet. On the other side of the stream, and about eight feet from its present bed, is a cliff, at the base of which the current ran in the memory of the parents of the present inhabitants.

There is another curious fact concerning it which I think is worth relating. What called my attention to this place was some nodules of hæmatite or red oxide of iron, which I saw in one of the cottages, and which I was told were dug out of the ground. Naturally, I wanted immediately to see the place where this mineral came from, and found that the nodules formed a layer in the bank of the stream, and also that with them were a number of rounded fragments of slag. The question at once arose, How came these waterworn remains of human industry into the bed of Dowles Brook? I found out, after some inquiries, that there formerly existed some blast furnaces about two miles higher up the brook, though they have not been worked, I was told, for a century or more. There is a corn-mill there now, called Furnace Mill, and I believe some few traces of the ancient works still exist, though unfortunately I was not able to visit the place myself. But here, several miles down the stream, the fragments of slag were brought and deposited by the current. Slowly the bed of the stream moved to the other side of the valley, and a verdant meadow sprung up on the newly-made land. Now, the course of the stream is swinging back again and wearing away the beds which it formerly deposited, most likely to carry this slag and iron farther down the stream, where in years to come the remains of the ancient iron-works will be found long after its traces have disappeared on the spot where they originally stood.

I might mention that coal was searched for near Dowles Brook about five years ago, and a boring 1,200 feet deep was made; but the result was unsatisfactory, though coal was found. Water has filled the bore from below, and approaches to near the surface, but is as salt as brine. It is not usual, I think, to find salt rocks in the Coal Measures, though other mineral springs occur in the neighbourhood. In the Chamberlain Wood, which forms a part of the Forest between Dowles Brook and Arley, is a spring called Stinking Ditch, which is so impregnated with sulphuretted hydrogen that it may be smelt a hundred yards away.

BEN NEVIS IN MID-WINTER.

BY CLEMENT L. WRAGGE, F.R.G.S., ETC.

I left Fort William for the hoary old Ben shortly before half-past ten on the morning of January 2nd, 1883, accompanied by my friend Mr. P. E. Warburton, Mr. William Whyte (my former assistant at the temporary meteorological observatory on the mountain), and Donald, an ancient guide, to assist in case of need, and ever ready to lend a willing hand. "Robin Renzo," my faithful Newfoundland dog, who knows Ben Nevis almost as well as his master, as usual made up the party. It will be remembered that on the 1st of November last, owing to stress of weather forbidding the regular daily ascents of the mountain, and to the absence of a permanent observatory-house there, I was obliged to discontinue the daily work of the meteorological observing system on the summit and slopes which was in simultaneous connection with a system of observations at the sea level at Fort William, and which I had the honour to organise and carry on during a second summer's season under the auspices of the Scottish Meteorological Society. The trip on this occasion was specially undertaken in order to examine the instruments, and to bring down those not intended to be left on the Ben for the entire winter. Some account of the weather conditions and of our doings before the final start must not, by the way, be omitted.

The early morning, then, of the 2nd of January, was wild and stormy—just such weather as one can thoroughly enjoy, more especially in the romantic Western Highlands, where the sweeping gusts and heavy rain squalls have, to my mind, a peculiar charm of their own.

My usual observations at nine A.M., near the sea level, showed that a depression from the Atlantic was passing, and that the weather would probably clear in its rear. The barometer, about 30ft. above sea and reduced to 32° Fahr., read 29·177., Aneroid 29·236, and pressure was rapidly recovering; temperature of the air by the dry-bulb thermometer was 43·0°, wet bulb 41·1°. These values showed a dew point of 38·8°, a relative humidity of eighty-five per cent., and an absolute humidity or weight of vapour of ·236in., leaving the weight of the dry-air represented by 28·941in. of the mercurial column. The temperature of the sea was 1·8° lower than that of the air; the wind had moderated, and was blowing with a velocity of twenty miles an hour from south-south-west; the sky was three-quarters covered with nimbus and loose cumulus clouds; 0·733in. of rain had fallen during the night, and rain was still falling. In the spectroscope the red solar lines were dark and prominent. No true rainband was seen to the left, but a dark broad shading to the right of the sodium line D, and the "green" lines were more distinct and better defined than at the same hour on the previous day. Altogether, the spectrum augured well for good weather. The observations over, our next business was to see to our luncheon and mountain equipment, and to get under way forthwith. We took care to call on Mr. James Young, of the Ben Nevis warehouse, and to lay in an extra stock of biscuits, and preserved coffee and milk, not forgetting a modest modicum of the famous "dew," and an ounce of the equally-renowned "Bristol Bird's Eye." It was from Mr. Young's establishment that we made our final start, amply provisioned, and laden with a cargo of tin cans and pannikins for boiling snow, a bundle of wood, wick-balls steeped in paraffin, wherewith to light our fire on the summit, a snow-spade, and sundry tools and other articles too numerous to mention. We took a short path following the right bank of the River Nevis for some little distance till we reached the shepherd's hut at Claggan, and then across the Peat Moss to Meall an t-Suidhe, the western shoulder of the Ben Nevis system, shaping a course direct for the well-known lake.

The views as the weather cleared were very fine. First there was the gushing river, swollen by the rains, at one point dashing over boulders with great turbulence, at another reflecting the blue sky above with detached fibres of storm cumulus lit up with the golden tints of the low winter's sun; while the dark pines and wooded slopes of Glen Nevis, studded with the graceful birch, gave an additional charm to the picture. Then we had the fine expanse of Highlands north of the Caledonian Canal, their uplands and peaks in places overcast by dark, lowering rain-squalls and spanned by portions of a brilliant rainbow coming out in finer outline against the dark braes below and snow-streaked mountains towering above. There, again, a fleeting patch of sunshine added to beauty by the greater contrast. Has not, indeed, all scenery a certain charm peculiar to itself and geographical position, from the Arctic regions to the lavish luxuriance of the Tropics; but what more fascinating to the lover of the Kosmos than the wild, wild Highlands of Scotland, with all their fogs, snows, and mountain squalls? Winter undoubtedly is the time when the West Coast scenery can be viewed to perfection. The ascent of Meall an t-Suidhe was easily accomplished, and at 11 23 a.m. we reached the "Thousand Feet Rock." Here the aneroid read 28·062, temperature was 37·8°, and a gentle south-westerly breeze was blowing. The track now took us over hummocks, swamps, and morasses, and past huge granite boulders, and small patches of snow lay round about. At a quarter past twelve we reached the intermediate observatory at "The Lake," 1,840 feet above sea, and forthwith seating ourselves on lumps of granite, surrounded by swamps and the delicate "reindeer moss," we began to discuss luncheon with that peculiar zest given by the pure and piercing mountain air. Biscuits, raisins, and sandwiches disappeared as if by magic, and pipes were lit with a keen enjoyment. I found the instruments all right, but the granite cairn containing the barometer had given way somewhat owing to the swampy foundation and the alternating frosts and thaws. At half-past twelve I took observations. The barometer, reduced to 32° Fahr., read 27·287, aneroid 27·272, the temperature of the air was 35·1°, and that of the Lake 34·0°. The central portions of the tarn were, however, frozen over. The wind was moderate from southward, and was travelling towards the eastern side of the retreating area of barometric depression, while the sky was half overcast with the loose storm-cumulus often seen in the rear of a disturbance. Shortly before one o'clock we continued our journey, passing the last swamps, and, leaving the region of the coarse-grained porphyritic granite, came to the district of the finer-grained rocks, graduating into felsite, which form the third in altitude of the five geological strata of which the Ben is composed. Near Brown's Well, at 2,000 feet, we came to the main snow, which was very hard, and lay in great shelving banks. These, not having Alpine requisites, we had to cross with great care, hacking in heels and making steps. Poor old "Robin Renzo" went slipping and sliding in the most ludicrous fashion, and kept "making leeway" all the way across. On reaching the Red Burn, at 2,700 feet, we found immense masses of snow on the south side of the ravine, over the ordinary track, and, considering discretion the best part of valour, we did not attempt to cross them, but pursued our way by a different route over loose rocks, and following the burn on its north side. With the rising barometer we were favoured with good weather and genial sunshine especially delightful, and the grey rocks, thickly dotted with the yellow lichen *(Lecidea geographica)*, gave a pleasant relief to the eye. When about 3,100 feet, a little before two o'clock, we came to a spring and grassy patch—a refreshing oasis in the snowy and rocky wastes—and grotesque globules and knots of ice had formed on the scanty vegetation around. The temperature of the water was 34·0°. Here we paused for a "bite of meat," and to drink freely of the clear, cool stream—the real mountain dew. Upwards again we plodded, over the snow banks and loose rock, slowly and carefully, and at 2 19 reached the intermediate station at Buchan's Well, 3,575 feet above sea. This far-famed spot, with the cairn surmounting it, was entirely covered by great hard slopes of snow; but my louvred thermometer box, four feet above ground, was just showing—safe and quite firm. With some difficulty I opened it and found the dry and wet bulbs both iced, marking a temperature of 27·3°. The wind had backed, and loose cumulus clouds were coming up from south-east by south, with a velocity of 2·0 on a scale of 0 to 6, and rolls and piles of mountain-cumulus lay over the grand stretch of highlands on the Atlantic seaboard. Some three miles away, far beneath, was the long narrow arm of Loch Linnhe reaching to seaward, at the foot of the dark mountains beyond; while the yellow slopes of Meall an t-Suidhe below, clad with verdure, and catching the horizontal rays of the winter's sun—beautifully in contrast with the pure white snow—gave a most pleasing touch to the picture. The aneroid at Buchan's Well was 25·472. I had now to remove the thermometers. Their screws were rusty and the stems hard frozen to their fixings; but patience accomplished the work, and they were safely stowed away in their boxes. Old Donald was now "done up" by the exertion, and we had to leave him to recruit on a snow bank and to follow on at leisure. The snow indeed was now wholly continuous, about four feet deep, and very slippery. As we continued the ascent, the views of old Winter in his lofty solitude became finer and finer, and the weather was beautiful. A solitary dark cairn in sharp outline against the deep - blue sky, the dark, gloomy mountains in the distance, the vastnesses of snow gleaming in the sunlight, the lights and shadows of the cold grey rocks overhanging the precipices, and the majestic crown of the ancient Ben, now bathed in an exquisite orange flush from the sinking sun, together with "glories of light" like circular rainbows cast on the loose fog over the precipice corries, all formed one grand picture in Nature that no artist could with truth portray. At length the dim contours of the Ordnance cairn and brink of the great precipice piled up with snow hove in sight through the films of mist covering the summit, and at a quarter past three we reached the top—once more on Ben Nevis and in mid-winter. The snow in the centre of the main plateau was but three feet deep, and the notice board and upper parts of the Ordnance and barometer cairns and thermometer cage were showing well, covered with grotesque ice-encrustations, and surrounded by trenches of drift formed by the whirling winds. On the south-east side of the plateau, however, the snow was over six feet in depth, and the roof of my hut, formed of ship's canvas, was level with the surface. Whyte set to work to kindle a fire, and was soon endeavouring to boil water in a pannikin, while Warburton cleared away the snow from the cage. and at 3 30 p.m. I had access to the thermometers. The temperature was 25·6°, or 6½° below freezing (I have often had it far colder than this in June); aneroid 24·700. Thin cloud-fog at times covered the summit, and a moderate south-easterly breeze was blowing. The lowest temperature recorded by the self-registering instrument since November 1st last was 9·5°, or 22½° of frost, which undoubtedly occurred during the great frost of December, and the highest value for the period was 35·9°. I may mention that looking sunwards with the spectroscope, about 11deg. above the horizon, Fraunhofer's C line in the "red" end was intense, more so than I have ever before observed; the line D and a rain-band shading immediately to the left of it were faint, but a very strong telluric band appeared on the right of D. The E and "b" sun lines in the "green" were moderately defined, but the F line in the "blue" was not detected.

My first care after taking observations, especially as the shades of night were fast falling, was to remove the thermometers that I intended to bring away (those that I had in use when at Farley), and to substitute others having metal scales to record the extremes of heat and cold during the remainder of the winter.

Having successfully accomplished my work, and leaving the mercurial barometer all snug in its icy cairn, I proceeded to the hut, and found that Warburton had digged down six feet, and that the door was clear. Indeed, it was part of my business to reach the hut, for other instruments had been stowed away there on November **1st**, when the daily observations closed, and these it was necessary to bring down. After gymnastic acts and feats of equilibrium I reached the bottom of this snowy pit, and found that masses of snow had accumulated in the interior of my little house, having driven through the chinks before the walls were buried, and odd-looking icicles hung from the canvas roof. On the snowy wall I found a live gnat. The place was now free from further drift, and could have been made quite warm and cosy. We only needed for a temporary lodging (had it been necessary to spend the night on the Ben) a tarpaulin and plenty of rugs for bedding, or, better still, Arctic sleeping bags, more fuel, and a lamp. A ladder to the platform of main snow would have completed the outfit, and the rude shanty, banked up as it was, would have been as habitable an abode as any underground hut in Kamtschatka, and lacking but little of the strange fascination of such a place. This tends, I think, to show how supportable, if not comfortable, life can be made during the winter months on Ben Nevis, when once the permanent observatory is up. The interesting work and reading will pass away the time, and whatever inconvenience the observers may suffer, they will feel at least some satisfaction in knowing that by their continuous winter observations—telegraphed daily to London—they will contribute to no small extent to the country's good by improving the weather forecasts, to the benefit of the entire community. Once in the interior of the hut, the hamper containing the stowed instruments was soon found. I lifted them out with the utmost care, and having packed them in their boxes with plenty of wool, prepared for the homeward journey. It was now about 4 30, and the surroundings were novel indeed. Our beards and whiskers were heavily frosted and "Renzo" presented a most grotesque sight with his black coat heavily fringed with the mountain rime. Then the broad acres of snow peering out through the gathering waves of mist, the hoary Arctic-looking cairns, and the fire glowing on the snow in the early shades of a winter's night, gave that peculiar relish that only travellers in our circumstances could thoroughly enjoy.

By 4 40 we had all ready, and, having adjusted burdens, commenced the descent. At first it was easy enough to retrace our tracks, but on reaching the hard slippery snow banks, at 4,300 feet, it was not such a simple matter, and our safety depended on most careful steering until we had got clear of the mist. Several slips and tumbles occurred, but fortunately no damage was the result. When we reached the Plateau of Storms, at 4,000 feet, we had passed from the fog, and the picture of a New Year's evening from the slopes of Ben Nevis was sublime. Dark bands of cumulo-stratus clouds bordered the south-western horizon, which was lit up in background by a bright belt of a light orange colour, marking the region of the sun, long set, and beautifully illustrating the effects of refraction in prolonging the twilight, while immediately above the sky had a most lovely shade of azure blue. This gradually deepened into a clear expanse of firmament bespangled by the stars, myriads, in fact, of far, far distant suns shining on our tiny Earth as mere brilliant points of light. What a field for the imagination! How far the mind wandered from the eloquence of that mountain solitude into the awful depths of space! The great planet Jupiter, with Saturn as an advance guard, made up the picture, together with the deep gloom of Glen Nevis in black contrast away below, and the pure white snow around us in one harmonious whole.

We had now to encounter the most difficult part of our expedition, and to descend in safety through the darkness over the fragmentary rocks glazed with ice alternating with the snow-banks, steep, hard, and slippery. It was dangerous work. Foot by foot and yard by yard we slowly groped and felt our way, now partially sliding on our backs, now again clinging to the sharp jagged stones, while our legs steered a course round some awkward corner, and in this manner we proceeded, pausing ever and anon to rest our muscles, until we again reached Brown's Well. Here we enjoyed a more lengthened rest, and I tried the temperature of the water, which was 35·9°. I may mention that during the summer the mean temperature of this well was about 47·0°.

The arduous part of our trip was now over, and at twelve minutes past seven we were safe back at the Lake. Here I took another set of observations, and found that the barometer had risen 0·182 since half-past twelve, the value at 32° Fahrenheit being 27·469. The temperature of the air was now 33·2°, the sky generally clear, and light airs came from eastward. The lowest temperature since Nov. 1st at this station was but seven-tenths of a degree higher than that on the Ben, or 10·2, and but 3deg. lower than the absolute minimum at Fort William during the corresponding period. As the three minima unquestionably took place during the frost of December, when pressure was steady and the weather was clear, they show the wonderful effects of nocturnal radiation in mountainous districts in equalising the temperature throughout the entire altitude.

It was now dark, save for a glimmer on the western horizon; and as it was impossible to pick and choose our steps, we went boldly on through the swamps and over hummocks of bog. At about 1,200ft. we paused and took a last look at the mighty Ben, showing its snowy profile against the starlit sky. As from behind it shone the glittering belt of Orion, away beneath were the lights of Fort William. We soon descended Meall an 't-Suidhe, waded through the swamps of the Peat Moss with delightful carelessness, while "Renzo," tinkling his bell like some frisky bullock in the Australian bush, vainly endeavoured to catch rabbits. By ten minutes past nine we were walking through Fort William, ready to do ample justice to the good supper that awaited us. I found that the barometer had risen 0·273in. in the twelve hours: temperature was 33·7; maximum for the day near the sea level 43·8, and minimum 33·0. Thus ended a most important day's work, and soon we were enjoying a well-earned night's repose.

TRUFFLES IN SHROPSHIRE.

BY W. PHILLIPS, F.L.S.

As the interesting article on "Underground Fungi," by our great mycologist the Rev. M. J. Berkeley, at page 1 of this volume of the "Midland Naturalist," cannot fail to awaken the interest of local botanists in the question of their existence in the Midlands, I will give a brief report of what has been done in searching for them in Shropshire. The prevalence of lime in the southern half of the county would lead one to expect an abundant variety of species; but as far as I know at present, the common Truffle (*Tuber æstivum*, Vitt.) has never been offered for sale in any market except Bridgnorth, and no species, except some found by myself, have ever been recorded. Inquiries set on foot to ascertain from where the person obtained the specimens offered in Bridgnorth market, were unsuccessful; but it is believed they were from the immediate neighbourhood of that town. Eleven years ago, while searching the charcoal beds of the Wrekin with a view of noting the fungi frequenting them, I found in a narrow avenue on the west side of the hill a solitary specimen of *Hydnotria Tulasnii*, B. and Br., measuring three and a half inches in circumference. A small portion of its surface appeared above the friable burnt soil in which it was growing, and looked both in colour and size not unlike a small potato. I have searched this same spot nearly every year since without being able to find another specimen: this capricious appearance and disappearance, however, is a common subject of remark in all practical works on Truffle growing. As the burning down of plantations is frequently found in France and Italy to be followed by an appearance of the highly-prized *Tuber melanosporum*, my success might have been due to the operations of the charcoal burners, and suggests the more careful examination of these beds.

In 1875 the Rev. W. Houghton sent me ample specimens of the white Truffle (*Choiromyces meandriformis*, Vitt.), collected at Lilleshall, the seat of the Duke of Sutherland. Some of these measured as much as 4½ inches in circumference, and the remarkably spinous sporidia formed striking objects under the microscope. Vittadini calls this species rare.

The two kinds of Truffles named above are the only edible species hitherto discovered in this county, but several others of much scientific interest have occurred. *Elaphomyces variegatus*, Vitt., was found in 1878 in woods near the Wrekin and again this last autumn, in company with my friend Mr. C. B. Plowright, of King's Lynn, who has been very successful in finding many British species; this same species was found on the Ercall Hill in considerable quantity, and many of the individuals were attacked by the peculiar parasite, *Torrubia ophioglossoides*, Tul., which thrusts its head above the moss in which the Elaphomyces lies buried, and might easily have been passed over for one of the larger Ophioglossums. The excursion during which these last fungi were found was memorable for the discovery of two of the rarest of British Tuberacei by my expert friend. Armed with a small iron rake provided with a short handle, which is removable, so that both can be carried in the pocket, he commenced to rake amongst the dead oak leaves and the humus beneath them, in which operation I humbly joined with a like weapon, when there was speedily brought to light what appeared not unlike a number of buried mulberries. It was *Sphærosoma ostiolatum*, Tul.! A further search resulted in *Genea hispidula*, Berk., which, with *Genea verrucosa*, Vitt., found near the same place in 1873, made two species of this genus for Shropshire. I have no doubt whatever that our local mycologists will be able during another season to add several more species to the comparatively short list given below.

SHROPSHIRE *Tuberacei*.

Tuber æstivum, Vitt. (?). Common Truffle, near Bridgnorth.	
Choiromyces meandriformis, Vitt. Lilleshall, near Newport.	1875.
Hydnotria Tulasnii, B. and Br. Wrekin Hill, on burnt ground.	1871.
Sphærosoma ostiolatum, Tul. Ercall Hill, near Wellington.	1873.
Genea verrucosa, Vitt. Ercall Hill.	
Genea hispidula, Berk. Ercall Hill.	1882.
Elaphomyces variegatus, Vitt. Ercall Hill.	1878.
Elaphomyces granulatus, Fr. Ercall Hill.	

THE FLORA OF WARWICKSHIRE.
AN ACCOUNT OF THE FLOWERING PLANTS AND FERNS OF THE COUNTY OF WARWICK.

BY JAMES E. BAGNALL.

(*Continued from page 16.*)

UMBELLIFERÆ.

SILAUS.

S. pratensis, *Bess.* *Meadow Saxifrage, or Sulphurwort.*
Native: In meadows, fields, and waysides. Local. July, August.
I. Maxtoke; Stonebridge; Hampton-in-Arden; Solihull; Tanworth, &c.
II. Meadows, by the Avon, Rugby, *Blox.*, *N. B. G.*, 1837; Tachbrook, Kenilworth! *Y. and B.:* Whitnash, Harbury! *H. B.;* Sow Waste, *Kirk;* Tysoe, Whatcote, Honington, Tredington, *Newb.;* Edge Hills; Alveston pastures; Bidford; Cold Comfort; Billesley; Alne; Henley-in-Arden.

ANGELICA.

A. sylvestris, *Linn.* *Wild Angelica.*
Native: In marshes, damp woods, ditches, &c. Common. July to October. Area general.

PASTINACA.

P. sativa, *Linn.* *Wild Parsnip.*
Native: On banks, waysides, and in fields, in calcareous and marly soils. Locally common. July.

II. Side of the Avon, near Rugby School: *Blox., N. B. G.:* Harbury, Whitnash, *Y. and B.:* Whatcote, Honington, Tredington, Halford, *Newb.;* near Alveston Pastures; Bidford; Wixford; Kinwarton; Exhall; Oversley; Great Alne; Rowington Canal bank.

The glabrous form, which is merely a remains from cultivation, occurs at intervals in cultivated land, old gardens, &c., throughout the county.

HERACLEUM.

H. Sphondylium, *Linn.* *Common Cow Parsnip.*

Native: In woods, on banks, waysides, borders of fields, &c. Common. May to October. Area general.

b. angustifolium? Rather rare.

II. Honington, Tredington, *Newb.;* Dripping wells and railway banks, Milverton, *H. B.;* Drayton Rough Moors, abundant; Compton Verney.

Seeds grown in my garden from this variety produced the typical form.

DAUCUS.

D. Carota, *Linn.* *Wild Carrot.*

Native: On banks, heathlands, and in meadows, &c. Common. July to September. Area general.

CAUCALIS.

C. daucoides, *Linn.* *Fine-leaved Hensfoot. Small Caucalis.*

Colonist: In cultivated fields, in Lias soils. Rare. June, July.

II. Alne Hills in cornfields, *Rufford;* in fields about Drayton Bushes! *Purt.* i., 146; cornfields at Binton! *H. B., Exch. Club Rep.,* 1875; Red Hill, near Alcester; field near Billesley; fields between Wilmcote and Stratford-on-Avon, abundant; stone quarries between Bidford and Exhall.

TORILIS.

T. infesta, *Spreng.* *Field Hedge Parsley.*

Colonist: In fields and on banks, in marly and calcareous soils. Local. June to August.

I. Curdworth; Wishaw; Temple Balsall; Solihull; Hartshill.

II. Fields near Alcester! *Blox., N. B. G.,* 1837; Chesterton, *Y.* and *B.;* near Rugby, *R. S. R.,* 1878; Tredington, Lambcote, *Newb.;* fields, Salford Priors! *Rev. J. C.:* Kineton, *Bolton King;* Henley-in-Arden; Alne Hills, Arrow; Moreton Morrell; Alveston pastures.

T. Anthriscus, *Gaertn.* *Upright Hedge-Parsley.*

Native: On banks, by roadsides, waste places, &c. Common. June to September. Area general.

T. nodosa, *Gaertn.* *Knotted Hedge-Parsley.*

Native: On walls and in meadows, in Lias soils. Rare. June, July.

II. ("*Caucalis nodosa*). On a wall at Walcot," *Purt.* i., 146; near the Race Stand, Warwick, *Per. Fl.* 25; near Rugby, *R. S. R.,* 1878; Warwick, Chesterton! *Y. and B.;* Warwick bank at the Cape, *H. B.;* on banks of old lime works, Little Lawford and King's Newnham, near Newbold Lime Works, *R. S. R.,* 1877; Ufton, near the village, 1873; near Chesterton Mill, in meadows, 1874.

CHÆROPHYLLUM.

C. Anthriscus, *Linn.* *Common Chervil.*
Native: On waysides and waste heaps. Rare. June, July.
I. Lane from Marston Green to Elmdon.
II. ("*Caucalis scandicina*). At the foot of the wall at Oversley Bridge," *Purt.* i., 147. (*Anthriscus vulgaris*) Hatton Rock, Emscote, Woodloes, *Y. and B.*; Ashow, *H. B.*; lane by Brandon Station; near the Lodge, Combe Abbey; in both stations abundant.

C. sylvestre, *Linn.* *Wild Chervil.*
Native: On banks, by waysides, in fields, woods, &c. Common. April to June. Area general.

C. temulum, *Linn.* *Rough Chervil.*
Native: On banks, by waysides, in fields, woods, &c. Common. May to August. Area general.

MYRRHIS.

M. odorata, *Scop.* *Sweet Chervil: Sweet Cicely.*
Denizen: In "orchards and waste places, but always near houses." Rare. June.
I. (*Scandix odorata.*) Temple Balsall, *Purt.* i., 153; Erdington, in a wild lane near the Old Chester Road, 1870, locality now destroyed.
I. ("*Scandix odorata.*) At Studley Castle," *Purt.* i., 153.

SCANDIX.

S. Pecten-Veneris, *Linn.* *Common Shepherd's Needle.*
Colonist: In cultivated marly fields. Rather common. April to September.
I. Sutton Park; Middleton; Hartshill; Coleshill; Solihull, &c.
II. Tachbrook, *Y.* and *B.*; near Combe Abbey; Southam; Bidford; Alcester; Alveston Heath.

(To be continued.)

METEOROLOGY OF THE MIDLANDS.

THE WEATHER OF DECEMBER, 1882.

BY CLEMENT L. WRAGGE, F.R.G.S., F.M.S., ETC.

The first half of the month was marked by severe winter weather—deep snow and hard frosts—while the second half showed the usual characteristics attendant on depressions and crests of pressure from the Atlantic passing northwards, and was, hence, generally mild and wet, with high winds and a fluctuating barometer. Flowers came into bloom near the close of the year. The highest reduced barometric reading took place on the 20th, and was about 30·294; the lowest happened between the 4th and 6th, and was about 29·010, as means for the Midlands. Mean temperature for the Central Counties may be given as 36·8, amount of cloud 8·9 (scale 0—10), and relative humidity 93 per cent. Westerly winds were again prevalent. The solar radiation thermometer read 83·8 on the 10th at Aspley Guise, and the terrestrial minimum —0·8 at Hodsock on the 12th. Bright sunshine only 16·0 hours at Hodsock, 20·7 at Strelley, 37·25 at Aspley Guise, 27 at Oxford, and barely 16 hours at Blackpool. The mean temperature of the soil at a depth of one foot was 38·5 at Hodsock, 37·4 at Strelley, and 41·7 at Cardiff. The mean amounts of ozone were 1·0, 1·8, 3·5, and 4·5—values for Oxford, Cheltenham, Carmarthen, and Blackpool respectively.

STATION.	OBSERVER.	RAINFALL. Total for M.	RAINFALL. Greatest fall in 24 hours.		RAINFALL. No. of rainy d.	SHADE TEMP. Absolute Maximum.		SHADE TEMP. Absolute Minimum.	
		In.	In.	Date.		Deg.	Date.	Deg.	Date.
OUTPOST STATIONS.									
Greenhill, Fort William (a) ..	C. L. Wragge, Esq., F.M.S.	7·30	....	..	..	48·8	27	13·2	15
Spital Cemetery, Carlisle	I. Cartmell, Esq., F.M.S. ..	2·56	0·34	8, 26	15	51·8	28	15·5	11
Scarborough (a)............	W. C. Hughes, Esq., F.M.S.	3·86	1·03	6	23	53·5	29	9·3	12
Blackpool (a)—South Shore..	C. T. Ward, Esq., B.A., F.M.S.	2·95	0·70	25	18	51·4	28	18·6	12
Llandudno (a)	J. Nicol, Esq., M.D.........	3·56	1·14	25	19	55·3	28	25·5	12
Lowestoft (a)	H. E. Miller, Esq., F.M.S...	3·67	0·70	7	21	55·0	27, 28	21·0	12
Carmarthen (a)	G. J. Hearder, Esq., M.D...	6·30	0·79	29	23	53·8	27	19·8	11
Cardiff (a)............	W. Adams, Esq., C.E.	4·86	0·73	31	25	53·7	31	20·2	11
Sidmouth (a)	W. T. Radford, Esq., M.D.	4·79	0·51	31	28	57·0	30	24·9	11
Guernsey	H. C. Carey, Esq., M.D....	5·33	0·56	26	27	56·5	22	30·3	11
Les Ruettes Brayes, Guernsey (a)	A. Collenette, Esq., F.M.S.	6·50	0·71	26	29	54·6	31	30·0	10
MIDLAND STATIONS.									
HEREFORDSHIRE.									
Burghill (a)	T. A. Chapman, Esq., M.D.	2·71	0·	12	27	57·3	28	20·2	11
SHROPSHIRE.									
Woolstaston	Rev. E. D. Carr	3·34	0·36	25	25	54·5	27	19·0	12
More Rectory............	Rev. A. S. Male............	3·71	0·32	25	28	54·0	26, 27, 28	8·6	12
Dowles, near Bewdley	J. M. Downing, Esq.	3·18	0·46	8	24	48·0	28	17·0	11
WORCESTERSHIRE.									
Orleton, near Tenbury (a)....	T. H. Davis, Esq., F.M.S. ..	3·18	0·31	6, 12	24	56·5	27	16·5	11
West Malvern	A. H. Hartland, Esq.	3·12	0·61	12	21	53·0	27	19·5	10
Evesham	T. J. Slatter, Esq., F.G.S...	2·91	0·36	30	21	54·5	27	19·5	12
Pedmore	E. B. Marten, Esq.	3·34	0·38	31	23	51·0	27	15·0	11
Stourbridge	J. Jefferies, Esq.	3·18	0·35	7	22	55·0	28	18·0	11
STAFFORDSHIRE.									
Rowley Regis	C. Beale, Esq..............	3·38	0·39	25	21	51·0	27, 28	18·0	11
Dennis, Stourbridge (a)......	C. Webb, Esq.	2·93	0·32s	7	22	56·0	27	17·0	12
Kinver	Rev. W. H. Bolton	3·09	0·33	7	23	55·0	28	22·0	11
Walsall............	N. E. Best, Esq.	4·39	0·43	27	24	52·0	28	18·0	13
Lichfield	J. P. Roberts, Esq.	4·81	0·61	25	24	55·0	27	20·0	11
Burton-on-Trent (c)..........	C. U. Tripp, Esq., F.M.S. ..	5·73	0·90	25	23	55·0	27, 28	18·0	11, 12
Wrottesley (a)	E. Simpson, Esq.	3·93	0·41s	12	21	54·8	27	18·0	11
Heath House, Cheadle (a) ..	J. C. Philips, Esq., F.M.S.	6·25	1·04	25	24	53·5	27	13·5	12
Tean (c)	Rev. G. T. Ryves, M.A., F.M.S.	6·12	1·05	25	25	54·4	27	14·2	12
Oakamoor, Churnet Valley (a)	Mr. Williams	7·08	1·04	25	22	54·6	27	10·9	11
Beacon Stoop, Weaver Hills (a)	Mr. James Hall	8·58	..	..	..	50·6	..	18·6	..
Alstonfield	Rev. W. H. Purchas	7·16	1·06	25	26	51·2	27, 28	..	..
DERBYSHIRE.									
Fernslope, Belper............	F. J. Jackson, Esq.	6·22	0·75	7	26	54·0	28	13·0	12
Spondon	J. T. Barber, Esq..........	5·26	0·90	25	22	..	..	..	..
NOTTINGHAMSHIRE.									
Park Hill, Nottingham (a) ..	H. F. Johnson, Esq.	4·92	0·83	25	22	54·2	27	17·6	12
Hodsock Priory, Worksop (a)	H. Mellish, Esq., F.M.S. ..	4·60	0·75s	7	21	55·0	27	7·7	12
Strelley (a)	T. L. K. Edge, Esq.........	4·88	0·83	25	24	53·1	28	16·0	12
Tuxford	J. N. Dufty, Esq., F.G.S. ..	4·84	0·80	7	17	51·0	28, 29	11·0	12
RUTLANDSHIRE.									
Uppingham............	Rev. G. H. Mullins, M.A., F.M.S.	3·83	0·73	25	23	53·6	28	18·3	12
LEICESTERSHIRE.									
Loughborough (a)............	W. Berridge, Esq., F.M.S...	4·32	0·74	25	21	55·0	28	17·3	12
Syston	J. Hames, Esq.............	3·61	0·66	25	23	53·0	28	20·0	12
Town Museum, Leicester	J. C. Smith, Esq.	4·28	0·74	25	14	55·0	28	16·4	12
Ashby Magna	Rev. Canon Willes	3·20	0·55	25	20	52·0	28	..	..
Waltham-le-Wold	Edwin Ball, Esq.	4·63	0·94	7	22	51·0	27	16·0	12
Coston Rectory, Melton (a) ..	Rev. A. M. Rendell........	3·98	0·77	25	20	53·5	28, 29	9·0	12
WARWICKSHIRE.									
St. Mary's College, Oscott ..	Rev. J. W. Brown, ...	3·96	0·50s	? 7	20	53·8	27	19·4	11
Kenilworth (a)	F. Slade, Esq., C.E., F.M.S.	3·56	0·44	25	24	55·1	28	17·2	12
Rugby School (a)	Rev. T. N. Hutchinson	3·36	0·60	25	22	55·4	28	15·0	12
NORTHAMPTONSHIRE.									
Pitsford, Northampton	C. A. Markham, Esq.	2·90	0·57	7	19	56·0	28, 29	15·0	12
Towcester	J. Webb, Esq.	2·79	0·38	25	19	..	..	..	..
Kettering............	J. Wallis, Esq.	3·41	0·70	7	19	55·0	29	17·0	12
BEDFORDSHIRE.									
Bedford (a)............	H. J. Sheppard, Esq.	2·48	0·51	7	21	55·1	27, 28	19·1	12
Aspley Guise (a)............	E. E. Dymond, Esq., F.M.S.	2·73	0·48	6	19	53·2	27	13·9	12
OXFORDSHIRE.									
Radcliffe Observatory, Ox. (a)	The Staff	3·17	0·71	29	17	55·0	29	17·8	12
WILTSHIRE.									
Marlborough (a)	Rev. T. A. Preston, F.M.S.	4·06	0·66	25	23	54·1	27	11·8	11
GLOUCESTERSHIRE.									
Cheltenham (a)	R. Tyrer, Esq., B.A., F.M.S.	3·16	0·36	25	24	55·3	27	17·0	12

We have to announce with the deepest regret the death of Mr. Scott, of Barlaston.

(a) At these Stations Stevenson's Thermometer Screen is in use, and the values may be regarded as strictly intercomparable. (c) Glaisher's pattern of Thermometer Screen employed at these stations.

Correspondence, etc.

SPHAGNACEÆ OF THE SOUTH MIDLANDS GATHERED IN 1882.—It is generally admitted that the cryptogamic flora of the South Midland Counties has received but little attention from bryologists. That it is not without interest, and would repay a careful investigation, is, I think, suggested by the following list. The specimens were gathered during the summer and autumn of 1882, but chiefly in the second week of August. The character of the summer, which, as a whole, was both cool and dry, affected the habit of such of these mosses as grew in the shelter of woods. The water in the pools, in which these plants find a congenial habitat, gradually diminished as the summer advanced, and as a consequence considerable portions of the living part of the stems were left standing above the water. The surrounding woods protected these from the force of the wind, and hence they were not beaten down, as were others which had been observed in July in some of the exposed bogs of the New Forest. But as it is essential to the life of these plants that their tissues should be saturated with moisture, in the case of those before mentioned, the spreading branches of the apexes of the stems became considerably elongated, so as to assist in drawing up the water. This was most strikingly the case with those that grew in "Mermaid's Pond," Aspley Woods, and has produced what Dr. Braithwaite designates "comal, attenuated branches." Specimens of all the gatherings were submitted to Mr. Boswell, who, with his usual courtesy, rendered valuable assistance in naming them. Besides this, duplicates were subsequently sent to several eminent bryologists, by whom they have been critically examined, and to whom also my best thanks are due.

SPHAGNUM.	BEDS.	BUCKS.	HERTS.
acutifolium.	Aspley Woods.	—	—
b. deflexum.	—	Little Brickhill	—
c. tenue.	Aspley Woods.	—	—
fimbriatum.	Aspley Woods. Flitwick Marsh.	—	—
squarrosum.	Flitwick Marsh.	—	—
b. imbricatum.	Flitwick Marsh.	—	—
intermedium.	Aspley Wood. Flitwick Marsh.	—	—
cuspidatum.	Aspley Wood.	—	Bricket Wood. Mr. A. E. Gibbs.
var. *riparioides.*	"Mermaid's Pond," Aspley.	—	—
rigidum.			
compactum.	—	Little Brickhill.	—
subsecundum.	—	—	Bricket Wood.
b. contortum.	—	Little Brickhill.	—
c. obesum.	—	—	Bricket Wood.
d. auriculatum	—	Little Brickhill.	—
tenellum.	—	Little Brickhill.	—
cymbifolium.	Flitwick Marsh. Aspley Woods.	Little Brickhill.	—
b. congestum. *c. squarrosulum*	Flitwick Marsh.	Little Brickhill.	--

J. SAUNDERS, Luton.

CURIOUS SUPERSTITION.—I have lately heard from some of the peasantry here (Hampton-in-Arden), the following strange receipt for effecting the cure of whooping-cough in children, viz.: take a pinch of hair from the nape of the neck of the afflicted person, and, after having cut it into very fine pieces, lay it between two slices of bread and butter, and give it to a dog to eat—a strange dog is preferable to one living on the premises. If it is for a girl care must be taken that the animal is of the male sex, and if a boy, of the opposite sex, otherwise the remedy would be inefficacious. The Rev. Thistleton Dyer states, in "English Folklore," that a very similar remedy is resorted to in Gloucestershire, and that measles are sometimes cured in the same way. Another remedy is to pass the afflicted child backwards and forwards beneath an arched bramble, one of peculiar growth, rooting at both ends. It would appear almost incredible in these days of medical science and social advancement that persons could still be found to rely so much upon so foolish a superstition. I have actually seen preparations made for applying the remedy, but have not heard of the result. Such cases as the above, and one may often meet with many equally curious in our rural districts, only tend to prove the force of long standing superstitions, and how difficult it is to remove certain ideas, however whimsical and fallacious, when once they have taken deep root in the mind.—R. ROGERS, Hampton-in-Arden.

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—MICROSCOPICAL GENERAL MEETING.—January 16th.—Mr. C. B. Plowright, the eminent fungologist, of King's Lynn, was unanimously elected a corresponding member of the Society. Mr. W. B. Grove exhibited the following fungi:—*Trametes gibbosa*, *Hymenochæte rubiginosa*, *Corticium ochraceum*, *C. Sambuci*, *Tremella indecorata*, *Helotium pallescens*, *Sphæria rubella*, and *S. acuta*, all from Sutton; *Sordaria breviseta* (new to the district), from Water Orton; *Sphæria sabuletorum*, from Rhyl, on stems of *Ammophila arundinacea*; *Stegonosporium cellulosum*, from Sparkhill; and *Torula sporendonema* (rare and new to the district), from Sutton. Mr. W. R. Hughes, F.L.S., then exhibited and presented to the Society six slides of Echinodermata and Entozoa, on behalf of Mr. F. W. Sharpus, of London, by whom they were mounted. He also gave a description of the slides and the points of interest which they illustrated. The first was a young individual of *Echinus sphæra*, the common egg urchin, measuring only one inch across, including the spines, mounted whole in such a manner that the student could examine the whole external anatomy in detail on either the upper or under surface. The second and third slides showed certain plates relating to the ambulacral and pore systems, and formed very beautiful objects. The fourth slide contained one of the arms of *Ophiocoma rosula*, the rosy brittle star, complete to the very base. This is very difficult to obtain; everyone, who has attempted to catch these brittle stars knows the facility with which they dismember themselves at the slightest provocation. The fifth and sixth slides contained perfectly mounted specimens of the liver-fluke, *Fasciola hepatica*, in which the whole internal anatomy of these parasites could be observed. Concerning this entozoon, which is the cause of the "rot" in sheep, Mr. Hughes gave several interesting particulars, which were supplemented by the remarks of other members who were present. The eggs of the liver-fluke, of which one individual can produce 50,000, pass with the bile into the sheep's intestines and are then dropped over the pasture. If then they are washed into water, they give exit to a ciliated embryo, which moves rapidly through the water. At this point there was formerly a doubt as to the precise mode in which the development was continued, but this has now been cleared up by the researches of Mr. A. P. Thomas, of Oxford, who has proved that the embryos bore their way into the tissues of a certain snail, *Limnæus truncatulus;* they will not, probably, enter any other species. This small mollusc is abundant in pools, ditches, and running streams, and, being amphibious, is also met with upon the surface of land not far from water, especially after floods. In the body of this "intermediate host" the embryo undergoes various complicated changes, finally assuming the form of a *Cercaria*, which escapes from the mollusc and becomes encysted on various objects, such as blades of grass. Eaten with the grass by the sheep, it undergoes further changes, and at last assumes the form of the mature fluke, which gains access to the liver of the sheep. When an animal is seriously infected with these parasites, there appears to be no cure; the only remedy is to kill them in some of the intermediate stages by killing the molluscs which they inhabit. This can be done by the use of salt, which is also otherwise beneficial to the sheep. Mr. Sharpus's slides are deposited in the Society's cabinet, and can be inspected by anyone who desires to see them. Mr. Hughes then read a note upon the "Poisoning of some Actiniæ." The species involuntarily made the subject of experiment was *Bunodes gemmacea*, the gem pimplet, obtained near Ilfracombe, and kept in a small aquarium. These were supplied daily with fresh sea-water, fetched in a vasculum made of silvered copper. Portions of the silver being rubbed off and the copper exposed, a galvanic action appears to have been set up and sulphate of copper produced. This being unwittingly given to the anemones, they were poisoned and nearly died. The remedy was to wash them carefully with fresh water, removing the decaying tissues with a camel-hair pencil. When they had recovered from this, they were afterwards nearly poisoned with fresh water, which was given them by mistake, and then all but frozen to death in the cold weather of last year. Nevertheless, they were exhibited to the meeting in a healthy and well expanded state, four months after their capture. January 23rd.—GEOLOGICAL SECTION.—The following exhibits were made:—Mr. S. Wilkins, for Mr. Mace—a large pebble, extremely hard and heavy, and quite spherical in shape, found near Stechford; Mr. W. H. Wilkinson—a specimen of *Lodoicea Seychellarum*, a curious double nut, commonly known as double cocoa nut, which grows only on two of the Seychelle Islands; Mr. S. Walliker—a humming bird and a leaf insect, Mantis, from the East Indies; Mr. J. Bagnall—two mosses, *Gymnostomum squarrosum*, Kingsbury, new to Warwickshire, and *Orthotricum saxatile*, Hampton-in-Arden, new to North Warwickshire; Mr. W. J. Harrison—belemnites from Upper Lias of East Leicestershire, fossil wood from Sheppey, and striated coal shale from Acocks Green. A paper was read by Mr. A. H. Atkins, B.Sc., entitled "A Note on some Glacial Markings in the Red Marl." The uppermost beds of the Red Marl, the highest division of the Trias formation, are often found considerably altered by glacial action, the clay being as a rule stiffer and of greater value commercially than the unaltered strata below. The section described occurs at Bordesley Green, near Small Heath, and there this tenacious upper clay is separated from the Red Marl itself by a hard band of greenish grey rock. The beds above the band are much contorted and broken, while underneath lies the ordinary parallel stratification of the Trias. The surface of the rocky layer, where the clay has been removed, is also very smooth and polished. These facts indicate glacial action, which must have occurred at the time when a great ice sheet covered the Midland Counties.

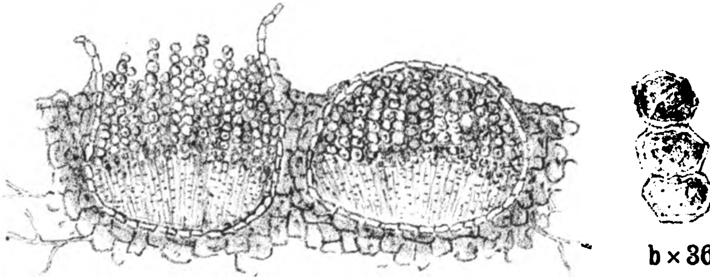
BIRMINGHAM MICROSCOPISTS' AND NATURALISTS' UNION.—ANNUAL SOIREE.—November 2nd and 3rd.—An exhibition of pond life by various members; *Lophopus crystallinus*, shown by Mr. Baxter *Volvox globator*, Mr. Dunn; Mr. C. P. Neville, *Nitella translucens*; Mr. Delicate, freshwater shrimp, showing circulation of blood; Mr. J. W. Neville, 100 slides of insects, mounted whole, and in dissected parts, also tongue of spider under microscope; collection of British and foreign land and freshwater shells; collection of silkworms, moths, and beetles, Mr. Boland; British land and freshwater shells, Mr. Madison; foreign Lepidoptera, Coleoptera, and flint implements, Mr. A. Walton; Lepidoptera and plants of the district, Mr. Wheeldon; British Lepidoptera and their insect parasites and district plants, Mr. Deakin. Various fossils were shown by Messrs. Hawks and Parks, the former including skeleton of small Ichthyosaurus. A short lecture on coal and coalfields was given twice each evening by Messrs Insley and Meacham, illustrated by lantern views of the coal period and mining scenes. November 6th. — MICROSCOPICAL AND GENERAL MEETING — Mr. Bradbury showed a case of insects from Colorado; Mr. Madison, Stigmaria found in Drift, Camp Hill; Mr. Boland, *Helix pomatia*, living, showing winter epiphragm. November 13th.—ELECTION OF OFFICERS —Mr. George St. Clair elected President. Reports of Secretary, Curator, and Treasurer read, that of the latter showing the Society to be in a healthy condition.—November 20th.—Mr. Hawks exhibited specimens of Euplectella. Paper on mounting botanical objects for the microscope, with practical illustrations by H. Insley. November 27th.—A specimen of white robin, shot at Bridgnorth, was shown by Mrs. W. Shakspeare; Mr. Hawks, a collection of Caddis cases made in the district, and leaves from America, gathered during the Indian summer, showing the richness of their tints. December 4th.—Mr. Delicate exhibited stuffed specimen of common Guillemot; Mr. Boland, stuffed specimen of Godwit, Dotterel, male and female; Crested Plover, male and female; Starling, and Lesser Tit. Paper, Wonders from Wonderland, W. Flowers. The wonders described were Stephanoceros, Hydra, Daphnia, Volvox, and Diatomaceæ; specimens were shown in illustration. December 11th.—Mr. Wykes exhibited *Pleurosigma angulatum*.

NOTTINGHAM G. R. S. NATURALISTS' SOCIETY.—This Society's second annual soirée was held at the Peoples' Hall, and was well attended. The opening ceremony took place shortly after eight o'clock, when the Mayor (Ald. Lindley) presided. His Worship, in a few remarks, spoke in favourable terms of the object of the Society, and congratulated the members on the success they had attained since the formation of the Society two years ago. Mr. Alderman Turney and Mr. G. B. Rothera also spoke. Mr. J. Potter Briscoe, President of the Society, referred to the formation of the Society, which, he explained, was an off-shoot from the Naturalists' Society. Among the principal exhibitors were Mr. G. B. Rothera, exotic butterflies, geological and botanical specimens; Mr. W. Shipman, specimens of the geology of the neighbourhood of Hastings; Mr. J. Potter Briscoe, specimens of Indian metal work, pottery, etc., local antiquities from Newark, Lenton Priory, curiosities of local printing, etc.; Mr. John Stanley, and Mr. Rose, cases of stuffed birds; Mr. Gent, entomological and ornithological specimens; Mr. Watson, specimens of geology; Mr. Mason, cases of birds and microscopes; Mr. Rigby, ornithological specimens and birds' nests; Mr. Lee, skeletons of birds and animals; and Mr. Clements, antiquities in connection with Nottingham churches. An additional attraction was afforded during the evening in the electric experiments of Messrs. Simpson and Baldwin, from the University College, Nottingham, and by the pianoforte selections of Miss Hickling. The Society consists of 31 members, and the Society's Rooms, at the Peoples' Hall, are open every Tuesday evening. Mr. J. G. Davidson is the secretary.

Exchange.

I shall be glad to exchange mounted Micro Slides for material. Will send a list of slides.—S. R. Hallam, 22, High Street, Burton-on-Trent.

Plate IV.



b × 360

Fig. 1. a × 88

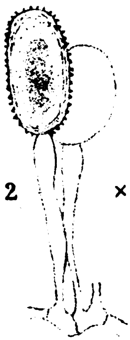


Fig. 2 × 500

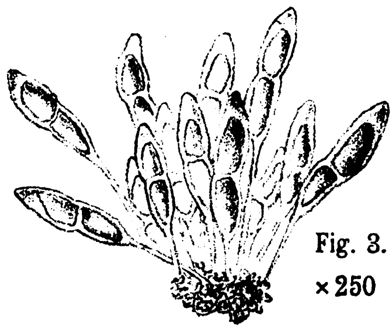


Fig. 3. × 250

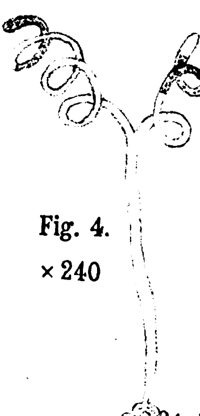


Fig. 4. × 240

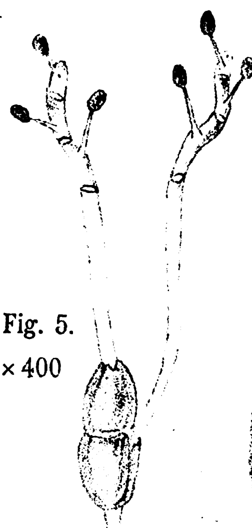


Fig. 5. × 400

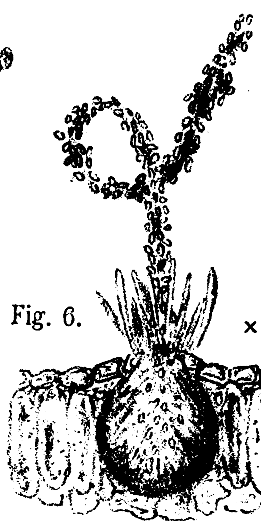


Fig. 6. × 240

THE UREDINEÆ

W. B. G., LITH.

NOMAD FUNGI: THE RECLASSIFICATION OF THE UREDINEÆ.

BY W. B. GROVE, B.A., HON. SEC. OF THE BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.

(*Continued from page 31.*)

LIFE-HISTORY OF A HETERŒCIOUS SPECIES.

It will illustrate this important phenomenon of heterœcism, as well as confirm the whole theory, if I trace the annual cycle of *Puccinia graminis* through its various forms; for, if it is once proved that *P. graminis* is descended from *Œcidium berberidis*, no one can any longer conceive a doubt about the truth of the theory in the other or *autœcious* species, where the various forms appear on the same plant.

This Puccinia (viz., *graminis*), then, begins its life in spring as an Œcidium, or cluster-cup, on the leaves of Berberis, usually upon *Berberis vulgaris*, the common wild barberry, but also upon most of the cultivated forms. If the spores of this, when ripe, be taken and sown upon the leaves of a young wheat plant, which has never been exposed to the risk of any accidental infection by other spores, it germinates, throwing out a germ-tube. This germ-tube travels over the leaf, searching for a stomate into which it may enter. As it elongates it assumes a spiral form. Sometimes after making four or five turns from left to right, it will reverse its motion, and make the succeeding turns from right to left. It is obvious that by these means it adds greatly to its chance of finding and entering a stomate; in fact, this motion, and the object of it, are very similar to that which Dr. Darwin has so recently made known with reference to the growing radicle of flowering plants. Mr. C. B. Plowright, to whose experiments I am now referring, says that all the trouble he took in conducting his experiments was fully repaid by the intense pleasure of watching this germ-tube feeling its way over the epidermis of the wheat-leaf in search of the opening by which alone it could enter in. Having obtained an entrance, the tube, by repeated branching, forms a mycelium, which increases within the plant tissues, and at last the ends of

REFERENCES TO PLATE IV.

Fig. 1.—*a*, Section of two cups of *Œcidium grossulariæ*, showing the spores originating in chains beneath the epidermis, × 88; *b*, three spores, × 360—(from nature).

Fig. 2.—Two uredo-spores of *Puccinia graminis*, seated on their pedicels, or basidia, × about 500—after De Bary).

Fig. 3.—Group of teleuto-spores of *Puccinia graminis*, × 250—(from nature).

Fig. 4.—Germinating spore of *Œcidium tussilaginis*, × about 240—(after Plowright).

Fig. 5.—Germinating teleuto-spore of *Puccinia magnusiana*; each segment of the spore has thrown out a germ-tube, bearing three "sporidia," × about 400 — after Plowright).

Fig. 6.—Spermogone of *Œcidium tussilaginis*, emitting a tendril of minute spermatia in water, × 240—(from nature).

the hyphæ turn upwards towards ths surface, forming an hymenium or layer of basidia. Each basidium, by constriction from its extremity, forms a uredo-spore, which assumes a deep yellow or orange colour. As the mycelium continues branching, and each branch produces a spore, the increasing mass at last ruptures the epidermis, and the spores escape. Now these spores, like those of the Œcidium, have only a thin cellulose coat; they are evidently adapted for germinating immediately. This is in fact what they do; each uredo-spore, if it falls upon a leaf of the wheat-plant, germinates at once, throws out a germ-tube, which searches as before for a stomate by which it enters, and forms a new mycelium, which produces again uredo-spores. By repetition of this process, the fungus spreads itself from plant to plant over a large area. The spores are easily dispersed by wind and rain.

But these spores, though evidently adapted by their vast numbers, their ready dispersion, and the ease with which they germinate, for effecting their object, namely—the rapid diffusion of the fungus, evidently do not furnish the best conditions for prolonging its life through the trials of winter, and preserving it to afflict the agriculturist in another year. These thin-coated spores lose their power of germination in a few weeks. Now see what the fungus does. Knowing what is coming, it takes the best means of ensuring its safety by producing spores calculated to resist the adverse influences of winter weather. Like a wise mother, it clothes its offspring in a warm greatcoat. In fact, it produces resting-spores, as do so many other organisms well known to the microscopists in this room. The same mycelium, which has produced uredo-spores all the summer, begins in autumn (influenced doubtless by the gradual ripening of the tissues of the wheat) to give off the puccinia-spores, which are not only two-celled—an unimportant circumstance *—but are distinguished by their thick cuticle, that peculiar dense waxy layer which the external laminæ of the cell-wall have the power of secreting if they wish to protect themselves against heat or cold. It is this layer which gives to a sorus of puccinia-spores its strikingly shiny aspect. Clothed in this extra garment, they lie snugly ensconced in the half-decayed tissues of their host, unchilled by wintry blasts, until the warmth of returning spring calls forth again the leaves upon which they are fitted to grow. In the case which we are considering the leaves for which they wait are those of the common barberry.

Here, however, is another difficulty. The puccinia spores are large and heavy—the hoplites of the fungal army; moreover, they are firmly attached to the basidia from which they spring, and not readily detached, as in the two other kinds. The wind and the rain can do but little to effect the transference of such a heavy brigade of spores as these from the surface of the ground to the young barberry leaves, which alone can furnish the requisite nidus. If the fungus had not still another resource in store, if it were now at its wit's end, the

* This is shown by the fact that in the genus Uromyces, which is in every respect analogous to Puccinia, these spores are one-celled.

farmer might breathe a sigh of relief, for perhaps his crops would never be attacked by rust or mildew again. But all is not yet lost: the fungus is equal to the occasion. Each cell of a puccinia-spore, germinating where it lies, sends out a short tube, forming at the end a few branches (usually two to four) into which the protoplasmic contents of the cell pass; the ends of these branches are constricted off, and we get two or three little round spores (the so-called *sporidia*), which are admirably adapted for being blown by the wind wheresoever it listeth. Imagine one of these tiny spheres alighting on a barberry leaf; it germinates, sending out a germ-tube as before, but this time the tube does not seek for a stomate, but bores its way straight through the tender cuticle into the leaf. Here it forms a mycelium, from which, after a week or two, the Œcidium is again produced.

Thus the life-cycle is complete, and I venture to say that we have here as nice an instance of adaptation of means to ends, and as strange a story of transformation, as any which biology can furnish. This romantic tale is founded upon fact. Puccinia-spores have been sown upon barberry leaves and observed to germinate, and from the mycelium thus produced an Œcidium has been seen to grow;* similarly the production of the Uredo from the œcidio-spores has been actually watched, while the production of a Puccinia from the same mycelium as the Uredo is a matter of easy observation. Thus, as in so many other instances, a common belief of country people, after enduring from so-called men of science the customary stages of incredulity and laughter, has now become an article of science; and in a few years the man who dares to question it will be received with as much ridicule as were those who formerly believed it. The Norfolk farmers, and others, always held that the presence of barberry bushes in the hedges of their cornfields had something to do with the rust and mildew of their crops; and this belief, though doubtless founded upon rough reasoning only, turns out to be quite correct. Many other beliefs of country bumpkins, now held up to scorn as instances of superstition, will in future years become a part of the scientific creed.

A perfect Uredinous fungus has, then, three distinct stages—the Œcidium, the Uredo, and the Puccinia, distinguished by Continental mycologists as I., II., and III., as will be seen by referring to the table of the revised classification on page 28. The spores of these are called, sometimes, protospores, stylospores, and teleutospores respectively; but the number of species in which all the three stages have been observed is comparatively few, and in the great majority either two or only one stage is at present known.

It must not be supposed, however, that a Uredine which has all three stages need pass through them every year. Just as in Phanerogams, a plant may have several modes of multiplication, of any of which it may avail itself according to circumstances. For instance, Mr. Plowright has shown that *Puccinia poarum* is a stage of *Œcidium*

* "Grevillea," xi. pp. 54-6.

tussilaginis; yet the Puccinia has been hitherto unknown in Britain, while the Œcidium occurs in vast abundance everywhere. A similar, but reversed, instance occurred in another of his experiments, where he produced *Œcidium zonale* (a plant new to the British flora) by sowing the spores of *Uromyces junci.* Even if we grant that the newly-discovered fungi did exist before in Britain, it must be in small quantity and in few places only. So *Peridermium pini* is a stage of *Coleosporium senecionis;* the latter is very common miles away from any locality where the former can be found. Stages II. and III., *or their physiological equivalents*, must indeed occur in most cases; but the œcidium-stage need perhaps only occasionally intervene. *Vide infra.*

In the genus Phragmidium the œcidium-stage has been hitherto but little known (I might say, in England altogether unknown),* and frequently confounded with the uredo-stage. In both cases the sori are surrounded by a ring of paraphyses, but in the case of the œcidium-sorus the spores are produced in chains; in the uredo-sorus each spore grows singly. For Triphragmium no stage I. has yet been discovered,† which is also the case with our species of Melampsora. In Melampsora and Coleosporium, stage II. is the ordinary uredo-like form, in which the spores occur in heaps like dust; stage III. is that in which the spores are closely compacted; in Melampsora, 1 to 4-celled and with a thickened cuticle; in Coleosporium, mostly 4-celled and surrounded by a tenacious gelatine. Gymnosporangium (with which Podisoma is united) has for stage I. the various species of Rœstelia. Of Cronartium, which has been discovered in Britain since the publication of the Handbook,‡ only stages II. and III. are known. Peridermium is stated to be the first stage of Coleosporium, but concerning this it is, I think, permissible to withhold one's opinion till further evidence is adduced. Endophyllum is a curious genus, in which the spores are produced in chains, and surrounded by a pseudo-peridium, exactly as in Œcidium, but nevertheless germinate like those of a Puccinia, with the formation of a promycelium and small round sporidia. It is found embedded in the leaves of *Euphorbia amygdaloides* and species of Sempervivum and Sedum. Dr. B. White has described (in "Scottish Nat.," iv., p. 163) a new genus, Milesia, allied to Endophyllum, found in the leaves of *Polypodium vulgare.*

Of the genera included in the Handbook, which are not mentioned in the foregoing list (p. 28), Xenodochus is absorbed in Phragmidium (a change hardly to be recommended); Tilletia, Ustilago, Urocystis, Thecaphora, and Tuburcinia are placed in the Ustilagineæ; Cystopus is removed to the Peronosporeæ; Trichobasis is merely a synonym of Uredo; and Graphiola is not truly British. A number of species,

* Mr. Plowright has recently recorded it in "Science Gossip" for January, 1883, pp. 11-12.

† The uredo-stage has, however, two forms—the one appearing in spring, physiologically, perhaps, but not morphologically representing the Œcidium the other in summer being the true Uredo.

‡ See "Grevillea," iii., p. 124.

however, at present imperfectly known, must be arranged provisionally under the pseudo-genera Uredo, Cæoma, and Œcidium; such are *Uredo agrimoniæ eupatoriæ*, *U. hydrocotyles*, *U. quercus*, *Cæoma mercurialis perennis*, *Œcidium quadrifidum*, *Œ. clematidis*, and others, among our British species.

(*To be continued.*)

GENERAL REPORT ON THE DREDGING OPERATIONS AT OBAN OF THE BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY, JULY 5TH TO 12TH, 1881.

BY JOHN F. GOODE AND WILLIAM P. MARSHALL.

In this Dredging Excursion of the Society the operation of dredging was carried on from a small screw steam-yacht, the "Curlew," Capt. Adam, engaged for a week for this purpose, of about 20 tons burthen, 50ft. length, and 9ft. beam; speed about 10 miles an hour. From nine to twelve dredgings per day were obtained in depths of water varying from 15 to 53 fathoms, and most generally about 20 fathoms depth. This steamer was found to be smaller in size than was desirable for convenience of working, and for speed in getting out to the dredging ground.

The dredge-nets used were 2ft. wide and 2ft. long, with 10in. opening between the steel-edged scrapers at the mouth; a tangle, 16in. long, was attached to each bottom corner of the net. Three dredges were taken, two of them being generally in use alternately with one another. A length of 100 fathoms of 2½in. circumference rope was taken out, and the whole length was required for the deepest dredging taken, which was in 53 fathoms of water. One arm only of the dredge-frame was made fast to the rope, the other arm being attached to the rope by a lashing of small cord, calculated to break before any injurious strain could come upon the rope; and the utility of this provision was experienced on one occasion when the dredge got jammed fast at the bottom and the lashing parted, causing the dredge-frame to open, and the net to come up empty but safe.

When the dredge was hauled up the contents were emptied out for examination upon a working table 3ft. wide and 4½ft. long, covered with white oil-cloth, fastened down smooth. This was convenient for sorting out the specimens and washing off the mud that was brought up with them, and the end of the table projected over the side of the vessel for discharging the *debris* continuously direct into the water. Glazed iron pans, 16in. diameter and 3in. deep, were used in sorting and cleaning the specimens, which were then put into wide-mouthed glass jars of three sizes—6in. diameter by 16in. high, 3½in. by 8in., and 2in. by 6in. The glass jars were kept in a box divided into separate compartments for safe carriage, in which they were daily brought to and from the steamer, and were finally packed for conveying home the selected specimens transferred into spirit. Three galvanised iron sieves were also used, having $1\frac{1}{2}$, $\frac{3}{4}$, and $\frac{3}{16}$ inch meshes respectively. Four tow-nets were taken, 1ft. diameter and 2ft. long, one made of coarse muslin, and the others of fine muslin; these were used occasionally, either from the steamer or from a rowing boat.

When the dredge was lowered it was left each time from ten to twenty minutes at the bottom, being either towed very slowly by the steamer, or allowed to drift with the current. The rope was hauled in by hand over the side of the vessel in raising the dredge; but a considerable inconvenience was experienced in doing this, from the labour of the work and the loss of time involved, about nine minutes being generally required for hauling in the dredge, even from the moderate depth of 22 fathoms. The provision of some simple hauling winch, with a leading pulley for the rope where passing over the side of the vessel (however rough in construction), will be an important advantage in future dredging operations; and these should be arranged so as to admit of being readily shifted in position, as the circumstances of the varying position of the dredge in the drifting of the vessel may render desirable.

A sketch map is appended, showing the localities of the several dredging stations; and an abstract is added of the log that was kept of the dredging operations, recording in each case the station, the time of lowering the dredge, and the time of remaining at the bottom, with a general note of the contents brought up, and the nature of the bottom.

The most important point of experience gained from the dredging, is the great value of the *tangles* as a means of securing good specimens; the large Funiculina specimen was brought up by being caught by a few of the hempen fibres of a tangle, and was secured by this means in perfect and uninjured condition; and one of the two Pennatula specimens was also caught by a tangle. A serious defect, however, in the present tangles (which are attached one to each bottom corner of the dredge-net), is that the dredge *precedes* the tangles, and the heavy cutting edge at the mouth of the net consequently scrapes over the whole of the ground that is passed afterwards by the tangles, and is thus liable to break off and damage objects that are growing upright at the bottom of the water. An important illustration of this damage is given by the circumstance that all the Virgularia specimens (which have a very brittle and rigid stem) were broken off at the bottom, the point of fracture being at a quarter to three-quarters of an inch below the lower extremity of the "feather" or fleshy body, and most probably very near the surface of the ground in which the objects were growing.

In the report of the "Challenger" Dredging Expedition special value is assigned to the tangles, and as many as eight tangles were used together in the dredging, carried by a transverse bar 5ft. long at the bottom of the dredge-net, which was $4\frac{1}{2}$ft. wide. A light iron rod was attached to each end of the tangle bar, extending to the mouth of the dredge, as a provision for keeping the dredge-net always extended to its full length, and for preventing any risk of the tangles or the end of the net getting folded over the mouth of the net, and so causing the dredge to come up empty. In the experience of the Oban dredging such accidents occasionally happened, and the adoption of a similar precaution in future is desirable.

Another point in which the working of the present dredge was not satisfactory is, that the dredge came up on several occasions only very imperfectly filled, and appeared to have not been dragged properly along the sea bottom, and to have been lifted off the bottom by the oblique pull of the rope. In the "Challenger" deep-sea dredging, where the difficulty from this cause was enormously increased by the dredging being carried to a depth of from 2½ to 4½ miles, a special contrivance was used for overcoming this difficulty, and a weight of 1½ cwt. was attached to the rope at 200 to 500 fathoms' distance in advance of the dredge (or a distance equal to about 1-8th of the depth being dredged). This "messenger" weight trailed along the sea bottom, and caused the pull upon the dredge to be under all circumstances in a direction parallel to the bottom and close down upon the ground, thus keeping the dredge at all times in the best position for its work. As a consequence of this arrangement, the risk was somewhat increased of the dredge getting jammed by some obstruction at the bottom, and whenever that occurred it became necessary to ease the rope by letting it slip for a certain distance, until the steamer could be backed over the dredge in order to clear it from the obstruction. The circumstance of the dredge becoming jammed was instantly ascertained by means of a spring-tension apparatus in the hauling tackle, the guiding pulley over which the rope was led to the dredge being suspended by a set of 80 strong india-rubber bands (similar to door springs), which were capable of stretching as much as 14ft. before reaching the strain at which the rope would break (2½ tons); and due warning was thus given by a sudden increased stretch taking place whenever the dredge got fast. In the Oban dredging this object was aimed at by feeling the tension of the rope by hand from time to time, to detect any undue resistance, and also to ascertain whether the resistance was sufficient for indicating that the dredge was dragging properly on the ground.

In order to prevent the injury of the specimens by the scraping lip of the net striking them before they can be caught by the tangles, it appears requisite for the tangles to be fixed separately farther up the rope in advance of the net, so that when the dredge is dragged along, the bottom shall be first *lightly swept* by the tangles before being *scraped* by the dredge; and it is also requisite that the cross-bar carrying the tangles shall not itself drag upon the ground so as to cause similar mischief to that previously done by the dredge scraper, but shall be propped up sufficiently high above the ground to prevent this, but not so high as to risk the tangles floating clear off the ground.

It is now suggested that the above objects, and also the other requirement of a "messenger" weight in advance of the dredge for ensuring a uniform horizontal pull upon the dredge, may be both conveniently effected by having a cross-bar carrying the tangles attached to the rope in advance of the dredge (say three fathoms in advance for twenty-four fathoms depth of dredging), and having a weight fixed to each end of this bar, of such a form as to drag upon the ground whilst holding up the bar at the required height above the ground;—the whole being made double-sided to provide for either side being uppermost when the dredge is lowered to the bottom. The present tangles at the bottom of the dredge-net to be retained as an additional provision, and the new tangle-bar to be made as much wider than the present dredge-net as may be practicable for convenient handling on deck.

In the "Challenger" Dredging it is worthy of note that the greater portion of the work was done with a wide *trawl-net* carried by a transverse beam that was as much as 18ft. in width with 20ft. length of net; and this was found so superior in results to the regular dredge-net of 4½ft. width and 4½ft. length, that the trawl-net was used for depths even as great as 3,000 fathoms, or 3½ miles. The two ends of the trawl-beam were carried about a foot clear above the surface of the ground by an iron-runner fixed to each end (like sledge-runners).

The trawl-net has an objection in the rather longer time required for sinking it to the bottom, and it is not so suitable for rocky or uneven ground as the narrow dredge; but it was used almost constantly during the latter part of the voyage of the "Challenger." In the deep-sea dredging (generally about three miles depth), the time required for lowering and hauling up the dredge was so great that only a single dredging operation could be effected in each day; the lowering of the dredge took about 3 hours, it was then allowed to remain at the bottom from 1½ to 2 hours, and 4 to 5 hours was taken for hauling up, the average rate of hauling up being 1ft. per second, or 10 fathoms per minute. The total number of dredgings effected in the 3½ years that the "Challenger" voyage lasted was consequently not more than 504, these being nearly all deep-sea dredgings, extending to an extreme depth of 3,950 fathoms, or 4½ miles.

In future dredging excursions of the Society it appears also desirable to consider the employment of a small-sized dredge in addition to the ordinary dredge, and so small in size that it can be hauled in readily by a single hand, and can be quickly and conveniently used as a trial dredge without involving the delay and labour of lowering and raising the large dredge. Such a dredge, of only seven inches width, and requiring a rope only as large as a common lead pencil, has been very successfully used down to a depth as great as 60 fathoms by Mr. David Robertson, of Glasgow, in his important dredgings for Foraminifera on the coasts of Scotland and Norway.

In reference to the preserving of specimens, it is very desirable that on future occasions (as pointed out in the Report on the Pennatulida from Oban) some few specimens of each object—fragments will suffice

—should be *preserved at once* in spirit directly they are captured, so as to be in good and natural histological condition for subsequent detailed examination with the microscope. The want of such preparations has been specially experienced in the microscopic examination of the Pennatulida specimens for determining difficult points of histological structure; the change of circumstances in the exposure of a deep-water object, even for a short time, to the higher temperature, diminished pressure, and greater light of surface water, being unfavourable to an accurate preservation of the microscopic details in animal structure.

MIGRATORY BIRDS.

REMARKS ON MIGRATORY BIRDS NOTICED IN NORTH OXFORDSHIRE IN THE AUTUMN OF 1882.

BY OLIVER V. APLIN.

The first sign of the autumn migration was the appearance of two Green Sandpipers (*Totanus ochropus*), which I observed on the Cherwell on August 19th. This species is an occasional visitor to us during the autumn and early winter months, frequenting the shelving banks of the larger streams. When sprung they generally follow the course of the stream, flying low over the water and uttering a shrill piping cry. I saw a single Wheatear (*Saxicola œnanthe*) that same day, a bird which only visits us on migration in spring and autumn, and noticed a considerable flock of Yellow Wagtails (*Motacilla Raii*) in the meadows, where they congregate preparatory to departure. A flight of Spotted Crakes (*Porzana maruetta*) appears to have passed over about the end of August. Specimens were picked up under the telegraph wires on the 29th, and on the 4th and 6th September. I observed seven or eight Wheatears on September 6th, looking restless and evidently on the move. On the 5th I shot a Common Sandpiper (*Totanus hypoleucus*) on the banks of the Cherwell, and on the 15th a man, whom I had asked to shoot for me any Sandpipers he might come across, turned up with a Jack Snipe (*Gallinago Gallinula*). It is not often that "Jacks" put in an appearance before October, and this is the earliest date that I have for its arrival in North Oxon. Another struck the telegraph wires and was picked up on the 23rd. A great many Pied Wagtails (*Motacilla lugubris*) visited us about the close of the month, and stayed for a short time. The Grey Wagtail (*Motacilla sulphurea*) arrived about that time. A small canal weir near Banbury, with some large stones scattered about in the rushing waters, is a favourite spot for this bird; on these stones it loves to settle, flirting its long tail and uttering its loud note, decidedly wagtailish in character, but easily distinguished from that of either of the two other common British species. I noticed the first on the 24th. Snipe (*Gallinago media*) have not been plentiful; the first flight was about October 7th, after three days of North East wind, and about the same time we were visited by large flocks of Peewits (*Vanellus cristatus*), which remained with us all the open weather. I have rarely seen them in such numbers. On the East coast of England there was probably an immigration of Jays (*Garrulus glandarius*) early in the month, as a considerable number passed over Heligoland on the 6th (*vide* "Zoologist," 1883, p. 1), and our inland districts were certainly affected by it in some degree. Several times during the season I observed upwards of a dozen together, an unusual circumstance, and the bird appears to have been much more numerous than usual in the district generally. On the 28th there were a good many Redwings (*Turdus iliacus*) in the hedges. I heard of no Bramblings (*Fringilla montifringilla*) actually *in* the county, but a little past the middle of October a few were observed on the Warwickshire boundary; the first was on the 18th. On November 2nd a Short-eared Owl (*Asio accipitrinus*) was brought to the stuffer's—the only one I heard of all the season. We had an immigration of Goldcrests (*Regulus cristatus*) about the latter part of November: I saw two examples, which had flown in at open windows. I noticed a single Siskin (*Chrysomitris spinus*) on the 18th. On December 9th there were some very large flocks of Larks (*Alauda arvensis*) on the stubbles, and Redwings and Fieldfares (*Turdus pilaris*) were numerous. Starlings (*Sturnus vulgaris*) also passed us in enormous flocks about that time, and especially on the 16th. Teal (*Querquedula crecca*) visited us in some numbers during that month; and a Royston Crow (*Corvus cornix*), the only one I heard of during the season, was brought in on the 21st. On the whole, winter birds, properly so-called, although perhaps not so scarce as in 1881, have been far from plentiful.—Banbury, Oxon.

THE HEDGEROWS OF LEICESTERSHIRE.*

BY F. T. MOTT, F.R.G.S.

Fences of live thorns have been in use for three thousand years at least. Homer mentions them in the "Odyssey," and Virgil in the "Georgics." It is not known which of the many thorny shrubs of southern Europe was used for this purpose by the Greeks and Romans—probably several. The Romans introduced the practice of planting Hawthorn hedges into England, and this shrub has been chiefly used here ever since their time. It is known to have been in use for the same purpose in Italy in the 14th century. But live hedges of any sort were not common in England until the 17th century. Up to that period they had been used for enclosing plantations, orchards, gardens, and other specially protected grounds, but not for agricultural divisions. Between the years 1600 and 1620 English farmers took to planting

* A paper read at a recent meeting of the Leicester Literary and Philosophical Society.

hedges round their meadows and pastures. There was a demand for young "Quick," and nurseries were started for the production of it. Fifty or sixty years later, when the Flemish method of husbandry began to be adopted in this country, cornfields also were inclosed with quickset* hedges, and the demand gradually increased till in the 18th century the production of Quick became a large and lucrative trade. Now, that nearly all the land in the country is fenced in, the demand has fallen off again.

The first hawthorn hedges in Scotland were planted by Cromwell's soldiers. At the present time quickset hedges are used throughout the United Kingdom, except in some parts of Ireland and the Highlands of Scotland, and in small isolated tracts where stone is more available, as on our Charnwood Forest, and the Peak of Derbyshire.

From this sketch of the history of hedgerows it may be inferred that while a few of those existing in this county may be very ancient, dating back to Norman, or Danish, or even Roman times, the great majority are not *more* than 200 years old. The longevity of a hedgerow is very great. I know of some which are very little altered from what they were as I remember them fifty years ago, and of others whose history can be distinctly traced back for more than 100 years. In this county there cannot be less than 15,000 miles of Hedgerows, occuping at least 7,500 acres of land, which at a value of only £50 an acre represents a capital of a third of a million lying dead. But against this there is the value of the timber trees, which, at the low average of ten to a mile, would be 150,000 trees. In some counties, as in Devon, the fields are much smaller on an average than in Leicestershire, and the proportion of land occupied by hedges would probably be twice as great. It has been estimated at over a million acres in England and Wales, but this appears to me too high a figure.

The variety of shrubs of which our Leicestershire hedges are made up is very considerable, although Hawthorn forms probably 90 or 95 per cent. of the total. The remaining 5 or 10 per cent. consists of Sloe, Bullace, Crab, Maple, Elder, Privet, Elm, Hazel, Sallow, Ash, Yew, Buckthorn, Oak, Holly, Dogwood, Sycamore, Beech, Hornbeam, Guelder-rose, Barberry, Gorse and probably a few others in out-of-the-way districts. Some of these have been purposely planted, others seem to have sprung up spontaneously from the scattering of indigenous seed. Those which came up in the open fields would be destroyed, while those in the hedges would be spared. A further list of climbing and trailing shrubs such as Ivy, Bramble, Dog-rose, Hop, Clematis, and Woodbine fill up some gaps and add their contribution of beauty, if not of utility, to the hedgerow; but these can scarcely be considered as part and parcel of the fence.

There is a good deal of Blackthorn or Sloe in our older hedges, but where this has been planted recently the larger and quicker growing form, known as the Bullace (*Prunus insititia*), seems to have been

* Quick means live, and a quickset hedge is one set with live thorns.

generally adopted. About Wanlip there are several long hedgerows entirely of Elm; near Birstal there is a fine Yew hedge, and about Loughborough there are considerable patches of Maple. Here and there about the county we find good Holly hedges, and there is nothing more effective for a close evergreen fence; but its growth is too slow for general use. All things considered, nothing beats the old Hawthorn either as a close-clipped fence for corn lands or as a tall "bull-finch," giving shelter to the cattle from sun and storm in pastoral districts. Any-one who passes along our Hawthorn hedges with his eyes open cannot fail to notice the extraordinary variety of form and size among the *leaves* of different bushes. Yet these bushes are all Hawthorn, and do not differ much in the appearance of the blossom, though there is considerable variety again in the size and colour of the *fruit*. These varieties are the result of continued hybridisation between two extreme and distinct forms, which are regarded by some botanists as separate species, by others as varieties only. One of these has two styles, a smooth flower-stalk and wedge-shaped shining leaves, and is now known as *Cratægus oxyacanthoides*. The other has one style, hairy flower-stalks, and dull pinnatifid or deeply divided leaves, and is called *Cratægus monogyna*. I have endeavoured to ascertain whether one of these forms was in use for hedges earlier than the other, but have not succeeded. They do not seem to have been distinguished before the beginning of this century. Linnæus's name *Cratægus Oxyacantha* appears to have represented our *oxyacanthoides*, while Ray, although he used the same specific name, seems to have described the other form. In Dr. Hunter's edition of "Evelyn's Silva," published in 1776, the description is that of *oxyacanthoides* while the plate is distinctly "*monogyna*." In the Leicester Free Library is a fine copy of Blackwell's Herbal, dated 1739, in which the plate of Hawthorn is also the form *monogyna*. The Dutch Botanist, Jacquin, the German Willdenow, and the Englishman Sibthorp appear to have recognised the two forms as distinct, and to have described them separately about the year 1800. In the latest edition of Sowerby's "English Botany" *oxyacanthoides* is said to be "not very common," while *monogyna* is described as "very common, and the form generally used for quickset hedges."

Now in the hedgerows of Leicestershire there is some indication that *oxyacanthoides* is the older form. It is very rare in hedgerows planted during the last fifty years, but is quite common in many old "Bullfinches," especially on the eastern side of the county. It may be, that it is the more truly indigenous form in this district of England, and that therefore as long as transport was difficult and locomotion limited, it was chiefly used here, but that since canals and railways have thrown all markets open the other form has been more grown in the local nurseries, and imported from distant ones, as being the more generally common throughout the country. Probably also it has a certain advantage for low close fences since it is a little more rigid and thorny than *oxyacanthoides*. But even our modern hedges contain very many variations from the pure *monogyna* type. The plant is raised from seed in the nurseries, and this seed is gathered from the hedges, so that wherever the two forms grow near together hybridisation is certain to occur. Moreover, there are many other species and varieties of Cratægus, some from southern Europe, others from North America, grown abundantly in shrubberies and ornamental plantations all over England, and the pollen of these also, carried by insects, would have its effect in modifying the hedgerow seed.

Another interesting point about our English hedges is that they are harbours of refuge for all vermin—animal and vegetable. Now "vermin" is a word invented by selfish utilitarians to express their hatred of those interesting little creatures who would share with them the fruits of the earth. Imagining in their ignorance and ingratitude that there is nothing more despicable or noxious than a worm, they use as a title of opprobrium the name of that great race to which they are especially indebted for their fertile soil. What they call vermin and weeds are treasures of beauty to a naturalist; but if it had not been for the sanctuary of the hedges very many species during the progress of modern agriculture would have been lost to the Flora and the Fauna of England.

Besides the score or two of shrubs and climbing plants which make the actual fence, the hedge bottoms swarm with annual and perennial herbs, and where, as was nearly always the old custom, the hedge is planted on a low bank formed of the soil excavated from a ditch alongside, the bank and the ditch together afford the most appropriate habitats for hundreds of plants, from the lowest Algæ upwards, Mosses, Fungi, Jungermanniæ, Ferns, Grasses, Docks, Nettles, and flowering plants in wonderful variety. Sometimes the ancient history of a hedge may be deciphered from the plants which it still harbours. Two or three years ago the Botanical Section of the Leicester Literary and Philosophical Society went in search of the site of Stocking Wood, near Mowmacre Hill, which, in the records of the last century, had been a famous place for rare and interesting plants, but had been since entirely cut down and the site ploughed over. Wandering about the fields, the hedges of which were mostly pretty straight, though tall, and at least half a century old, they came upon one hedge which had an altogether different character.

It followed the tortuous course of a very small brook, scarcely more than a ditch, but too irregular to be anything but a natural excavation, and in the bottom of this hedge were growing Wood Sorrel, Wild Hyacinths, Wood Anemones, and several rare Mosses, all bearing witness that this had at one time been the boundary of a wood. They knew that the object of their search was found. The wood, whether part of the primeval forest of Arden or a mediæval plantation, had been bounded by the little natural brook, and in order to prevent cattle from straying into it and damaging the timber a hedge had at some time been planted along the brookside. Into this hedge many of the wood plants had spread, and when the wood was sold and turned into a farm they still held their ground under shelter of the thorny Cratægus.

Of the 150 species of mosses, recorded in this county, at least half may be found in the hedges and ditches; and of the 850 flowering plants about one-third. The Rubi and the Roses of Great Britain have each been divided by modern botanists into about 60 or 70 separate forms. In the Leicestershire hedges there have been recorded about half these forms of Rubi and one-third of the Roses.

The hedge bottoms are also the great refuge of our land molluscs, snails, and slugs of many species. In the summer months uncountable millions of gnats, midges, and flies of all kinds repose on the under sides of the leaves and twigs, coming out towards sunset to sport in the air and to feed on the juices of unfortunate humanity. Here also spiders, of many species, spread their wonderful nets, for these are rich hunting grounds for all insectivorous creatures, and here some 30 species of our Leicestershire birds build their nests.

Among Mammals, the hedgehog, the polecat, stoat and weasel, the rat, the field-mouse, the short-tailed vole, and the little shrew, all haunt the hedgerows and burrow among their matted roots. Of our few Reptiles, frogs and newts breed in the ditches, snakes and lizards on the banks, and even fishes are represented in the hedgerow Fauna by the little Stickleback in those ditches which are permanent watercourses.

It seems evident that if England had carried out the system of high farming *without* hedgerows both its Fauna and its Flora must by this time have been considerably reduced; and if foreign competition should render it necessary in the future to economise every yard of land, to grub up the million miles of hedges in the 40 English counties, and so add 500,000 acres to our food-producing area—such a reduction of the Fauna and Flora must inevitably result. Among the less common of our Leicestershire plants which would almost certainly be lost with the loss of our hedges, may be mentioned:—*Astragalus glyciphyllos*, *Smyrnium olusatrum*, *Viburnum Lantana*, *Picris arvalis*, *Campanula patula*, *C. glomerata*, *Lithospermum officinale*, *Calamintha menthifolia*, *Daphne Laureola*. It is well, then, that local naturalists should bestir themselves to record in the most thorough and complete manner, while the opportunity remains, all the species and all the local forms and varieties, both of plants and animals, in their respective counties, as a chapter of the world's history which it may be impossible ever again to write.

In conclusion, it would be interesting to me to hear from any member of the Midland Union evidence as to the antiquity of any particular hedgerow; as to the longevity of the Hawthorn or other hedgerow shrub; as to the comparative abundance of the two extreme forms of Cratægus in any district; the use of any shrub for fencing purposes which I have not mentioned; or any other facts respecting hedges, whether historical or scientific; also any opinions as to the figures and statistics which I have given. The calculations on which these are founded I have purposely omitted in order to save space.

THE FLORA OF WARWICKSHIRE.
AN ACCOUNT OF THE FLOWERING PLANTS AND FERNS OF THE COUNTY OF WARWICK.

BY JAMES E. BAGNALL.

(Continued from page 43.)

UMBELLIFERÆ—*continued.*
CONIUM.

C. maculatum, *Linn.* *Common Hemlock.*
Native: On hedge-banks and borders of fields, in marly and Lias soils. Locally common. June, July.
I. Fields near Gravelly Hill, 1874; Forge Mills; Maxtoke; near Coleshill.
II. Warwick, Leamington, *H. B.;* Honington Park! *Newb.;* Salford Priors! *Rev. J. C.;* Alveston Pastures; Binton; Bidford; Red Hill; Alne Hills; Napton, &c.
[*Smyrnium Olusatrum, Linn.* Blackwell, near Honnington, *Newb.*]
[*Coriandrum sativum.* Casual weed, near the Skin Yards, Kenilworth, *H. B.* Brought with foreign skins.]
[*Ammi majus* is also found near the Skin Yards, Kenilworth, *H. B.* Brought with foreign skins.]

ARALIACEÆ.
HEDERA.

H. Helix, *Linn.* *Common Ivy.*
Native: In woods and hedges; on old walls, ruins, &c. Common. September. Area general.

CORNACEÆ.
CORNUS.

C. sanguinea, *Linn.* *Wild Cornel Tree, Bloody-twig, Dogwood.*
Native: In hedges and woods. Locally common. June.
I. Middleton, Shustoke, Hartshill, Maxtoke, Elmdon, Hampton-in-Arden, &c.
II. Honington, Tredington, Halford, *Newb.;* Salford, *Rev. J. C.;* Wyken, *Kirk;* Rowington; Lapworth; Ipsley; Little Alne; Preston Bagot, Red Hill; Stratford-on-Avon; near Foleshill; Brandon, &c.

LORANTHACEÆ.
VISCUM.

V. album, *Linn.* *Common Mistletoe.*
Native: On apple, poplar and hawthorn trees. Rare.
I. On a poplar, near Packwood, 1868; on an apple tree, Packwood Grange.
II. Scarce in the neighbourhood of Warwick, Norbrook, *Perry Fl.;* in an orchard at Birdingbury. *H.B.;* on hawthorn, at Birdingbury, *H.B.;* apple orchard, Abbott's Salford, *Rev. J. C.;* in an orchard near Alcester.

CAPRIFOLIACEÆ.
ADOXA.

A. Moschatellina, *Linn.* *Tuberous moschatel.*
Native: On banks and in woods. Local. April, May.
I. Erdington; Gravelly Hill; Castle Bromwich; Kingsbury; Marston Green; Bentley Heath; Earlswood; Shirley.

II. Alcester, in the rough ground by the floodgates, *Purt.* i., 206; grove at Wootton Grange, *Perry Fl.*, 37; Honington, *Newb.;* Lillington, *H. B.;* Shrewley; Kenilworth, *Y. and B.;* Allesley; Meriden; Rowington; Kingswood; Alne Hills; Harborough Magna

SAMBUCUS.

S. nigra, *Linn.* *Common Elder.*

Native: In woods and hedges. Common. May, June. Area general.

Var. 2. Berries green and white. Warwickshire. *With.*, ed. 7, ii., 402.

S. Ebulus, *Linn.* *Dwarf Elder.*

Denizen: In hedges and on wayside banks. Very rare. July.

I. Tamworth Castle Hill, towards the river. *With.*, ed. 7, ii., 400. "A fresh specimen shown me from Shirley, 1879," *Newb.* Near Knowle, on marly banks! *With.*, ed. 7, ii., 400.

II. Near Grafton Church, on the side of the road. *Purt.* i., 162. It has been seen in this locality recently by the *Rev. J. H. Thompson.* "In the grounds of Evelyn Phillips Shirley, Esq., Eatington Park," *Rev. J. Gorle.* Moreton Morrell Church. *With.*, *l.c.*, 400; believed to be extinct in the last locality.

VIBURNUM.

V. Opulus. *Linn.* *Common Guelder Rose, Marsh Elder.*

Native: In hedges and damp woods. Local. June.

I. Coleshill Bog! *Ick. Anal.*, 1837, near Coleshill; Forge Mills; Middleton; Sutton Park; Blossom Fields, Solihull; Bradnock's Marsh; river bank, near Stonebridge, &c.

II. Kenilworth; Radford, *Y. and B.;* Salford, *Rev. J. C.;* near Avon Mill, *R. S. R.*, 1877; Broadmore Wood, near Alcester; Austey Wood, near Wootton Wawen.

V. Lantana, *Linn.* *Wayfaring Tree.*

Native: In woods, copses, and hedges, in calcareous soils. Locally abundant. May.

II. Hedges between Leamington and Southam! *With.*, ed. 7, iii., 398. Hedge between Harborough and Cosford, *Blox.*, *R. S. R.*, 1872; Whitnash; Chesterton! *Y. and B.;* near Frankton Wood, *R. S. R.*, 1877; Gaydon, *Bolton King;* Austey Wood, Wootton Wawen; Little Alne; lane from Norton Lindsay to Claverdon; Aston Cantlow; Drayton bushes; Oversley Wood; Binton; Alveston pastures; Compton Verney; Pillerton; near Kineton; Ufton Wood.

LONICERA.

L. Periclymenum, *Linn.* *Common Woodbine, Honeysuckle.*

Native: In hedges, woods, and copses. Common. June to September, or later. Area general.

[*L. Xylosteum.* *Linn.* Is recorded by Withering, iii., 315, as occurring "in the wood S.-W. side of the lake in Edgbaston Park, 1812."]

[*L. Caprifolium.* *Linn.* Chadshunt, quite naturalised, *Bolton King.*]

RUBIACEÆ.

GALIUM.

G. cruciatum, *With.* *Crosswort.*

Native: On hedge banks, waysides, and in woods. Common. May, June. Area general.

G. verum, *Linn.* *Yellow Bedstraw; Cheese Rennet.*
Native: Hedge banks and fields. Rather common. July, August.
I. Castle Bromwich; Shustoke; Hartshill; Solihull; Knowle.
II. Honington; Tredington; Shipston, *Newb.;* Alveston pastures; Bardon Hill; Arrow; Henley-in-Arden, &c.
b. ochroleucum. Rare.
In a pit by footpath from Wellesbourn to Moreton Morrell, one large patch with *G. verum, H. B.*

G. erectum, *Huds.* *Upright Bedstraw.*
Native: In meadows and pastures. Rare, June, July.
I. Coleshill Heath, *Bree, N. B. G.*, 1835.
II. On the side of a wet ditch at Pophills, June 27, 1821, *Purt.*, iii., 564. On railway banks, Leek Wootton and Kenilworth, *H. B.;* Cathiron Lane, near Rugby, *Rev. A. I. Blox.*

G. Mollugo, *L.* *Common Great Bedstraw.*
Native: On banks, in fields, hedges, &c. Locally common. July, August.
I. Canal bank, Hatton to Knowle; Berkswell, near Meriden; Tanworth.
II. Weir-break Hill and Cross-of-the-Hill, near Stratford, *Perry Fl.*, 12; Radford Semele; Walton; Moreton Morrell, *H. B.;* Alcester; Binton; Temple Grafton; Henley-in-Arden; Ullenhall; Little Alne, &c.
Var. *scabrum.* Radford, *H.B.*
c. Bakeri. Ufton Wood, *H. B.* *Exch. Club Report*, 1876. Moreton Morrell, *H. B.;* Golden Cross Lane, Wixford.

G. saxatile, *Linn.* *Heath Bedstraw.*
Native: On dry banks, heaths, &c. Local. June.
I. Sutton Park; Hill Wood, near Sutton; Middleton Heath; Coleshill Heath; heathlands near Bentley and Hartshill; Arley Wood.
II. (*G. procumbens*). Studley Common! *Purt.* i., 97; Kenilworth Heath! *Perry Fl.*, 12; Oversley Wood.

G. palustre, *Linn.* *Marsh Bedstraw.*
Native: In marshes, drains, and streams. Common. June to September. Area general.
b. elongatum, Presl. Rather rare.
I. Lane from Water Orton to Minworth; Coleshill Pool; Osier Bed Lane from Solihull to Sharman's Cross; Shirley Heath; Lane near Rotten Row, Knowle.
II. Milverton, *H. Bromwich, Herb. Brit. Mus.;* Honington! *Newb.;* River Avon, near Hill Wootton, *H. B.;* Leam, near Offchurch, *H. B.;* Sow Waste, near Coventry; cattle pool near Coombe Abbey.

G. Witheringii. *Sm.* Rather rare.
I. Sutton Park; Coleshill Pool; Bannersley Pool; bog, near Packington; Shirley.
II. Yarningal Common, Shrewley Common, *H. B.;* canal near Wootton Wawen.
This variety has, I think, been not unfrequently mistaken for *G. uliginosum.*

G. uliginosum, *Linn.* *Rough Marsh Bedstraw.*
Native: In bogs and marshes. Very rare. July, August.
I. Coleshill Bog, *Purt.*, i., 99; Bannersley Pool; Sutton Park; Arley Wood.
II. Bog at the Woodloes, near Warwick; Haseley, *H. B.*

G. anglicum, *Huds.* *Small Ladies' Bedstraw. Small Goose-grass.*
Native: "On wall;" sandy ground. Rare. July."
II. "On high ground in Oversley Wood," *Purt.*, i., 97.
Although I have made special search for this plant on all the high ground in and near Oversley Wood, I have not been able to find it. I found an abundance of a tall form of *G. saxatile.* This Purton does not record.

G. Aparine, *Linn.* *Common Goose-grass, Cleavers.*
Native: In hedges, woods, and as a weed in arable land. Common. May to September. Area general.
The plant is better known among the peasantry by the name of *Hayrif* or *Herrif.* According to Prior this is derived from the A.-S. *hege*, hedge; and *reafa*, a tax-gatherer or robber, so called, we may suppose, from its plucking wool from passing sheep. It is in much repute as a diuretic.

G. tricorne. *With.* *Rough Corn Bedstraw.*
Colonist: In arable land, in calcareous and marly soils. Rather rare. July, August.
II. On Alne Hills; in a cornfield by Drayton Bushes! *Purt.* i., 99, in the last locality in 1880; near Birdingbury, *R. S. R.* 1877; Chesterton; Tachbrook; Harbury; Lighthorne, *H. B.;* Kineton; Chadshunt, *Bolton King:* Moreton Morrell; near Binton; Steeple Hill, Bidford; Red Hill; Temple Grafton; Wilmcote; Birdingbury; Brandon.
Although occurring over so wide an area in the Avon basin, I have never found it in any locality in the Tame basin. I should, however, expect it to be found about Hartshill or Nuneaton.

ASPERULA.

A. odorata, *Linn.* *Sweet Woodruff.*
Native: In damp woods and on banks in marly soils. Locally abundant. April to June.
I. Hockley, near Knowle; lanes about Meriden and Meriden Shafts; lanes about Arley; Hartshill Wood.
II. Oversley! Spernal! Ragley Woods! *Purt.*, i., 101. Honley! Whitnash, *Y. and B.;* Cathiron Lane, *R. S. R.*, 1877; Red Hill, near Alcester; Combe Woods; Harborough Magna; Kemp's Green.

A. cynanchica, *Linn.* *Quinancy-wort.*
Native: In cornfields in Lias soils. Very rare. July.
II. Cornfields, near Wilmcote, *Rev. A. Blox.*

SHERARDIA.

S. arvensis, *Linn.* *Blue Field Madder.*
Native: In fields and meadows. Common. May to October. Area general.

VALERIANACEÆ.

VALERIANA.

V. dioica, *Linn.* *Marsh Valerian.*
Native: In marshes and wet meadows. Local. May, June.
I. Garlick Meadows, Erdington, *With.*, ii., 90; Sutton Park; Middleton Heath; Coleshill Pool; Hampton-in-Arden; meadow by Olton Pool; near Hockley; near Solihull Railway Station.
II. Marshy ground by Hoo Mill; near Middletown, *Purt.* i., 59. At Leamington; near the Race Stand, Warwick, *Perry Fl.*, 4; Kenilworth, *Y. and B.*

V. officinalis, *Linn.* *Common Valerian.*
a. Mikanii, Syme.
Native: In woods and moist places. Rare. July.

II. Chesterton! Tackbrook! *Y. and B.* Near Oakley Wood; between Stratford-on-Avon and Alcester; Alveston Pastures.

b. sambucifolia, Mik. Rather common.

I. In the Garlick meadows near Penn's Mill! *With.*, ii., 91. Sutton Park; Solihull; near Knowle, &c.

II. Oversley Wood, *Purt.*, i. 59. Warwick, not rare, *Perry Fl.*, 5. Combe Woods; near Tile Hill, &c.

VALERIANELLA.

V. olitoria, *Moench.* *Common Lamb's Lettuce.*

Native: On banks and walls and in fields. Common. May, June. Area general.

[*Valerianella carinata*, Lois. Was found by Cheshire at Alderminster on the borders of Warwickshire, and may occur in this county.]

V. auricula, *DC.* *Sharp-fruited Lamb's Lettuce.*

Colonist: In cornfields in Lias soils. Very rare. July.

II. In a cornfield in the bridle road from Red Hill to Binton village, 1877 and 1879. Drayton Bushes.

V. dentata, *Koch.* *Narrow-fruited Lamb's Lettuce.*

Colonist: In corn and other cultivated fields. Local. June to August, or later.

I. Oscott, *Rev. J. C.* Fields near Schoolrough, Marston Green; heathy pasture near Coleshill Pool.

II. Cornfields about Rugby, *Rev. A. Blox.*, *N.B.G.S.*, 1837; Sow Waste, *Kirk;* plentiful in cornfields, Blue Boar Lane, *R. S. R.*, 1877; Tachbrook, Harbury! *Y. and B.;* Chesterton; Moreton Morrell, Lighthorne! Whitnash, *H. B.;* Red Hill, Drayton Bushes; Wilmcote.

b. mixta, Duf.

I. Cornfield near Bannersley Pool; heathy pasture near Coleshill Pool.

II. Tachbrook, Harbury, *Y. and B.* Moreton Morrell, *H. B.* Red Hill; Drayton Bushes.

[*Centranthus ruber*, DC. On a wall near Kenilworth Castle, *Kirk*, *Phyt.* ii., 970. Extinct in this locality now, 1880. Naturalised on walls at Salford! *Rev. J. C.;* Eastgate, Warwick, *Perry*, 1817. I do not think this plant can be considered as more than a straggler from cultivation in this county.]

(*To be continued.*)

METEOROLOGY OF THE MIDLANDS.

THE WEATHER OF JANUARY, 1883.

BY CLEMENT L. WRAGGE, F.R.G.S., F.M.S., ETC.

The month was on the whole wet, with a rainfall above the average; mild and stormy, with some fogs. The fogs in the Churnet Valley, by the way, were exceptionally dense, and the observer at my station at Oakamoor reports that on the 19th distinct vision was limited to "a couple of yards." The atmosphere generally was in a very disturbed condition, especially during the third and last weeks, owing to the passage of depressions from the Atlantic; and the great and sudden fluctuations of the barometer formed a special feature.

STATION.	OBSERVER.	RAINFALL. Total fall. In.	RAINFALL. Greatest fall in 24 hours. In.	RAINFALL. Greatest fall in 24 hours. Date.	RAINFALL. No. of rainy days.	SHADE TEMP. Absolute Maximum. Deg.	SHADE TEMP. Absolute Maximum. Date.	SHADE TEMP. Absolute Minimum. Deg.	SHADE TEMP. Absolute Minimum. Date.
OUTPOST STATIONS.									
Greenhill, Fort William (a) ..	C. L. Wragge, Esq., F.M.S.	8·48	....	..	..	51·0	19	26·4	8
Spital Cemetery, Carlisle	I. Cartmell, Esq., F.M.S. ..	3·38	0·58	24	13	59·3	20	23·3	31
Scarborough (a)............	W. C. Hughes, Esq., F.M.S.	1·47	0·25	24	14	5[illegible]·4	2	30·4	24
Blackpool (a)—South Shore..	C. T. Ward, Esq., B.A., F.M.S.	5·17	0·84	28	22	52·7	1	26·9	31
Lowestoft (a)	H. E. Miller, Esq., F.M.S...	1·74	0·29	25	17	54·4	1	29·6	31
Carmarthen (a)	G. J. Hearder, Esq., M.D...	6·04	0·86	28	23	52·0	1	28·1	7
Cardiff (a)...................	W. Adams, Esq., C.E.	5·75	1·11	24	25	54·2	1	31·6	16, 31
Sidmouth (a)	W. T. Radford, Esq., M.D.	2·82	0·32	14	24	54·7	1	31·0	31
Les Ruettes Brayes, Guernsey (a)	A. Collenette, Esq., F.M.S.	2·99	0·44	25	20	55·0	1	32·2	10
MIDLAND STATIONS.									
HEREFORDSHIRE.									
Burghill (a)	T. A. Chapman, Esq., M.D.	3·00	0·40	24	22	56·2	1	27·8	31
SHROPSHIRE.									
Woolstaston	Rev. E. D. Carr	3·79	0·52	24	21	53·0	1	26·0	7, 8
Stokesay (a).................	M. D. La Touche	4·47	0·61	24	17	54·5	1	25·5	31
More Rectory................	Rev. A. S. Male............	4·47	0·59	28	24	53·0	2	28·0	16
Dowles, near Bewdley	J. M. Downing, Esq.	3·17	0·51	29	19	61·0	18	21·0	31
WORCESTERSHIRE.									
Orleton, near Tenbury (a)....	T. H. Davis, Esq., F.M.S. ..	3·99	0·60	24	24	55·7	1	26·3	31
West Malvern	A. H. Hartland, Esq.	4·29	0·57	24	22	51·5	1	28·0	6
Evesham (a)	T. J. Slatter, Esq., F.G.S...	2·52	0·51	29	23	54·0	1	27·0	7
Pedmore	E. B. Marten, Esq.	3·96	0·49	25	19	55·0	18	23·0	6
Stourbridge	J. Jefferies, Esq.	3·63	0·47	27	22	55·0	1	26·0	30
STAFFORDSHIRE.									
Rowley Regis	C. Beale, Esq..............	3·30	0·86	24	19	57·0	1	28·0	30, 31
Dennis, Stourbridge (a)......	C. Webb, Esq.	3·57	0·48	24	20	53·5	1	26·5	7
Kinver	Rev. W. H. Bolton	3·41	0·45	27	22	53·0	1	26·0	30
Lichfield	J. P. Roberts, Esq.	2·83	0·42	27	20	54·0	1	28·0	31
Wrottesley (a)	E. Simpson, Esq.	3·22	0·62	2	18	53·6	1	26·7	7
Heath House, Cheadle (a) ..	J. C. Philips, Esq., F.M.S.	3·68	0·59	27	21	56·0	31	24·6	31
Tean (b)	Rev. G. T. Ryves, M.A., F.M.S.	4·11	0·63	27	21	53·0	1, 28	26·0	7, 31
Oakamoor, Churnet Valley (a)	Mr. Williams	4·48	0·57	27	21	54·0	1, 2	20·0	21
Beacon Stoop, Weaver Hills (a)	Mr. James Hall	4·92	....	..	..	50·0	..	25·0	..
Alstonfield	Rev. W. H. Purchas	4·21	0·81	24	16	51·3	1	22·3	7, 31
DERBYSHIRE.									
Stony Middleton	Rev. U. Smith	4·67	....	..	17	57·0	18, 19	21·0	30
Spondon	J. T. Barber, Esq..........	2·31	0·24	29	17	..	..	..	..
NOTTINGHAMSHIRE.									
Park Hill, Nottingham (a) ..	H. F. Johnson, Esq.	1·96	0·27	29	18	58·5	1	28·1	31
Hodsock Priory, Worksop (a)	H. Mellish, Esq., F.M.S. ..	2·51	0·50	27	19	54·5	1	22·4	31
Strelley (a)	T. L. K. Edge, Esq.	2·46	0·34	27	21	53·1	28	24·9	31
Tuxford	J. N. Dufty, Esq., F.G.S. ..	2·18	0·45	24	17	50·0	1	33·0	6
RUTLANDSHIRE.									
Uppingham..................	Rev. G. H. Mullins, M.A., F.M.S.	2·00	0·34	29	18	53·4	1	27·0	24, 31
LEICESTERSHIRE.									
Loughborough (a)............	W. Berridge, Esq., F.M.S...	2·58	0·42	27	18	54·7	1	26·7	31
Syston	J. Hames, Esq..............	2·17	0·35	27	24	53·0	1, 18	29·0	24, 31
Ashby Magna	Rev. Canon Willes	2·71	0·43	29	18	51·0	1	..	..
Waltham-le-Wold	Edwin Ball, Esq.	2·01	0·36	29	16	52·0	18	26·0	24
Coston Rectory, Melton (a) ..	Rev. A. M. Rendell........	2·31	0·39	27	20	55·5	1	24·0	31
WARWICKSHIRE.									
St. Mary's College, Oscott ..	Rev. J. W. Brown, ...	2·97	0·42	29	13	58·3	1	25·5	31
Henley-in-Arden	T. H. G. Newton, Esq.	3·39	0·66	29	25	54·0	1, 18	20·0	31
Park Hill, Kenilworth (a) ..	T. G. Hawley, Esq.	2·91	0·47	29	21	54·2	1	26·1	31
Kenilworth (a)	F. Slade, Esq., C.E., F.M.S.	3·28	0·50	29	23	54·0	1	25·9	31
Rugby School (a)	Rev. T. N. Hutchinson	3·17	0·77	29	20	53·6	1	21·0	31
NORTHAMPTONSHIRE.									
Pitsford, Northampton	C. A. Markham, Esq.	2·68	0·33	29	21	54·0	1, 18	26·0	31
Towcester	J. Webb, Esq.	2·96	0·58	15	22	..	..	..	..
Kettering....................	J. Wallis, Esq.	2·87	0·48	29	20	54·0	2	28·0	24, 31
BEDFORDSHIRE.									
Bedford (a)..................	H. J. Sheppard, Esq.	1·75	0·30	29	21	51·4	29	27·4	31
OXFORDSHIRE									
Radcliffe Observatory, Ox. (a)	The Staff	2·28	0·34	24	21	54·9	1, 18	28·6	31
WILTSHIRE.									
Marlborough (a)	Rev. T. A. Preston, F.M.S.	3·79	0·39	24	21	58·2	1	28·3	31
GLOUCESTERSHIRE.									
Cheltenham (a)	R. Tyrer, Esq., B.A., F.M.S.	2·67	0·50	29	2[illegible]	56·0	1	27·5	7

(a) At these Stations Stevenson's Thermometer Screen is in use, and the values may be regarded as strictly intercomparable. (b) Glaisher's pattern of Thermometer Screen employed at these stations.

The Stafford Station is temporarily closed owing to the absence of an observer.—C.L.W.

Snow fell on the 8th, and almost daily from the 24th to the 30th inclusive. The minimum thermometer, about four feet above ground, fell below 32° Fahr. about eight times, and some nineteen grass frosts were recorded; the cold, however, could not be called intense on any of these occasions, and the mean temperature of the air may be given as 39·6°.* Mean pressure was about 29·870in., the highest mean reading of the barometer was 30·640 on 22nd—23rd, and the lowest 29·026 on 25th—26th. West-south-west and east-south-east winds were frequent, and much damage to trees, etc., resulted from the violent gales of the last week. The mean amount of cloud was 6·9 (scale 0 to 10), and relative humidity 90°/o. The absolute maximum temperature in the sun's rays (reported) was 95·6° at Hodsock on the 30th, and the absolute minimum on grass was 18·9° at the Radcliffe Observatory on the 31st. Bright sunshine 45·4 hours or 18°/o at Hodsock (being slightly more than in the two previous years), 49·5 hours or 20°/o at Strelley, 60 hours at Oxford, and 41·7 hours at Blackpool. The mean temperature of the soil at a depth of one foot was 39·3° at Hodsock, 38·8° at Strelley, and 43·2° at Cardiff. At a depth of four feet at Cardiff the mean temperature was 46·3°. The mean amounts of ozone were 1·1, 3·2, 4·0, and 4·4 on the usual scale of 0 to 10—values for Oxford, Cheltenham, Carmarthen, and Blackpool respectively. Lunar halos on the 17th and 18th.

NOTES BY OBSERVERS. — *Stokesay.* — Large bunch of primroses gathered in a wood adjacent on 7th; missel thrush singing throughout the month. *More Rectory.*—A complete absence of winter birds, especially fieldfares; a few redwings, however, and one hawfinch appeared. *Orleton.*—Land become perfectly saturated with rain, and all farming operations stopped. *Rowley Regis.*—Primroses and polyanthus in flower. *Spondon.*—Filberts in blossom early in the month; yellow crocus in bloom in third week; all early spring flowering bulbs advancing rapidly. *Hodsock.*—Snowdrop blooming on 17th, in full flower 29th; hazel in flower by 23rd, and in full flower on 29th; dog's mercury in bloom 29th. *Waltham-le-Wold.*—Snowdrop, primroses, etc., in bloom during the latter part of month.

Correspondence.

NOTE ON THE FOOD OF SMALL BIRDS.—Now that winter is come, and the arable land is for the most part broken up, the feeding grounds of our small hard-billed birds become very much restricted in area. In the few stubbles still remaining—chiefly those which were barley or oats planted with clover to follow—the Finches, Sparrows, and Buntings congregate in considerable numbers, and the amount of seed that it takes to keep them alive cannot fail to be a matter of curiosity to the naturalist, and of interest to the farmer. About the middle of this month I shot from a flock of small birds a Tree Sparrow (*Passer montanus*), and noticing that the œsophagus was considerably distended, I had the curiosity to examine its contents. I took from it twenty-two shelled oats, two seeds of a small species of vetch, and one hundred and ninety-two others, the greater part of which appeared to be those of the field clover, there were also numerous fragments, and allowing four for these, it brings up the total to 220 grains. These were in the crop alone, and

* It must be borne in mind henceforth that all mean and extreme values (except where otherwise stated) are for the districts embraced by our Midland Stations only and that all barometric values are reduced to 32° Fahr. and sea level.

quite fresh, showing that they were the result of that day's foraging; the stomach contained a considerable quantity of broken fragments, but in too far advanced a state of digestion for me to make any computation as to the number of seeds. When we consider that the flock must have consisted of at least three or four hundred individuals, we may form some idea of the amount of food that they would daily consume.—OLIVER V. APLIN, Banbury, Oxon, December, 1882.

NEW BRITISH MUCORINI. — In the process of cultivating various species of Pilobolus, I have recently had the pleasure of meeting with the following other species of Mucorini, concerning which I can find no record of their occurrence in Britain, viz.:—*Pilobolus œdipus*, *Pilaira Cesatii*, *Piptocephalis Fresenianu*, and a species of Mortierella, which is closely allied to *Mortierella tuberosa*, but may possibly prove to be distinct.—W. B. GROVE, B.A.

DACTYLIUM OBOVATUM (Berkeley).— I have recently met with this species on willow twigs, the habitat on which it was found by Rev. M. J. Berkeley, but my specimens clearly show that it is only a young state of *Dactylium roseum;* every stage can be traced between the slender, simple, colourless filaments of the former, and the branched, intricate, rosy tufts of the latter.—W. B. GROVE, B.A.

Questions and Answers.

FRUIT OF THE ASH.—In the fruit of the ash there is frequently, if not always, a small cavity corresponding to that *loculus* of the ovary which contains the undeveloped ovule of the two which were originally in the carpel of the flower. This gives a greater degree of lightness to the *samara* or winged fruit, and so assists in the dispersion of the heavy seed which is enclosed within it. Is this empty *loculus* or chamber filled with air, or is it a vacuum; perhaps some one of your readers can tell me if it be known?—JNO. J. OGLE, Nottingham.

FRUIT OF COMPOSITES.—Is the *pappus*, which is characteristic of many of the Compositæ, composed of hollow hairs or not? If solid, how can the floating of the fruit in the air on a still day be accounted for, as the specific gravity of the whole would then be heavier than that of air.—JNO. J. OGLE.

[In answer to Mr. Ogle's inquiries, it may be stated that the cavity in the ripened fruit of the ash is filled with air.

The pappus of the Compositæ is formed of cells, and these cells, when the pappus is dry, are filled with air. Examination in water under the microscope will at once show the cellular nature of the pappus, and also the presence of air in those cells. The pappus floats in air because it offers a relatively large surface of resistance to the air. Even on the stillest days there are currents of air sufficient to waft about the winged messengers of the dandelion and other Composites.—J. E. B.]

BURNISHERS.—I beg to thank Mr. Harrison for his remarks in answer to my query on page 281, vol. v., of the "Midland Naturalist." I cannot help thinking, however, that he is not acquainted with the stones to which I refer, as they possess little resemblance to the Agates of the Bunter beds of this neighbourhood, but on the contrary have, when cut, the appearance of steel, though many are of a more or less red hue. I am led to conclude they are Hæmatite rather than Silica. Can any one enlighten us upon this question?—W. S. GRESLEY.

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—GENERAL MEETING, January 30th.—Mr. J. E. Bagnall exhibited a series of ninety-six species of mosses, arranged in groups to represent those peculiar to the various habitats; also *Bartramia ithyphylla*, from Dovrefield, Norway, with a microscopic preparation showing the inflorescence. Mr. W. H. Wilkinson, exhibited Lee-chee nuts, the fruit of *Nephelium Litchi*, from China, *Cactus triangularis*, the prickly pear, also models of an orange and a lemon. Mr. W. B. Grove, exhibited *Agaricus velutipes*, *Polyporus spumeus*, and *Tremella foliacea* from Sutton Park; *Peziza omphalodes*, a curious species which occurs on charcoal heaps, covering them with a wide confluent velvety mass of a beautiful pink colour, from the vinery of the Crystal Palace, Sutton; *Ptychogaster albus*, which is now considered a conidial stage of *Polyporus Ptychogaster*, but was formerly placed among the Myxomycetes; and (on behalf of Mr. W. H. Wilkinson), *Schizophyllum commune*, from a gate-post at Washington, U.S.A., a species remarkable for its enormous range, having been found in every quarter of the globe from the Arctic Seas to Australia. The Rev. H. Boyden then read a paper on the "Geography and Botany of the Rea," in which he said that, with a slight interval at Pebble Mill Pool, he had travelled along the whole course of the river from the point where its country associations begin, at Calthorpe Park, to its source at Wetty Farm. He considered that the highest source was at a spring on the "Shoulder-of-Mutton Hill." Flowing from that place past the Rubery Asylum, it is joined by a tributary from the Frankley Hills, and thence runs through Northfield and Lifford to the Pebble Mill Pool, where it receives the tributary waters of the Bourne. He remarked upon the curious fact that most manuals of geography seem to be unaware that Birmingham stands on the Rea. Along the banks of the river he had collected 140 species of flowering plants, the whole of which, as well as a number of algæ, mosses, hepaticæ and fungi, found along the valley, were exhibited at the meeting. Among them were *Colchicum autumnale*, from a field at the Dog-pool Lane, *Petasites vulgaris* from several places, and *Campanula latifolia* from the railway embankment, at Northfield. ANNUAL MEETING—February 6th.—At this meeting the Annual Report and Treasurer's Accounts were read; the latter showed that the Society was slightly in debt, but all outstanding liabilities were amply covered by the subscriptions still due to the Treasurer. In addition to this, the Society had paid off the debt which was incurred in connection with the removal to the Mason College. The following officers and Committee were then elected for 1883:—President, Mr. T. H. Waller; Vice-Presidents, Messrs. W. G. Blatch and R. W. Chase; Ex-Presidents, (who are Vice-Presidents), Messrs. J. Levick, W. R. Hughes, W. Graham, and A. W. Wills; Treasurer, Mr. C. Pumphrey; Librarian, Mr. J. E. Bagnall; Curators, Messrs. R. M. Lloyd and H. Miller; Secretaries, Messrs. J. Morley and W. B. Grove; Committee, Messrs. E. W. Badger, W. J. Harrison, W. P. Marshall, E. Tonks, S. Wilkins, and W. H. Wilkinson. The meeting was then adjourned to receive the retiring President's Address at a future date. BIOLOGICAL SECTION—February 13th.—Mr. A. W. Wills was re-elected chairman, and Mr. J. F. Goode secretary for the current year. Mr. Thomas Bolton exhibited a new marine capito-branchiate annelid, *Haplobranchus æstuarinus*, figured and described in a well-illustrated paper in the "Quarterly Journal of Microscopical Science" by Mr. Alfred Gibbs Bourne, B.Sc. London. In a few remarks on this specimen Mr. Hughes paid a just tribute to Mr. Bolton for his indefatigable zeal in discovering new forms and bringing them under the notice of the society. Mr. J. E. Bagnall exhibited the following mosses:—*Bartramia granulata*, *B. œderi*, *B. stricta*, *B. seriata*, *Catoscopium nigritum*; and *Dicranum scoparium*, from Hampton-in-Arden, with microscopical preparations of each species; also, for Mr. R. Rogers, *Campylopus fragilis*, from Hampton-in-Arden (rare), in fruit; and a fungus, *Hydnum auriscalpium*, from same habitat, new as a record for Warwickshire. Mr. W. B. Grove exhibited and described *Pilobolus œdipus*, from Sutton and *Piptocephalis Freseniana*, from Edgbaston, both species of

Mucorini, new to the British Flora. Mr. R. W. Chase read a paper "On the Study of Ornithology." The subject was divided under the following heads, viz:—Classification, Feathers, Skeleton, Digestive Organs and Trachea, Life History and Habits, all of which were fully treated. One of the most important points of study for the collector is to obtain a perfect knowledge of the various stages which each species goes through until maturity is reached, some species taking longer than others to arrive at their mature plumage, *e.g.*, some require three or four years, whilst others attain it on being fully fledged, or after the first moult. A striking change of plumage also occurs as they assume their winter or summer garb. The construction of the nest, the materials employed, the situation chosen, and the colouring of the eggs should be noted; also if they simulate the surroundings, so as to make it difficult to discover them. The importance of noting the colour of the legs and eyes in freshly-killed specimens is essential, as many mistakes occur in descriptions taken from dried specimens from which the colouring matter has faded or disappeared. The contents of the birds' stomachs also furnish a vast amount of information, and will repay examination to ascertain upon what the bird feeds, and so be able to tell the habitat of the species. The paper was illustrated by numerous typical specimens and interesting preparations. MICROSCOPICAL GENERAL MEETING—February 20th.—Mr. T. Bolton exhibited a new infusorian, just discovered by himself, to which he had given the name of *Chilomonas spiralis*. The Rev. H. Boyden exhibited a small collection of plants from the South of France and South of Portugal, gathered by the Rev. F. H. Thompson; many of them rare. Mr. J. F. Goode exhibited a minute Alga, *Coccochloris Brebissonii*. Mr. J. E. Bagnall exhibited *Utricularia neglecta*, from Staines; *Elatine hexandra*, from Surrey; *E. triandra*, from Kew Gardens; *Selinum carvifolium*, from Lincolnshire (newly-discovered in Britain), with *Peucedanum palustre*, from Norfolk, with which it has been hitherto confounded; *Ulota intermedia*, *Tetraphis pellucida* (in fruit), *Funaria fascicularis*, and *Mnium rostratum* (for Mr. R. Rogers), all rare, from Hampton-in-Arden; also two Hepaticæ, *Lunularia vulgaris* and *Metzgeria furcata*, and a fungus, *Galera sphagnorum*, from the same place; also *Geaster limbatus*, from near Kidderminster (for Dr. Arnold Lees), and a series of Fungi to illustrate Mr. Plowright's paper. Mr. W. B. Grove exhibited the following fungi:—*Hypoxylon marginatum*, *Helicomyces* (probably *roseus*), *Corticium incarnatum*, and *Peziza Chavetii* from Sutton; *Dactylium obovatum* (Berkeley), also from Sutton, growing on willow twigs, and showing all stages between that figured by Mr. Berkeley in the "Annals of Natural History" under the name given above, and the ordinary form of *Dactylium roseum*, thus rendering it probable that the two species are not distinct; also *Elaphomyces variegatus*, from King's Lynn, sent by Mr. C. B. Plowrigh and the zygospores or sexually produced spores of *Mucor mucedo*, obtained by cultivating the Mucor in a deficiency of oxygen. Mr. T. H. Waller exhibited globular phosphate of lime, from South Russia. Mr. Bagnall then read a paper by Mr. C. B. Plowright on "The Reclassification of the Uredines," in which the writer gave an account of the changes which have recently been made in the arrangement of those fungi, owing to the adoption of the theory of their Trimorphism, and appended a list of the British species, according to the system adopted by Dr. Winter.

BIRMINGHAM MICROSCOPISTS' AND NATURALISTS' UNION.—MICROSCOPICAL AND GENERAL MEETING.—January 8th.—Mr. Madison showed *Limax flavus* (living specimen); Mr. Boland, a collection of Indian marine shells; Mr. Delicate, microscopical section of shell of cocoa-nut; Mr. J. W. Neville, dredgings from "Challenger" Expedition. January 13th.—Mr. H. Insley exhibited a collection of Australian woods, polished, showing their structure. A paper, "Notes on Nebulæ," was read by Mr. J. Wykes. January 22nd.—Mr. Tylor showed a microscopical Fungus found in an Oporto wine cellar and Mr. Baxter, a specimen of *Membranipora pilosa*. January 29th.—Special pond life: various common objects shown and described. February 3rd.—Mr. Tylor showed a specimen of Labradorite; Mr. Baxter, *Ophiocoma neglecta*, and *O. rosula*. A paper was read by Mr. Wheeldon, "Notes on Dragon-Flies," illustrated by diagrams.

Plate V.

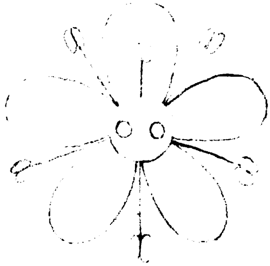


Fig. 1.

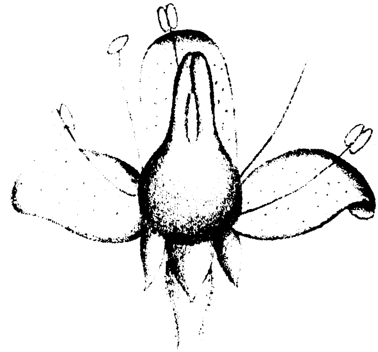


Fig. 2.

Fig. 4.

Fig. 5.

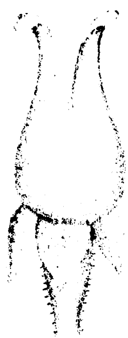


Fig. 3.

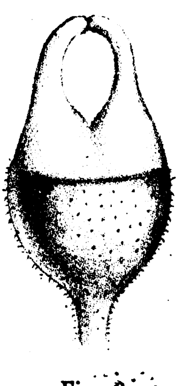


Fig. 6.

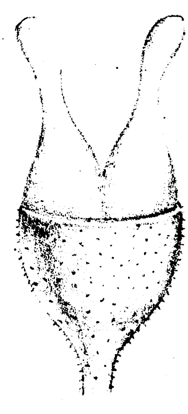


Fig. 7.

J. G. D., Del.

W. B. G., Lith.

THE FERTILISATION OF SAXIFRAGA.

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OBSERVATIONS ON THE FERTILISATION OF CERTAIN SPECIES OF *SAXIFRAGA*.*

BY JNO. J. OGLE.

The Saxifrages and their close allies, the Sundews *(Drosera)*, the Golden Saxifrage *(Chrysosplenium)*, and the Grass of Parnassus *(Parnassia)*, exhibit some very wonderful phenomena of vegetable life. Bennett, Hooker, Darwin, Lubbock, and others have observed and described several of the peculiarities that characterise plants belonging to the natural order (Saxifragaceæ), which includes the above-named species; but so far as I am aware no one has yet described the way in which the members of the genus Saxifraga are fertilised. In the case of the Grass of Parnassus and the Golden Saxifrage their arrangement and motions for the prevention of the fertilisation of an individual flower by its own pollen have been well described. In the cases I am about to describe the same object is achieved by a somewhat different process.

That some such contrivance is necessary for the health and vigour of succeeding individuals of the same species is a well-ascertained fact. Plants raised from seed produced by self-fertilised flowers (*i.e.*, flowers having ovaries impregnated by pollen from the same individual to which each belongs) are always weaker than those from seed which has been set by cross-fertilised flowers (*i.e.*, those the stigmas of which were brought into contact with pollen from other plants of the same species). On the ground of a similar law in the animal world applicable to that highest of animals—man, Scripture and the law of the land prohibit the marriage of very near relatives, as the children of such marriages would be very weakly, and in many cases a burden to themselves and to society.

But to return to the Saxifrages. It will be necessary to point out the structure of the flower of a typical saxifrage and the relations of its

REFERENCES TO PLATE V.

Fig. 1.—Diagram of flower of a *Saxifraga*.

Fig. 2.—Flower of *Saxifraga umbrosa*, with two petals and stamens near them removed.

Fig. 3.—Ovary of the same in a more advanced state.

Fig. 4.—Ovary of *S. muscoides*; early condition.

Fig. 5.—The same; later condition.

Fig. 6.—Ovary of *S. granulata*; early condition.

Fig. 7.—The same; later condition.

* This paper was read before the Nottingham and District G. R. S. Naturalist's Society in June last.

parts one to another before we proceed further. Fig. 1 is a diagram that will answer our purpose. The sepals are not shown, as they do not affect the point we wish to elucidate. The outside ring of leaves represents the corolla, consisting of five petals. Next, there are the stamens, an outer whorl or circle of five long and an inner whorl of five short ones. Each of these consists of a filament or stalk, and a head or anther, which is two-celled, and contains the pollen. Then in the centre we have the ovary, or seed-vessel, which is two-chambered. Connected with each chamber is a projection called a style, and at the tips of these two styles are the stigmas.

We are now in a position to understand the description of the phenomena of the fertilisation of the Saxifrages.

If we take a flower of the London Pride (*Saxifraga umbrosa*), which has not been too recently nor too long expanded, and tear away two of the petals with the stamens near them, we shall see something like what is shown in Fig. 2. Here we notice that the two styles touch at the tips. One of the longer stamens has lost its anther, another has assumed an almost erect position, with the anther crosswise on the top of the filament, and the three remaining stamens of the inner whorl have grown out to about the length of the outer stamens, but still lie back upon the petals. If we had examined this flower a little earlier we should have found the stamens entire, and the styles a little apart all the way up. Later on, when all the pollen is shed, the petals and stamens will wither and fall, and the ovary assume the appearance of Fig. 3. Here the styles have parted from each other and sprayed out, exposing the rough sticky stigmas at their tips, so as to brush off from any insect that may alight upon the flower some of the pollen with which it may have been dusted from a flower in the state shown at Fig. 2. Figures 4 and 5 represent the ovary of the mossy saxifrage (*S. muscoides*) at an early and at a later stage of development; and Figures 6 and 7 exhibit the same features in the White Meadow saxifrage (*S. granulata*). The shape and size of the ovaries in these species differ from one another and from the London Pride, but essentially the same motions take place in each of the three species. At first, we have stamens entire, of two lengths, in two whorls, and ovary with immature parallel styles. Later on, the styles bend over to each other, and press their stigmas together, while each of the stamens, first of the outer whorl then of the inner, in succession assumes an erect position, with the bursting anther lying across the top of the filament, just in the right position to besmear any hairy insect that may alight upon the flower, and at the same time incapable of dusting the stigmas by reason of their close contact throughout the whole of their surfaces. When each stamen has shed its pollen the filament either goes back to its former position or shrivels up; and when all the stamens have performed their office the styles of the ovary part from each other and, widely diverging, fully expose the now ripe stigmatic faces. Finally, a passing insect coming from a younger flower brushes by, and leaves a portion of the pollen behind it.

The phenomena above described were noticed by me for the first time when gathering specimens of the White Meadow Saxifrage, with a view to verify and extend my observations of a former year on the variations in the parts of the flower as illustrative of vegetable morphology.

Herewith I append a table of my notes of nine specimens of this flower, taken at random, which, I venture to believe, will be found to bear out my conclusions. Since making these notes I have had many opportunities of testing my first impressions in the examination of various individuals of the *Saxifraga umbrosa*, *S. granulata*, and *S. muscoides*, and the result has in every case verified my first impressions. With the hope that this simple record may encourage and stimulate all young botanists to a a closer observation of the common plants of our fields and woods, I herewith conclude.

No. of Flower.	Corolla.	Stamens.	Ovary.
1....	Normal	*Pollen* shed.............	*Stigmas* across the apices of the styles (*not* on one side only, as is usual), with a slight cleft in each; rough; reddish tinge; and only very slightly touching at the two inner edges, fully displayed.
2....	Normal	*Pollen* not shed. *Filaments* five long, five short................	*Styles* rudimentary, about 1-16 inch apart. *Stigmas* immature; vertically cleft; and slightly leaning to each other.
3....	Normal	Like No. 2.	*Styles* more rudimentary than in No. 2, but touching.
4....	Normal	Like No. 2, excepting outer whorl of varying lengths, the longest dehiscing..........................	*Styles* immature. *Stigmas* just touching at lower edge.
5....	Gnawed apparently by insects.............	*Pollen* shed	*Styles*, one immature, the other apparently eaten away.
6....	*Petals* unusually long	Outer and inner whorl of varying lengths; none dehiscing..................	*Styles* immature, not touching.
7....	Like No. 6.	Like No. 6, but not quite so forward....	*Styles* immature; separated by twice the distance of the same in No. 6.
8....	Shrivelled..	Shrivelled	*Styles* widely diverging. *Stigmas* almost petaloid; not so rough as No. 1, and face to face.
9....	*Petals* unusually long; not shrivelled.....................	Shrivelled	Like No. 8, but expanded stigmas at right angles.

My grateful acknowledgments are due to Mr. J. G. Davidson, natural history draughtsman to Professor Blake, University College, Nottingham, for the drawings from which the illustrations accompanying this paper have been prepared; and to Mr. W. B. Grove, B.A., of Birmingham, for lithographing them.

THE ALLUVIAL AND DRIFT DEPOSITS OF THE LEEN VALLEY.*

BY JAMES SHIPMAN.

The River Leen is a small tributary of the Trent. It rises at the foot of Robin Hood's Hills, in Kirkby Forest, on the western border of Notts, and about a mile or so north-west of Newstead Abbey, the "home of Lord Byron." Thence running in a southerly direction, and, fed by many springs on the way, it enters the Trent Valley by the west side of Nottingham, after a course of about ten miles. It is at best only a small stream, but the geological evidence furnished by its deposits invests it with an interest which it would not perhaps otherwise possess.

We can hardly wander far about the valley of the Leen, especially the lower half, without noticing how thickly the ground is covered with pebbles. There is scarcely a ploughed field or ditch-side but what has its tale to tell about the abundance of gravel all over the valley. Gravel may even be seen perched on the top of the low cliffs of the crimson Lower Mottled Sandstone that stand out at intervals along the east bank of the Leen. In one or two places this high-level gravel may be seen in the roads that cut through it on that side of the valley. The gravel that lines the valley slopes is exposed now and then by the side of the Midland Railway between Basford and Bulwell, and again in the small gravel holes that dot the low flat ground by the side of the same line on Bulwell Forest. But although this gravel lies eight or ten feet thick in some parts, there are no good sections in it, and we can only get occasional glimpses of its character. In some spots—between Basford and Bulwell, for instance, — this gravel forms terraces, now grass-grown, and with little to indicate that the river which now flows many feet below had anything to do with their formation. The gravel itself probably occupies shelves or terraces cut back out of the solid rock that forms the sides of the valley. A good example of one of these river terraces may be seen where it is cut into by the old sand pit at Spring Close, Lenton, just at the junction of the Leen Valley with that of the Trent.

As we look upon these sheets and terraces of gravel scattered up and down the Leen Valley we can hardly help wondering where all this gravel came from, and how it got so distributed about the valley. Gravel, to most people's minds, is suggestive of a flood of some kind, and it is generally (but of course erroneously) regarded by the non-scientific as a pretty certain indication of the presence of the sea over that part not very long ago. Let us see, however, what we can deduce from the gravel itself, as to where it probably came from, and when. The gravel that lines the sides of the Leen Valley

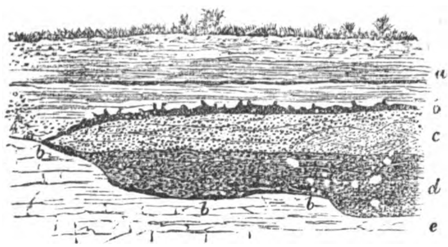
* Read before the Nottingham Naturalists' Society, October 11th, 1882.

gets thicker as we follow it down into the narrow strip of flat meadow ground through which the Leen now meanders. This fact itself would suggest that the bottom of the valley probably contains a good thickness of gravel along with sand and silt brought down by the river. It must not be inferred, however, that the gravel that covers the sides of the valley is exactly the same in character or was formed at the same time and by precisely the same agency as the gravel in the bottom of the valley. Even the gravel and sand that is spread along the valley slopes is probably not all of the same age. Excavations made in the meadow ground that immediately borders the river show that our supposition as to the thickening of the gravel as we approach the river is quite true, and that in fact the meadow itself owes its flatness to the layers of sandy, gravelly, and clayey materials of which it is composed. But where did all the gravel come from; and how did it get spread along the sides of the valley high above the level of the river as we now find it?

The pebbles most abundant in these gravels of the Leen Valley are quartzites of all sizes, many of them split, perhaps by intense frost, some perhaps by the pressure of glacier ice; but there are besides quartz, coal measure sandstone, millstone grit, chert, flints, and more rarely pebbles composed of the harder rocks of the neighbourhood. An examination of the rocks out of which the Leen Valley has been scooped shows that the pebbles in the valley gravels could not all have been derived from the rocks that bound the valley. The valley of the Leen has been worn for the most part out of the Lower Mottled Sandstone of the Trias, as may easily be seen by the little low cliffs of bright crimson sandstone which have been formed by the river here and there along its east bank. Now, the Lower Mottled Sandstone contains only a few small pebbles, so that they could hardly have been derived from the wearing away of this rock. In some parts of its course, indeed, the Leen has entirely swept away the thick mass of this Lower Mottled Sandstone that once stretched across its bed and far away over the ground beyond, and has even eaten its way down into the Middle Marl of the Permian, and through that again into the underlying Permian Magnesian Limestone, which, along with a small strip of Coal Measures, form its western slopes. But there are very few pebbles to be found that have been derived from these rocks. The majority of the pebbles were no doubt derived from the wearing away of the Bunter Sandstone, which forms so much of the country to the north-east. But most of the others were in all likelihood brought from North Derbyshire, while the flints must of course have come out of the Chalk. Many of the pebbles now found in the gravel of the Leen Valley, then, must have come a very long way. One of the questions we shall have to try to solve is, when and by what means these pebbles were brought.

Until lately, our knowledge of the gravelly deposits that line the Leen Valley was confined to what we could make out from examining the gravel that mantles the valley slopes. Although this gravel is very instructive, it does not tell us all we want to know, however. It contains only about one chapter as it were of the history of this ancient valley. Fortunately, a good opportunity has at length been afforded of making a more complete examination of the alluvial and drift deposits of this valley. Some extensive excavations made recently in the narrow alluvial plain of the Leen, during the extension of the Nottingham Corporation Gas Works at Old Radford and at Basford, opened out a series of very instructive sections in the deposits that underlie this plain. The evidence revealed by these sections was found to throw a good deal of light on what had hitherto been a blank page in the geological history of the valley.

FIG. 1.



Section of the Alluvium of the Leen at Old Radford.

(a) Yellow, bluish, and dark gray clay.
(b) Peat, with upright stems of young trees.
(c) White and gray "sharp" sand and gravel.
(d) Brown gravel, with flakes of red hematite, and thin seams of red sand near the bottom.
(bbb) Isolated small patches of peat.
(e) Lower Mottled Sandstone (Trias).

The first of these excavations was made by the west side of the Leen at Old Radford, in 1879-80, and was for a well for a new gasholder. This well was something like 180ft. in diameter, and about 40ft. deep. It passed through the whole of the deposits of the Leen that form the alluvial flat, and far down into the Lower Mottled Sandstone rock beneath. The Leen now wanders through a level meadow which varies in width from a few yards to a quarter of a mile. The excavation at Radford, however, revealed the fact that beneath the middle of this flat meadow lay a ravine, not very broad—probably not many yards—that is, supposing the part opened out in this cutting to be only half the entire width, and nine or ten feet deep, carved out of the solid rock (Fig. 1). This cavity was filled up by layers of gravel and sand, peat and clay, piled bed upon bed, while the Leen itself now flowed over all. At the bottom there was rusty-brown gravel, stained crimson here and there by bits and flakes of decomposing red earthy hematite which it contained. This hematite could have been derived from no other source in this district than the Coal Measures, probably of

Derbyshire. Above this coarse brown gravel came a loose, sharp, coarse gray or white sand, in some parts clayey and pebbly, but mostly free from pebbles. The traces of oblique bedding in it indicated that this sand was deposited by water flowing somewhat rapidly down the valley, though not perhaps more rapidly than the Leen would flow now were the artificial dams and water-mills removed. Judging from the horizontal extent and uniform thickness of this sand, too, the stream, must have been considerably wider than it is now. Several stools of trees were found in this deposit in the position in which they grew. Some of the fragments of these trees which I collected were too much decomposed to make out what they were, but one fragment of a stool about ten inches in diameter was found by Dr. W. Carruthers, F.R.S., of the British Natural History Museum, South Kensington (who kindly examined the specimens for me) to be *Quercus robur* (Lin.) "This fragment," says Dr. Carruthers, "belonged to a slow-growing tree, as the annual rings are very small, and consequently the vessels very numerous and close together." Resting on this gray sand was a band of peat, from six to ten inches thick, full of upright stems of young trees, along with leaves and twigs, all jumbled together and in a more or less decomposed or carbonised state. Another fragment of wood met with here is believed by Dr. Carruthers to belong to *Pinus sylvestris*, and in all likelihood came out of the peat bed. The peat was covered by about three feet of stiff clay or silt, which contained no pebbles. This clay swelled out on the south side of the excavation to about five feet in thickness, as if it occupied an old saucer-shaped hollow in that direction. Laterally, these alluvial deposits rested against a mass of red sand and clay and pebbles, which appeared to partly line that side of the old river hollow, though it was not now easy to draw the line between the two. The red sand with pebbles was evidently all that remained of a mass of Glacial Drift that may once have entirely filled the ravine, and in which the Leen had since eaten out a channel for itself.

(To be continued.)

NOMAD FUNGI: THE RECLASSIFICATION OF THE UREDINEÆ.

BY W. B. GROVE, B.A., HON. SEC. OF THE BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.

(Continued from page 53.)

Meaning of the Œcidium Stage.

There is one point which strikes an attentive observer of the foregoing phenomena very forcibly; I mean, the apparent uselessness of the œcidium-stage in the life-history of a Uredinous fungus. Why should a puccinia-spore generate an Œcidium? Why not produce the Uredo at once? Some Puccinias indeed have no Œcidium, as *P. malva-*

cearum, but why not all? This is a question upon which I have seen few attempts made to throw any light. We can see the object of the Uredo and the Puccinia, but not of the Œcidium. There is only one glimmer in the darkness, and that will be introduced by the point to which I wish now to draw attention. I believe that in the life-history of most plants there must occur, more or less frequently, a process akin to the fertilisation of the phanerogams. There must be that mysterious commingling of the contents of two distinct cells, from which animal and vegetable species alike derive a renewed lease of life. Many facts point to the conclusion that a species which reproduces itself only by budding has a tendency to degenerate continually, and finally to become extinct. It is true that there are apparent (or real) exceptions to this law, where a species maintains itself, so far as we know, by purely asexual means. But it seems to me that we lose the significance of a whole body of facts if we refuse to believe that the law is as I have said. We cannot forget in how many instances the presence of an act of fertilisation has been detected where it was formerly unknown, as in the Fucaceæ or Bladder-wracks of our sea-coasts, and in Volvox, the Desmidieæ, the Diatomaceæ, and other Algæ, not to speak of instances now so well known as the Ferns and the Mosses. There are now several groups of Fungi in which a true reproductive process is known to occur, as in the Mucorini, the Peronosporeæ, the Saprolegnieæ, and some of the Ascomycetes. We must remember that the reproductive process is one of the chief means, on the Darwinian theory, by which new species are produced; a group of organisms, which has entirely lost traces of a gamogenetic act, has thereby reduced itself to this difficulty—that as the existing species disappear, under the influence of competition, it can form no others of a more or less divergent character to suit the changing circumstances, and so has doomed itself to a sure, though lingering, death. It is true that, if it avail itself of the sexual act to produce invigorated descendants, it perpetuates itself under a changing form, which finally becomes what we call a distinct species; but still it does perpetuate itself, which is the main point. I believe that the only cases, in which it may be conjectured from our present knowledge, that gamogenesis is absent, are found in organisms which inhabit water: such are, perhaps, the Oscillatorieæ. But it is conceivable that most species which live in water are not subject to such changing conditions, do not require therefore so great a power of adaptation to circumstances as do those which live in the air. However this may be, a family of plants so large and so varied as the Fungi are must have formerly possessed the means of sexual reproduction, and probably in great part still retains it; in no other way can the existence of numerous and closely-related species be accounted for.

Now, if we were to look for a process of fertilisation in our leaf-fungi, where should we probably expect it to occur? Analogy will help us to answer this question. A flowering plant usually produces seed when the vigour of its growth is ceasing. I need only remind you that a rapidly-growing fruit-tree, in which a superabundance of sap is present, seldom fruits; and that a gardener who wishes to make a geranium flower stints its supply of water. It is true that there is a seeming exception to this law in the case of trees which flower in spring, before the leaves are out; the common Coltsfoot (*Tussilago*) would also seem to contradict the rule; but really they obey it. In all these cases the buds which are to develop into the flowers are formed at the *close* of growth in autumn and only wait till spring to complete their development. Applying these considerations to the Uredineæ, we are naturally led to look for the sexual process in the production either of the Puccinia or of the Œcidium. The probability is vastly in favour of the latter, viz: that fertilisation occurs in the mycelium produced by the germination of the sporidia, and that the Œcidium is the product thereof. Curiously enough, it is here that we meet with the only known organs which suggest a sexual process in the Uredineæ, the *spermogones*. These are minute flask-shaped bodies, which are produced on the same leaf which bears the Œcidium, usually a little earlier, sometimes on the opposite side of the leaf, sometimes among the Œcidia themselves. They contain an enormous number of small oblong cells, which are perfectly transparent, and enveloped in a mucous secretion. These were called *spermatia*, from a suspicion that they represent the male element in a reproductive act; this suspicion was strengthened by the difficulty of inducing them to germinate. Recently, however, it is said that a well-known French biologist has succeeded in compelling them to germinate, and thus produce a mycelium; but remembering how a pollen-grain may be said to germinate, in a sense, when it sends out a pollen-tube, we may be excused for waiting for further investigation before we consider such a statement a bar to the truth of the supposed function of the spermatia. It is at least probable, both from their size and character, their vast numbers and their mode and time of growth, that these bodies are the male organs, and that the female organs are produced and fertilised on the spot where the Œcidia are subsequently formed. The Œcidia would then be the true fruit of the fungus. The whole subject is at present wrapped in mystery. I often think how the next generation, after clearing up this and many similar difficulties, will look down upon us as a crowd of bunglers, who did not know how to use our microscopes. The subject is one of great interest to us from our present point of view, because, if the reasoning just given should turn out to represent the facts correctly, the whole scheme of arrangement of these fungi must be remodelled. The Œcidium-stage, and not the Puccinia-stage, would then be the typical one, and our classification must be founded upon that basis.

It may be asked whether, under these circumstances, it is right to continue to give names to these stages of growth, as if they were independent species, to talk, *e.g.*, of *Œcidium violæ* as well as of *Puccinia violarum*. To this question the answer must, at present, be in the affirmative; it is only when our knowledge is approximately complete that we shall be able to decide finally what arrangement should be adopted. When we consider that many of these fungi are often met with under one form only, we must admit the necessity of having a provisional name for that form. At the same time it will be possible to arrange the various stages of species, so far as they are known, together, and not, as now, on widely separated pages; and this scheme would also meet the requirements of those who merely want to discover the names of their finds, if a little typographical ingenuity be exercised in placing them so that one may be able to glance through all the œcidium-forms, for instance, without reading the descriptions of the other stages.

Finally, I may remind you that I promised to treat of "Nomad Fungi," and ask you whether the title is not merited by those species, of which one begins its existence upon the Dock, and terminates it upon the Reed; another pitches its tent upon the Nettle, and transfers it to the Sedge; a third on the Coltsfoot, from which it passes to the Meadow Grass; a fourth travels from the Wood Spurge to the Common Pea; a fifth from the Fleabane to the Rush; and a sixth from the Barberry to the Corn.

ARUM MACULATUM.

One of the most conspicuous plants which arrests the attention of the rambling botanist during the early spring months is the Spotted Arum or Cuckoo's Pint (*Arum maculatum*), the appearance of which is thus described by the poet Clare:—

> "How sweet it used to be when April first
> Unclosed the Arum leaves, and into view
> Its ear-like spindling flowers their cases burst,
> Betinged with yellowish, white, or purplish hue."

It is in many respects a peculiar plant, exhibiting in a marked degree the curious and most interesting phenomenon of vegetable evolution of heat, which may be felt by the hand or tested with an ordinary thermometer for some hours after the expansion of the spathe. It is also one of the few Monocotyledons possessing reticulated veins in the leaves. The spadix—the club-shaped organ within the spathe—is a spike with a succulent axis, a kind of flower stalk in fact, bearing two sorts of flowers—those most essential organs for the reproduction of the species by means of matured seeds—stamens and pistils, both destitute of calyx and corolla.

At the base is a cluster of fertile pistils, surmounted by a frill of one or two rows of rudimentary organs of the same kind. Above these is a group of stamens, and still higher another ring of abortive stamens. These organs are all said to be very good microscopical objects when viewed under a low power. The spathe is contracted below the middle, and on tearing it away from any fully-developed flowers there will often be found some small dipterous insects imprisoned at the base, some of which are dead, indicating that they have probably been there for some time previously, while others are active, and on the destruction of their prison they fly forth to enjoy their regained liberty. It may be asked, How came these insects to be within the spathe? Probably attracted by the peculiar fetid odour of the plant, they entered the aperture at the top of the spathe in search of food; the downward tendency of the hair-like aborted stamens in the topmost cluster would facilitate their entrance; but on their endeavouring to escape again by the same way they would force the delicate hairs upwards, and so close the aperture. Then finding themselves to be prisoners, in their ineffectual attempts to escape they would distribute the pollen from the perfect stamens on to the stigmas below, so fulfilling nature's purpose in fertilising the ovules.

The leaves are very acrid, and are sometimes mistaken for Sorrel; but their disagreeable effects are soon perceived on their being chewed, "pricking the tongue as nettles do the hands," says Culpeper, "and so abiding a great while without alteration." But notwithstanding the dangerous property of the herb, according to this quaint old author, it possesses many "virtues," and seems to be truly a most wonderful herb. He speaks of its power of curing coughs, boils or any bad sores, weak and red eyes, and that troublesome complaint the itch; adding, further, that "the herb is under the dominion of Mars, and, as Tragus reports, a dram weight, or more if need be, of the Spotted Wake Robin, either fresh, green, or dried, having been eaten and taken, is a present and sure remedy for poison and the plague."

In Cheshire this Arum is called Gethsemane, because it is said to have been growing at the foot of the cross, and to have received on its leaves some drops of blood—

> "Those deep, unwrought marks,
> The villager will tell thee,
> Are the flower's portion of the atoning blood
> on Calvary shed.
> Beneath the cross it grew."*

A farina prepared from the corm or rootstock has been used as an article of diet, and has been also employed to adulterate arrowroot. The corm contains a considerable amount of starch, and Culpeper informs us that "it was anciently used instead of starch to starch linen with." And hence probably the old name of Starchwort. Concerning the popular name of "Lords and Ladies," which appears to be the most widely distributed of its many titles, Miss Baker aptly remarks, in her "Glossary of Northamptonshire Words and Phrases,"

* *Vide* Thistleton Dyer's "English Folk-lore."

that "this playful appellation has suggested some of the numerous and interesting reminiscences with which Clare's poetry abounds, and which constitute one of its principal charms." (See "Village Minstrel"):—

"Oft under trees we nestled in a ring,
Culling our 'Lords and Ladies.' O ye hours!
I never see the broad-leaved Arum spring,
Stained with spots of jet. I never see
Those dear delights which April still does bring,
But memory's tongue repeats it all to me."

From the same authority I gather that the appellations Dog Bobbin and Bobbin and Joan were in use in some parts of Northants, both of which names have doubtless been suggested by the fancied resemblance to a lacemaker's bobbin. It would be interesting to ascertain if they are still in use within the county, also by what additional names the herb is known among the rustic population of the Midland Counties.

I have been informed that the peasantry of this district (Hampton-in-Arden) term them Bulls and Cows, or Cows and Calves, of which the dark-coloured spadices are bulls, and the lighter ones cows. It would appear from the above authority that the use of this name has also extended into the adjoining county of Northants, though at present I have not heard it used there. The terms Cuckoo Flowers and Cuckoos are not in general use, though sanctioned by Clare. (See "Rural Muse," as quoted by Miss Baker):—

"And gaping Cuckoo Flower, with spotted leaves
Seems blushing of the singing it has heard."

And

"Bedlam Cowslips and Cuckoos,
With freck'd lip and hooked nose,
Growing safe near the hazel of thicket and woods."

Clare's MS. Poems.

Respecting Cuckoo's Pint, I think very probably that this is but the corruption of the phrase "the point (poignard or spear) of the Cuckoo," which is a translation of the name by which the plant is known in Wales. Culpeper adopts what seems to be the more correct orthography—"Cuckow's Point."

Among more than twenty names for the plant noticed by Parkinson, are—Cuckowe's Pintle, Priest's Pintle, Rampe, Buckrams, Starchwort; "and in Latin—*Arum*, and by some *Pes vituli*, because the leaf doth somewhat resemble a calve's foote; some also *Dracontea minor*, and *Serpentaria minor*: others againe, from the figure of the pestle or clapper in the middle of the hose, call it *Sarcerdotes penis*, and *Caius priapus.*"

Robt. Rogers, Hampton-in-Arden.

ORNITHOLOGICAL NOTES FROM LEICESTERSHIRE FOR 1882.

The winter of 1881-2 was one of the mildest on record. An almost entire absence of snow and frost resulted, as a matter of course, in a corresponding absence of winter visitors. No Fieldfares and very few Redwings were seen. Wild violets were found on 3rd January. On the 5th.—Thrush in full song. 11th.—Tufted Duck killed on Saddington Reservoir. 17th.—Tomtit singing.

February 2nd. — A Merlin was shot at Bardon. 3rd. — Hedge Accentor singing. 10th.—Lark soaring and singing. 11th.—Tufted Duck seen. 19th.—Wren singing, Missel Thrush singing. 21st.—A Chiffchaff was seen at Langton by Mr. Logan.

In reference to this last note, I should say that in the *Field* of March 4th it was recorded that the Chiffchaff was seen and *shot* in Nottinghamshire on February 8th, and seen and *heard* in Devonshire on February 22nd. A correspondent of the "Zoologist" for March 1st also states that he saw and heard the bird in December and January in Oxfordshire. It appears, therefore, that owing to the exceptional mildness of the winter, some few specimens of this little warbler wintered in England; probably some always remain behind, but do not survive.

March 13th.--Bullfinch singing. 17th.—Coletit singing. On the same date Mr. Davenport reports the Willow Wren seen in Skeffington Wood. 26th.—I saw the Willow Wren in Gumley Wood, and on the same day heard the Blackcap. The above dates are unusually early for these migrants, and may be due to the mildness of the season or possibly, like the Chiffchaff, they may have wintered in this country.

April 4th.—Cuckoo heard. 6th.—First Swallow. 7th.—Lesser Whitethroat seen. 16th.—House Martin and Sand Martin observed. 18th.—Nightingale heard. 19th.—Yellow Wagtail. 21st.—Wryneck and Common Sandpiper. 24th.—Sedgewarbler.

May 5th.—Landrail heard. 10th.—Mr. Davenport sent me word that he had found the nest of the Long-eared Owl in Skeffington Wood. This is, I believe, the first record of this bird nesting in this part of Leicestershire. As the keeper was murderously inclined we decided to take the young, and on the 14th May I heard from my friend that he had secured the four young birds. I saw them a few days after their capture, when they were apparently about three weeks old; there was no doubt about their being Long-eared Owls. One unfortunately died young, but the other three are alive and well at the time I write. The parent birds had appropriated an old Carrion Crow's nest for domestic purposes. 18th. — Turtle Dove seen. 28th. — Common Flycatcher arrived.

June 23rd.—Two Common Gulls on Saddington Reservoir.

July 7th.—Two Great Crested Grebes on Saddington Reservoir.

October 13th.—An Osprey was seen at Saddington Reservoir, and on 18th and 22nd the same bird (probably) was seen at Gumley. I have already recorded this in the "Midland Naturalist," Vol. V., p. 261. 26th.—A Long-eared Owl was caught in a rat trap at Saddington Reservoir. 31st.—Two Hen Harriers seen at Gumley.

November 1st.—Redwings seen first time. 3rd.—Fieldfares; both late arrivals, and very scarce. 11th.—A Chiffchaff was seen in the garden at Gumley Rectory by Rev. A. Matthews. This confirms my previous note of the probability of this bird remaining in England during the winter. 15th.—I saw a flock of about twenty Siskins in a lane near Gumley. 16th.—Short-eared Owl killed at Smeeton. 23rd.—Redwings abundant (by thousands), but very few Fieldfares. Female Merlin seen at Gumley.

December 10th.—Grey-lag Goose shot at Shangton by Mr. Brown. 12th.—Female Hawfinch shot at Gumley. 13th.—Herring Gull and a male Sheldrake seen at Gumley. 24th.—Three Wild Swans seen passing over Gumley.

THOMAS MACAULAY, M.R.C.S.L., &c.

Kibworth, March, 1883.

THE FLORA OF WARWICKSHIRE.

AN ACCOUNT OF THE FLOWERING PLANTS AND FERNS OF THE COUNTY OF WARWICK.

BY JAMES E. BAGNALL.

(Continued from page 67.)

DIPSACEÆ.

DIPSACUS.

D. sylvestris, *Linn.* *Wild Teasel.*

Native: On hedge-banks and in fields. Rare and local. July, August.

I. Near Hampton-in-Arden, in one or two localities.

II. Between Hatton and Warwick, *With.*, ed. 7, ii., 217; Salford! *Rev. J. C.;* Honnington, *Newb.;* Henley-in-Arden; Wixford; Exhall; Binton; Little Alne; Kineton, &c.

D. pilosus, *Linn.* *Small Teasel, Shepherd's Rod.*

Native: On wet hedge-banks, near streams, and in damp woody places. Very local. August.

I. Near Coleshill, *Countess of Aylesford, B. G.*, 633; Merivale, *J. Power;* banks of the Blythe! near Coleshill; Bournbrook, Shustoke, *Bree, Mag. Nat. Hist.*, iii., 163. Banks of the Bourn, near Arley.

II. Studley Mill; Wixford Lane; Oversley Hill, *Purt.*, i., 94; Emscote, on the road to Lillington, *Perry Fl.*, ii., Honington! *Newb.;* Stoneleigh; Offchurch, *H. B.;* hedge bank, near Yarningal Common.

SCABIOSA.

S. succisa. *Linn.* *Devil's-bit Scabious.*

Native: On waysides, heath lands and pastures. Rather local. July, August.

I. Sutton Park; Middleton Heath; Coleshill Heath; Maxtoke; Fillongley, &c.
II. Near Rugby, *R. S. R.*, 1878; Drayton; Henley; Lapworth, &c.

S. columbaria, *Linn.* *Small Scabious.*
Native: On banks and in pastures, in calcareous and marly soils. Very local. June to September.
II. Tachbrook, Stockton, *Y. and B.* Right of road between Birdingbury and Wharf, *R. S. R.*, 1878. Moreton Morrel! Compton Verney, *H. B.*; Butler's Marston, *Bolton King;* between Bearley Cross and Little Alne; bridle road near Billesley; hedge bank between Drayton Bushes and Red Hill; Binton; Marl Cliff; Ashorne; Edge Hills, near Ratley.

S. arvensis, *Linn.* *Field Scabious.*
Native: On hedge banks and in fields and pastures. Common. June to September. Area general.
Var. *integrifolia*, occasionally with type.

COMPOSITÆ.

ONOPORDON.

O. Acanthium, *Linn.* *Common Cotton Thistle; Common Argentine.*
Alien or denizen; on rubbish and roadsides. Rare. July to September.
II. Bidford: Broome, *Purt.*, ii., 385; near the old pound, Coten End, Warwick; in a lane leading from Emscote to Nicholas meadow, Warwick; *Perry Fl.*, 68; Woodloes; Hampton Lucy; Offchurch, *H. B.;* Tredington, *Newb.;* Temple Grafton; Alveston Pastures.

SILYBUM.

S. Marianum, *Gaertn.* *Milk Thistle; Ladies' Thistle.*
Casual or Alien: On rubbish heaps, road sides and ditch banks. Rare. June.
II. Alcester; Coughton, *Purt.* i., 380. Race-course, Warwick; *Perry*, 1817; hedge bank on the N. side of the common, Warwick; in a lane leading from Nicholas meadow to Emscote Road; and in the Saltisford brickyard; Warwick, *Perry, Fl.*, 67. Chesterton, *Y. and B.;* Scarbank, *Herb. Per.;* hedge banks, Milverton; Chesterton Windmill, *H. B.*

CARDUUS.

C. nutans, *Linn.* *Musk Thistle.*
Native: On heaths, banks, and in fields. Locally common. May to July.
I. Banks at Aston and Nechells Green, *Ick. Anal*, 1837. Field by Saltley toll-gate, 1867, *W. B. Grove.* Sutton Railway Bank; Sutton Park; Middleton; Coleshill Heath; Shustoke; Hartshill, &c.
II. Great plenty at Red Hill! and Grafton! amongst the quarries of limestone, *Purt.* ii., 379; on the road from Stratford to Warwick, *Perry Fl.*, 67; Chesterton; Emscote, *Y. and B.;* near Great Alne; Alveston Pastures; Hill Morton; Edge Hills.

C. crispus, *Linn.* *Welted Thistle; Thistle-upon-Thistle.*
Native: In woods, on banks, and in pastures. Very local. July to September.
I. *(Polyanthemos)*, Four Oaks, near Sutton; lane from Shustoke to Maxtoke; fields near Coleshill church; Coleshill Heath; Temple Balsall.

II. (*Acanthoides*), Chesterton Wood! *Herb. Per.;* Honington; Tredington; Halford; Shipston, *Newb.;* Oversley Wood; fields between Oversley and Arrow; banks, Arrow lane; (*Polyanthemos*), Bardon Hill, Stratford-upon-Avon; Shilton, near Edge Hills; (*litigiosus*), pea field, Drayton Bushes; near Temple Grafton.

C. lanceolatus, *Linn.* *Spear Thistle.*
Native: In woods, pastures, heath, and on waysides and banks. Common. July to September. Area general.

C. eriophorus, *Linn.* *Woolly-headed Thistle; Globe Thistle.*
Native: On waysides and in meadows, in calcareous soils. Rather rare. July, August.

II. On the road from Warwick to Stratford; between Warwick and Hatton; on the road from Harbury to Tachbrook; Binton! Oversley Hill! *Perry Fl.*, 67; Allesley, *Bree, Mag. Nat. Hist.*, iii., 165; Cathiron Lane, by the old canal! *Blox.*, *R. S. R.*, 1874; Chesterton! Whitnash: Morton! *Y. and B.;* in the Newbold Road, by the river, *Blox.*, *N. B. G.*, 1837; Honington, and near Sherrington Hall, *Newb.;* abundant at Great Alne; near Billesley; Drayton Bushes; Binton; Bardon Hill; Marl Cliff; Eatington.

C. palustris, *Linn.* *Marsh Thistle.*
Native: In damp woods, damp waysides, meadows, marshes, and bogs. Common. June to August. Area general.

C. pratensis, *Huds.* *Meadow Thistle; Single-headed Thistle.*
Native: In marshes and damp meadows. Very local. June, July, or later.

I. Packington! *Countess of Aylesford, B. G.*, 1850; bog below Coleshill Pool,! *Bree. Mag. Nat. Hist.*, iii., 165; moist meadows, Merivale, *J. Power*, 1835; Coleshill, *Freeman, Phyt.*, i., 262; marshes, Sutton Park; damp pasture above Olton Pool; meadows by School Rough, Marston Green; Coleshill Pool.

II. Near Wroxhall! *Bree, N. B. G.*; Baddesley Clinton; The Oaks Farm, Kenilworth, *H. B.*

C. acaulis, *Linn.* *Dwarf Thistle.*
Native: In pastures, and on waysides and rubbish heaps, in calcareous soils. Rare. July to September.

II. Opposite Moorhall, on the Bidford Road; and between this place and Red Hill, on the hedge bank, *Purt.* i., 383; Long Compton Hill, *Perry Fl.*, 68; road side, near Harbury (caulescent form), *Kirk, Herb. Per.;* Chesterton! Tachbrook, *Y. and B.;* rough pasture in Rounshill Lane! *H. B.;* Hatton, Beausale common, *H. B.;* near Birdingbury Wharf; lime heaps, Lawford Fields, *R. S. R.*, 1874 and 1878; Honington Park! Tredington, *Newb.;* a white variety and the caulescent form at Chadshunt, *Bolton King;* by Chesterton Windmill; Yarningal common; caulescent form at Itchington Holt.

C. arvensis, *Curt.* *Creeping Plume Thistle.*
Native: In woods, pastures, on banks, heaths, waysides. Common. July to September. Area general. The white variety not unfrequent with type. Var. *setosa*; one patch of this occurred in a field at Milverton! this field is now a potato garden, *H. B.*

I have found a hybrid between *C. crispus* and *C. nutans* in pastures near Coleshill, and Mr. Bromwich finds a hybrid between *C. palustris* and *C. arvensis* in a cornfield at Myton, Warwick.

(To be continued.)

Reviews.

The Colours of Flowers, as illustrated by the British Flora. By GRANT ALLEN. 119 pp. Nature Series, 1882. Price 3s. 6d.

THIS ably written little book is a valuable addition to our botanical literature.

The leading idea of the work, "the derivation of petals from flattened stamens," is well sustained, and ably supported by examples from most of the leading Natural orders of British plants. However much the reader of this work may differ from some of Mr. Allen's conclusions, he will be compelled to acknowledge that throughout the work there are abundant evidences of close and patient study, not merely of written books, but also of the plants themselves in all their various phases. He will see that although he may have collected every British plant, he has still much work of interest and importance awaiting him on every hand, and that time which has possibly been spent in endeavouring to understand the innumerable varieties into which some of our plants run might have been better employed in endeavouring to trace the descent of many of our wayside weeds.

This work will be found to teem with suggestions in this direction, and may be read with interest and instruction by every botanist. "If the botanical reader will provisionally accept the principles laid down in this little book, and will then test their validity by applying them to the flowers which he meets in his daily walks, he will find many other confirmatory examples occur to him at every step. He will find that close inspection reveals some unexpected answer to a superficial difficulty, some solution for the problem of an apparent exception, which can only be obtained by personal examination of the specimen with that particular object held definitely in view."

The work is written in a very pleasant style, and will be charming to even non-scientific readers. The illustrations, of which there are forty-five, are very good; the price so extremely moderate as to place it within the reach of all; and the matter of such extreme interest that Mr. Allen will be sure to have many followers.

This work will be found to be a valuable companion volume to Sir John Lubbock's interesting little book on "British Wild Flowers in Relation to Insects."

J. E. B.

Other Worlds than Ours. By R. A. PROCTOR. Fifth Edition. 318 pp., 14 plates. Price 10s. 6d. Longmans & Co.

THIS is a new edition of one of the most fascinating works on astronomy that has ever been written. Mr. Proctor's rich imagination, curbed and guided by his sound mathematical knowledge, has led him to form new theories on many points concerning the physical condition of our fellow-planets—theories which subsequent research has justified and maintained. The chapters on the Sun, on Meteors and Comets, and on Nebulæ are also of high interest. The coloured plates of Jupiter, Saturn, Mars, etc., are beautifully executed, while the delicacy of those representing nebulæ and fixed stars leaves nothing to be desired.

Elementary Botany. By H. EDMONDS, B.Sc. 207 pp., 308 woodcuts. Price 2s. Longmans & Co.

THIS work has been written primarily for the Science and Art Department's examination in Botany, and, from long experience in preparing students for that examination, we can strongly recommend Mr. Edmonds' book. The definitions are clear and terse; there is enough to satisfy the real student, yet not so much as to perplex him. The illustrations are very numerous, well drawn, and appear to be largely original. There is a useful appendix of 100 questions, and a capital (combined) index and glossary.

Heroes of Science: Botanists, Zoologists, and Geologists. By Prof. P. M. DUNCAN. 348 pp. Price 4s. S.P.C.K.

THE chief personages of whom this work treats are Linnæus, Buffon, Pennant, Lamarck, Cuvier, Hutton, W. Smith, Murchison, and Lyell; but sketches of several less known worthies are added, and the whole is so welded together by the skilful pen and wide knowledge of Professor Duncan, that in this volume we have a general history of the progress of those sections of natural science to which it relates from the time of Aristotle, Pliny, and Theophrastus down to the present day. The book is a thoroughly readable one; it has both a scientific interest and a human interest. In reading it we learn the progress of science by the efforts of individual workers, and our natural interest in the *man* is reflected upon his *work*. This volume may be read with pleasure both by scientific tyros and by veterans.

METEOROLOGY OF THE MIDLANDS.

THE WEATHER OF FEBRUARY, 1883.

BY CLEMENT L. WRAGGE, F.R.G.S., F.M.S., ETC.

The first part of the month—indeed until the 19th—was marked by a continuance of the cyclonic type of weather, with its accompanying rains, resulting floods, and saturated lands. The cyclonic depressions followed each other with wonderful rapidity, travelling along the western coasts of Ireland and Scotland, and skirting a high-pressure area existing over the Western and North-Western parts of the Continent which held its ground with great persistency. Hence, steep gradients, heavy gales, prevalent south-westerly winds, and mild weather, owing to the general course followed by the storm-centres.

A new distribution of pressure came about on the 19th; and an anti-cyclone—probably a "tongue" from the great high pressure region north of the Sargasso Sea—stretched up from south-west, and ultimately encircled nearly the whole of the British Islands. The weather then became fine, the ground dried, and agricultural operations and spring sowing were pushed on apace.

STATION.	OBSERVER.	RAINFALL. Total for M. In.	Greatest fall in 24 hours. In.	Greatest fall in 24 hours. Date.	No. of Rainy days.	SHADE TEMP. Absolute Maximum. Deg.	Absolute Maximum. Date.	Absolute Minimum. Deg.	Absolute Minimum. Date.
OUTPOST STATIONS.									
Spital Cemetery, Carlisle	I. Cartmell, Esq., F.M.S. ..	1·88	0·28	6	15	58·2	20	25·8	1
Scarborough (a).............	W. C. Hughes, Esq., F.M.S.	2·58	0·65	10	17	55·3	27	33·5	1
Blackpool (a)—South Shore..	C. T. Ward, Esq., B.A., F.M.S.	1·87	0·20	10	18	51·2	14	26·6	1
Llandudno (a)	J. Nicol, Esq., M.D.........	2·79	0·53	13	18	54·8	21	32·2	1
Lowestoft (a)	H. E. Miller, Esq., F.M.S...	2·17	0·36	8	15	53·7	22, 24	31·6	20
Carmarthen (a)	G. J. Hearder, Esq., M.D...	6·20	0·91	17	21	53·6	14	30·3	1
Cardiff (a).................	W. Adams, Esq., C.E.	3·73	0·65	10	20	51·7	22	29·9	1
Babbacombe (a).............	E. E. Glyde, Esq., F.M.S. ..	5·68	1·21	1	18	57·6	27	29·2	1
Sidmouth (a)	W. T. Radford, Esq., M.D.	4·81	0·85	10	24	56·3	21	28·8	1
Les Ruettes Brayes, Guernsey (a)	A. Collenette, Esq., F.M.S.	4·33	0·93	10	21	52·3	7, 21	34·8	19
Guernsey (a)	F. Carey, Esq., M.D.	3·89	0·81	8	21	52·5	21	35·2	24
MIDLAND STATIONS.									
HEREFORDSHIRE.									
Burghill (a)	T. A. Chapman, Esq., M.D.	3·61	0·78	1	17	58·7	25	29·6	1
SHROPSHIRE.									
Woolstaston	Rev. E. D. Carr	4·22	0·61	1, 12	20	56·0	21	27·0	1
Stokesay (a).................	M. D. La Touche	3·88	0·87	1	16	59·5	24	29·1	23
Bishop's Castle	E. Griffiths, Esq.	5·26	1·41	1	16	55·0	21	30·0	2
More Rectory................	Rev. A. S. Male............	5·04	1·30	1	21	52·0	21	32·0	23
Dowles, near Bewdley	J. M. Downing, Esq.	2·82	0·63	2	15	..	..	25·0	16
WORCESTERSHIRE.									
Orleton, near Tenbury (a)....	T. H. Davis, Esq., F.M.S. ..	3·35	0·68	1	18	57·5	24	29·0	16
West Malvern	A. H. Hartland, Esq.	3·90	0·65	1	16	55·0	24	30·5	15
Evesham	T. J. Slatter, Esq., F.G.S...	3·26	0·73	10	17	51·0	24	28·5	1
Pedmore	E. B. Marten, Esq.	2·98	0·53	1	16	59·0	24	29·0	15
Stourbridge	J. Jefferies, Esq.	2·73	0·52	1	15	56·0	21	28·0	15
STAFFORDSHIRE.									
Rowley Regis	C. Beale, Esq...............	2·97	0·42s	1, 10	15	51·0	21, 24	29·0	1, 2
Dennis, Stourbridge (a)......	C. Webb, Esq.	2·83	0·53	1	15	57·0	24	30·5	16
Kinver	Rev. W. H. Bolton	2·79	0·48	1	16	55·0	21	29·0	15
Walsall......................	N. E. Best, Esq.	3·03	0·48	10, 12	18	52·0	23	28·0	1, 6
Lichfield	J. P. Roberts, Esq.	2·45	0·44	10	15	59·0	21	31·0	15
Burton-on-Trent (b)	C. U. Tripp, Esq., M.A., F.M.S.	2·38	0·53	10	14	58·0	20, 24	24·0	1
Wrottesley (a)	E. Simpson, Esq.	2·69	0·46s	1	15	54·7	21	27·8	1
Heath House, Cheadle (a) ..	J. C. Philips, Esq., F.M.S.	2·19	0·32s	1	17	55·5	24	30·0	1
Tean (b)	Rev. G. T. Ryves, M.A., F.M.S.	2·53	0·32	1	18	57·0	24	29·0	16
Oakamoor, Churnet Valley (a)	Mr. Williams	3·49	0·71	11	18	[illegible]	21	28·0	1
Beacon Stoop, Weaver Hills (a)	Mr. James Hall	2·87	....	....	..	51·8	..	28·0	..
DERBYSHIRE.									
Stony Middleton	Rev. U. Smith	2·99	0·49	11	15	58·0	21	30·0	1
Spondon	J. T. Barber, Esq...........	2·73	0·73	10	16	..	..	..	..
NOTTINGHAMSHIRE.									
Park Hill, Nottingham (a) ..	H. F. Johnson, Esq.	2·86	0·88	10	18	57·2	24	31·6	2
Hodsock Priory, Worksop (a)	H. Mellish, Esq., F.M.S. ..	2·73	0·51	10	17	56·6	21	25·4	1
Strelley (a)	T. L. K. Edge, Esq.	3·00	0·83	10	17	56·9	24	27·6	1
Tuxford	J. N. Dufty, Esq., F.G.S. ..	3·02	0·73	10	14	52·0	21	25·0	1
LEICESTERSHIRE.									
Loughborough (a)...........	W. Berridge, Esq., F.M.S...	3·03	0·58	10	15	57·8	24	26·4	1
Syston	J. Hames, Esq.	2·71	0·70	10	20	55·0	21, 24	28·0	1
Town Museum, Leicester	J. C. Smith, Esq.	3·19	0·69	10	14	57·0	24	31·5	16
Ashby Magna	Rev. Canon Willes	3·43	0·66	10	16	54·0	21, 24	26·0	16
Waltham-le-Wold	Edwin Ball, Esq.	2·93	0·84	10	17	52·0	24	30·0	16
Coston Rectory, Melton (a) ..	Rev. A. M. Rendell........	3·10	0·76	10	18	56·0	24	29·0	1
WARWICKSHIRE.									
St. Mary's College, Oscott ..	Rev. J. W. Brown, ...	3·01	0·58	10	15	57·8	24	28·2	1
Henley-in-Arden	T. H. G. Newton, Esq.	3·45	0·77	10	17	57·0	24	27·0	1
Park Hill, Kenilworth (a) ..	T. G. Hawley, Esq.	2·93	0·60	10	14	55·8	24	28·6	1
Kenilworth (a)	F. Slade, Esq., C.E., F.M.S.	3·00	0·60	10	17	56·1	24	26·7	1
Rugby School (a)	Rev. T. N. Hutchinson	3·41	0·66	10	16	58·8	24	28·0	1
NORTHAMPTONSHIRE.									
Pitsford, Northampton	C. A. Markham, Esq.	3·51	0·73	10	15	55·0	21, 25	30·0	1, 2
Towcester	J. Webb, Esq.	4·21	0·80	10	16	..	..	..	..
Kettering....................	J. Wallis, Esq.	3·28	0·63	10	17	54·0	22	30·0	1
BEDFORDSHIRE.									
Bedford (a)	H. J. Sheppard, Esq.	2·53	0·49	10	16	55·8	24	28·6	1
WILTSHIRE.									
Marlborough (a)	Rev. T. A. Preston, F.M.S.	5·50	1·13	0	19	52·7	28	30·9	16
GLOUCESTERSHIRE.									
Cheltenham (a) *	R. Tyrer, Esq., B.A., F.M.S.	4·60	0·57	2	..	..	..	..	..

(a) At these Stations Stevenson's Thermometer Screen is in use, and the values may be regarded as strictly intercomparable. (b) Glaisher's pattern of Thermometer Screen employed at these stations.

* The Temperature Values for Cheltenham were unfortunately torn off in course of post.

Mean pressure was about 30·010; the highest mean reading of the barometer, 30·760, happened on the 23rd—24th, and the lowest, 28·935, on the 2nd.

Temperature was above the average, and the mean value may be stated as 41·5. Some eighteen grass frosts were observed; and only three frosts at four feet above ground. The mean amount of cloud was 6·5 (scale 0 to 10), and relative humidity 91%. The absolute maximum in sun's rays was 117·3, at Stokesay, on the 24th; and the absolute minimum on grass 20·7, on the 16th, at Strelley. Bright sunshine 74·8 hours or 28% at Hodsock, 71·3 hours or 26% at Strelley, and 71·4 hours at Blackpool. The mean temperature of the soil at one foot was 39·7 at Hodsock, 39·3 at Strelley, and 42·6 at Cardiff. At four feet at Cardiff 45·2 was the value.

The mean amount of ozone was 5·0 at Carmarthen, and 7·4 at Blackpool. Lunar halos on 12th, 16th, 19th, and 21st. Some snow and hail between the 11th and 19th, with electrical disturbances.

Notes by Observers.—*More Rectory*.—Blackbirds, thrushes, and chaffinches in full song, and vegetation very forward. *Tean*.—The bright sunshine and dry searching winds which prevailed during the last ten days effected a wonderful improvement in agricultural prospects in this district. *Oakamoor*.—Blackbirds and thrushes heard in the Churnet Valley Woods on the 1st. All spring flowers in full bloom.

Correspondence.

As we are not far from a sunspot maximum it is worthy of note that on February 24th, on carefully scanning the sun's disc with an instrument of 2¾ inches clear aperture, I could not detect one single spot.—Clement L. Wragge, Edinburgh.

The Weather, it seems, like history, repeats itself. The Rev. J. C. Bloomfield writes from Launton Rectory that the following record of the weather is written on the fly-leaf of a Register of Bicester Church:—"June the 19th, 1763. It began raining and continued mostly wet weather till the begining of February, 1764, and a perpetual flood for the most part of November, December, January, and the beginning of February—fifteen weeks."—J. M. Downing, Dowles, near Bewdley.

Vagaries of the Season.—In a garden in the southern suburbs of Birmingham the following flowers were gathered on New Year's Day in the present year:—Christmas Roses, Erica carnea, Tussilago fragrans, Primroses, Polyanthuses, Blue Hepaticas, and a bud of Gloire de Dijon rose. A new shoot of Clematis Jackmanni measured 6in. in length; new growth on rose bushes from 1in. to 2in. long, honeysuckles were breaking into leaf, and many other plants showed signs of growth. About noon on the same day, a number of gnats were seen flying about as though spring had arrived. To-day (March 24th) how changed is everything in the same garden; spring flowers of many kinds which three weeks before were plentiful are now all cut up by frost and the east wind; all kinds of trees and shrubs look miserable in the extreme, and have I fear, suffered severely.—E. W. B.

Breedon and Cloud Hill Lime.—Will one of your correspondents inform me what are the constituents of Breedon and Cloud Hill lime? Also what in particular renders them unfit for agricultural purposes?—E. A. Green.

Early Spring Flowers.—January 29th—*Primula vulgaris*, Primrose. February 9th—*Potentilla Fragariastrum*, barren Strawberry; 14th—*Viola odorata alba*, White Violet; *Mercurialis perennis*, Dog's Mercury; 15th—*Ranunculus Ficaria*, Lesser Celandine; 18th—*Taraxacum officinale*, Dandelion; 25th—*Tussilago Farfara*, Coltsfoot.—O. M. F., Frankton Rectory, Oswestry, Salop.

Heralds of Spring.—February 18th—A gloriously warm, sunny day, bringing out the Honey Bees in plenty. 23rd—The Mason Bee *(Anthophora retusa)*, with its musical pipe and lightning-like flight, only resting a moment, poising over some open flower to sip the first nectar of spring, and then on again in its rapid flight. This bee makes its burrows in sandbanks exposed to the south, also in the mortar of old walls, and where it is plentiful I would advise entomologists to search its nest for the rare Parasitic Beetle *(Sitaris humeralis)*, and in a short time the beautiful silver-striped Parasitic Bee *(Melecta argentata)* will make its appearance I have taken both of these parasitic insects in localities where Anthophora occurred. Another insect that always appears with the first hot weather is the Biting Sand-fly *(Simulium reptans)*. It is a most persevering blood-sucker. The organs of the mouth will well repay careful study, as also will those of its larvæ, which I have just seen for the first time. February 28th.—I observed, besides these two insects, *Bombus terrestris;* and on March 5th, the first Tortoiseshell Butterfly *(Vanessa urticæ)* and the Wild Bee *(Andrena albicans)*. In a wood near Woking, of about ten acres extent, the ground is literally carpeted with the Wild Daffodil *(Narcissus pseudo-narcissus)*, which, seen for the first time, will never be forgotten. March 6th.—The weather changed suddenly, commencing with 6° of frost, increasing to 14° last Saturday night.—Fred. Enock, Ferndale, Woking Station, March 16th, 1883.

Anomalies of the Season During March, 1883.—Throughout the Winter, since the middle of December last, the weather has been extremely mild up to the beginning of March, primroses here (where we are rather bleak) remaining in flower most of the time. On Sunday, the 4th (a beautiful day), I saw a Rhododendron in a neighbour's garden with two very fine flowers quite open; and a week previously we pulled Rhubarb from our garden which had not been covered up at all during the winter. After the almost Arctic weather that has prevailed since the 6th, a very different sight presented itself at the back of the Town Hall, Birmingham, yesterday, the 22nd, in the middle of the day. Near the fountain of the Chamberlain Memorial are a few evergreens. One of these, two or three feet high, standing in a tub—an *Aucuba* or allied plant, for it was difficult to make out its species as the leaves were blown off—was in a position that enabled it to receive the fine spray driven from the fountain by the bitter east wind. It was, by the sharp frost prevailing, consequently encrusted with ice all over the stems, from which here and there an icicle of several inches in length depended. The cylindrical ice was in many parts more than an inch in thickness and the plant presented a singular appearance, very like a beautiful stalactite. Several other plants near it were also encrusted with ice, reminding one of the photographs of Niagara during the winter months.—W. R. Hughes, Handsworth Wood, Good Friday, 1883.

WORCESTERSHIRE PLANTS.—I am desirous of forming a Herbarium exclusively of Worcestershire plants, specimens of both common and rare species, with their varieties, being wanted from each of the four botanical districts—(see "The Botany of Worcestershire," by Mr. Edwin Lees). At present I do not propose to collect any cryptogamous orders, excepting those enumerated in the London Catalogue, 7th edition—viz., Filices, Lycopodiaceæ, Marsileaceæ, Equisetaceæ, and Characeæ. My own specimens chiefly represent the Malvern district, and to those botanists who collect in other parts of the county I should feel much obliged for assistance in forming this collection, which, I need scarcely say, while in my possession, would be at the service of any who might wish to consult it. I should, of course, be pleased to supply as far as I could the wants of others from the plants of this neighbourhood. There are many Malvern and Teme Valley plants also which I should be very glad of.—R. F. TOWNDROW, 2, Commercial Buildings, Malvern Link, March 16th, 1883.

Gleanings.

NOVELS AND SCIENCE.—In Mr. Hardy's new book (*Two on a Tower*) the author shows that he has been studying astronomy to good purpose. The hero is enthusiastically devoted to the study of the stars, and the heroine is a wealthy lady, who presents him with a fine telescope! This book is another illustration of the rapid strides which science is making, and of the manner in which it is becoming part of the daily life, nay, even of the amusements of every educated person.

THE STUDY OF SOCIOLOGY.—The Committee of "The Birmingham Natural History and Microscopical Society" have, on the request of fifteen of its members, and in accordance with the provisions in their rules, unanimously resolved to form a new section, to be called "The Sociological Section for the study of Mr. Herbert Spencer's system." The Spring Meetings of the Section will be on Thursdays, May 3rd and June 7th, at 7 o'clock in the evening, at the Mason College. The subject chosen for consideration and discussion at these first meetings is Mr. Herbert Spencer's "Essay on Education." The discussion at the May Meeting will be opened by Mr. W. Greatheed. Full particulars respecting the organisation of the Section, which will be open to the members of the Society, may be obtained of Mr. Alfred Hayes, B.A., Hon. Sec., Prospect Road, Moseley.

FACTS ABOUT PLANTS.—In his recent and very interesting work on Plant-life (*Freaks and Marvels of Plant Life, 463 pp., 97 woodcuts, 6/6, S.P.C.K.*), Dr. M. C. Cooke estimates the number of living species of plants of all kinds at not less than *half a million!* Among these, the middle position, in point of size, would be occupied by, say a moss of an inch and a half in height; for, on the one hand, the microscope will disclose to us water-plants (*algæ*) consisting of a single cell barely the 2500th part of an inch in diameter, while, on the other, the Eucalypti of Australia tower to a height of 420 feet. Dr. Cooke's book teems with most interesting accounts of vegetable wonders, including the rain-tree, carnivorous and sensitive plants, plants which mimic other plants, light-giving plants, mystic plants, etc. Everyone who cares at all for flowers (and who does not?) will here find something to interest, to please, and to instruct.

MARINE EXCURSION.—The Birmingham Natural History and Microscopical Society have resolved to have a second Marine Excursion at Oban this summer. The great success of the last excursion to this charming and salubrious part of Scotland, coupled with the fact that Mr. W. P. Marshall, M.I.C.E., and Prof. A. Milnes Marshall (who recently obtained the Darwin Prize awarded to Biology by the Midland Union) have still to determine some important points connected with the Pennatulida, have influenced the Committee in this decision. The time fixed for the Excursion is from Friday evening, 29th June, to Tuesday, 10th July. Committees have been appointed for Transport and Commissariat and Dredging arrangements. Information about the Excursion may be obtained from Mr. John Morley, Hon. Sec. to the Society, Sherborne Road, Balsall Heath, Birmingham.

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—GEOLOGICAL SECTION.—February 27th.—Mr. W. J. Harrison, F.G.S., was re-elected chairman, and Mr. A. H. Atkins, B.Sc., secretary for the ensuing year. Dr. H. W. Crosskey read a very interesting paper on "Recent Investigations in the Glacial Geology of the Midlands." He described three localities where he had found remarkable traces of glacial action. The first was a section in the Lias at Stockton, near Rugby, where a mass of boulder clay overlies a Lias bed. The clay is much contorted, and contains fragments of millstone grit, quartzite, granite, flints, and striated Lias pebbles. The second locality was at Mochas Bay, near Barmouth, where a large number of angular boulders, derived from the neighbouring mountains, are found on the sea coast near the water. Above these, nearer the shore, is found a bed entirely composed of shells and fragments of shells and rock, and this in turn is succeeded by the ordinary sea-shore sand. This section indicates glacial conditions, followed by a subsidence of the land, when a varied molluscan fauna abounded in the bays and estuaries. This was succeeded by an elevation, and the accumulation of sand which is going on now. The third phenomenon described was a curious series of striated and polished blocks of basalt, or Rowley Rag, found in some clay beds on the Rowley Hills, which apparently could not have been so acted on except by ice action. He thought that it was quite possible that about the time of the Glacial epoch the Rowley Hills and other similar elevations might have been islands in the Glacial Sea, and that the comparatively small ice masses on them might have caused the effects mentioned. BIOLOGICAL SECTION, March 6th.—Mr. J. E. Bagnall exhibited *Dicranum montanum* (new to Worcestershire), *Bryum roseum* and *Leucobryum glaucum*, from Shrawley Wood; *Targionia hypophylla*, and *Kantia arguta*, from Habberley Valley; and *Usnea hirta* and *Bæomyces rufus*, from Shrawley and Stourport. Mr. T. Bolton exhibited *Hemidinium nasutum*, an Infusorian which he discovered, for the first time in Britain, in Sutton Park last month. It somewhat resembles *Peridinium tabulatum*, but is only half as large, and the equatorial groove extends only half-way round the body. It is described in Stein's recently published volume. Mr. W. B. Grove exhibited the following fungi:—*Sphæria aquila*, *Hypomyces aurantius*, and *Trichia chrysosperma*, from Sutton; *Sphæria pulvis-pyrius*, and *Diatrype stigma*, from Uffmoor Wood, Halesowen; and a remarkably large specimen of *Polyporus betulinus*, from Harborne, measuring thirteen inches across, and six inches thick. Mr. W. Greatheed then read a paper entitled "An Evolutionist's Notes on Transmigration," in which he showed how our predecessors had a glimpse of one of the truths of evolution as revealed by Darwin, namely, heredity. He began with a quotation from Plato, in which Socrates clearly set forth the view that the present is, consciously or unconsciously, the possessor by inheritance of all the treasures of knowledge painfully acquired by the past. The doctrine of transmigration, as believed by the Greeks, the Hindoos, and the Jews, has not the meaning which we are accustomed to attribute to it. That the souls of men pass, after their death, into the bodies of animals, is an absurd addition to the real truth, which is that the descendants of each living being inherit therefrom a portion of their mind as well as a portion of their body. The savage—nay, the more educated man, who perceives how the children inherit the mental and physical characteristics of their parent may be excused for believing that the soul of the latter has migrated into the former. Mr. Greatheed showed by examples how each higher group of animals inherits the experiences and feelings of all those below it, and how man himself, passing as he does in his development, though in a curious abbreviated way, through all the gradations of structure which mark the classes below him, inherits more or less the physical and mental attributes of all the animals from the amœba to the anthropoid ape. Increasing complexity of structure is indissolubly connected with increasing complexity of mind. The ancients had then a dim anticipation of the reality; the past was not "golden," any future destiny to which man may attain must be nobler than any of those through which his ancestry has already passed. The paper, which was of a highly philosophical character, was much applauded; and a discussion followed, in which Mr. S. Wilkins said that the writer's aim was to show how there lay in man the potentiality of a higher life, to which the human race, by a continuance of the evolution which had made it what it was, must in time attain. BIOLOGICAL SECTION.—March 13th. — Mr. Bagnall exhibited Lichens: — *Parmelia conspersa* and *Parmelia physodes*, various localities; *Ramalina farinacea* and *Ramalina fraxinea*, from Hampton-in-Arden; *Peltigera spuria* (rare), Hampton-in-Arden, new to Warwickshire. Fungi : — *Ascobolus denudatus*, from Handsworth (new to district ; *Comatricha Friesiana*, one of the Myxomycetes, from Handsworth (new to Stafford), for Mr. G. S. Tye; *Peziza cochleata*, from near Bewdley (from Dr. Arnold Lees). Mr. W. B. Grove exhibited Fungi: — *Auricularia mesenterica*, *Arcyria incarnata*, *Chondrioderma physarioides*, and *Rhizomorpha*, from Sutton; *Peziza stercorea*, from Quinton; *Zasmidium cellare* and *Podisoma Juniperi*. Mr. J. F. Goode exhibited Ova of Cleanser Swimming Crab (*Portunus depurator*), and of Masked Crab (*Corystes cassivelaunus*). GEOLOGICAL SECTION.—March 20th.—Mr. T. H. Waller exhibited a thin section of Foraminiferal limestone (carboniferous) from North Wales. Mr. W. G. Blatch exhibited *Cryptarcha strigata* and *Cryptarcha imperialis*, two species of Clavicorn bettles found at Knowle, and new to the district. Mr. J. E. Bagnall exhibited four lichens—*Lecanora atra*, *L. ulmicola*, *L. varia*, and *Pertusaria communis*, from various localities. Mr. W. B. Grove exhibited two interesting species of Myxomycetes—*Hemiarcyria rubiformis* and *H. clavata*, and two species of Torulacei (almost the simplest kind of fungi)—*Bispora monilioides* and *Speira toruloides*, all from Sutton, and all new to the district. Mr. Bagnall then read some "Notes upon Plants collected at Hunstanton, Norfolk, by Mr. R. W. Chase." He gave a brief account of the distribution of the plants which he exhibited, and read extracts upon their peculiar medicinal virtues from the quaint old herbals of Gerarde, Parkinson, and Culpepper. Among the most noticeable were *Suæda fruticosa*, and several species of *Statice* or Sea Lavender, which occupy several acres of marshy ground near Hunstanton, and when in bloom in August make a splendid show. He afterwards made some general remarks upon the distribution of plants, with especial reference to the predominance of the Scandinavian flora, the occurrence of which in so many parts of the world, in conjunction with such diverse native floras, he showed could be accounted for by the theory of the Glacial Epoch.

NOTTINGHAM NATURALISTS' SOCIETY.—February 20th.—An interesting and able paper on the "Rhætic Beds of Nottinghamshire" was read by Edw. Wilson, F.G.S., illustrated with numerous specimens, diagrams, and maps. Twenty-five new members were elected and six proposed at this meeting.

MIDLAND UNION OF NATURAL HISTORY SOCIETIES.

The Annual Meeting of the Union for the year 1883 will be held at Tamworth on Tuesday and Wednesday, June 12th and 13th, under the presidency of Mr. Egbert de Hamel. The local arrangements, under the direction of the Tamworth Natural History, Geological, and Antiquarian Society, are already well advanced. On the first day the Council Meeting will be held at 12, and the Annual Meeting at 3, in the banqueting hall of Marmion's Castle (by kind permission of T. Cooke, Esq.). For visitors who are not members of the Council, arrangements will be made to conduct a party over the antiquarian remains in which Tamworth is so rich, including the Earthworks surrounding the old town, the Church, the Moat House, and the Castle. Various manufactories may also be inspected, including Messrs. Hamel's Tape Mills, the Pottery Works, etc., while, if the weather is fine, a botanical excursion in boats on the River Anker will doubtless prove a most attractive feature.

In the evening a Conversazione will be held in the Town Hall.

On the second day of the meeting, Wednesday, June 13th, excursions will be made to Hartshill and to Lichfield. The Hartshill excursion will follow the old Roman road, called Watling Street, in a south-easterly direction, examining *en route* Polesworth Nunnery, Merivale Abbey, Oldbury Fort, the tumuli, Castle, and quarries of Hartshill, Mancetter Church, and home by Atherstone; the newly-discovered Cambrian rocks, which form the Hartshill ridge, will be studied, and the line of country taken is specially favourable to geological and antiquarian inquiries.

The Lichfield Excursion will proceed by Drayton Manor (Sir Robert Peel's seat), along Watling Street, in a north-westerly direction (examining Hint's Tumulus and Off Low); thence to the Roman station of Etocetum, and on to Lichfield, where the Cathedral will be visited, and also Dr. Johnson's statue and house. The return journey will be by Borrow Cop Hill, Whittington Heath, Hopwas Wood (through which the party will walk), and so home. This Excursion will be rich in botanical and antiquarian attractions.

Tamworth will be reached in the evening by each party before 7 p.m., so as to catch the various trains.

Considering that the Midland Union may be said to have had its inception at Tamworth, in 1876, and knowing also the energy of the members of the Tamworth Natural History Society, we confidently look forward to a numerously-attended and very successful meeting.

Change of Address.—Hon. Secretaries and Members of the Midland Union generally are requested kindly to note the new address of the General Hon. Sec.:—

Mr. W. Jerome Harrison,
365, Lodge Road, Birmingham.

REMARKS ON THE PEN PITS AND OTHER SUPPOSED EARLY BRITISH DWELLINGS.

BY HORACE B. WOODWARD, F.G.S.

At the western end of what was once the great forest of Selwood, and near the junction of the three counties of Wilts, Dorset, and Somerset, a considerable tract of country is found to be broken up by numerous circular hollows, which are generally known as the Pen Pits. Their more precise situation is between the towns of Mere in Wiltshire, and Wincanton in Somerset, and just in the bounds of the latter county.

Of their antiquity there is for the most part no question. Indeed it has been asserted that they were overgrown with large oaks in the time of the Saxons; but their purpose has been a fertile source of controversy among antiquaries ever since much attention was bestowed upon the subject. The more commonly received opinion has been that the excavations were originally intended as Pit-dwellings, and that hence we have evidence, at this place, of one of the earliest and one of the largest British villages in the country.* Sir John Lubbock has observed that "Many of the dwellings in use during the Bronze Age were no doubt subterranean or semi-subterranean. On almost all large tracts of uncultivated land, ancient villages of this character may still be traced. A pit was dug, and the earth which was thrown out formed a circular wall, the whole being then probably covered with boughs."†

That the Pen Pits were British habitations was the view taken by Sir Richard Colt Hoare, whose residence at Stourhead gave him ample opportunities for investigating the matter, and in his "Ancient History of South Wiltshire" (1812), and "History of Modern Wiltshire" (1822), he has given many details about the pits. In form they are like inverted cones or "punch-bowls," varying from three to forty feet in diameter, in some instances being double, with a slight partition of earth, and they exhibit great regularity. He observed that formerly they extended over 700 acres of land. Another explanation is that the Pen Pits were simply opened for the purpose of obtaining stone, and this view has recently been supported by members of a Committee appointed by the Council of the Somersetshire Archæological and Natural History Society. The members were—General Lane-Fox (now Pitt-Rivers), the Revs. Prebendary Scarth, J. A. Bennett, J. H. Ellis, H. H. Winwood, T. W. Wilkinson, and Mr. W. Müller. The ground in which the pits have been made, is formed of the Upper Greensand, which was ascertained to comprise a top layer of chert and

* T. Kerslake: "A Primæval British Metropolis," Bristol, 1877; and T. Wright: "The Celt, the Roman, and the Saxon," edit. 3, 1875, p. 115.

† "Prehistoric Times," edit. 2, p. 52.

rubble, succeeded by five feet of sandstone (locally called Penstone), resting on green and buff-coloured sand, of which a thickness of thirty-two feet was proved.

The Greensand forms an escarpment, called Penridge, facing the west, and overlooking a vale of Oxford and Kimeridge (?) clays. To the east of this high ground a lateral valley has been hollowed out through the Greensand to the clay beneath; and in this deep and ramifying valley, in what are now the picturesque grounds of Stourhead, rises the river which gives its name to the place, and to the adjoining village of Stourton.

Upon two spurs of the Greensand bordering the Stour valley, and not far to the east of Penzlewood (or Pen Selwood) Church, the excavations are found. These are separated by Rose Combe, to the south of which are the Pen Pits proper, those on the north being called the Gaspar Pits. At the eastern end of the Gaspar promontory are remains of earthworks, and a keep called the Castel—fortifications which the Committee decide to be probably Norman, if not earlier. But a most interesting conclusion which they formed was that prior to the erection of these earthworks excavations had been made for the purpose of obtaining Penstone. Further investigations among the Gaspar Pits revealed only evidence of workings for stone, and not of habitations. In all cases the pits had been partially refilled by subsequent weathering and falling in of the sides.

Turning their attention to the Pen Pits proper, the Committee made an examination of two deep cone-shaped pits, where the usual rubble of chert, sand, and penstone was met with, and nothing found but a few fragments of charcoal and chalk-flint. A block of penstone, with tool markings, was the only object of any importance worthy of notice. The results of this investigation of the Committee, "showing an entire absence of pottery, or any other trace of human occupation, warrant them in concluding that, in spite of any preconceived opinions to the contrary, these pits were never intended for the purpose of dwellings but that they were the work of people who had dug into the surrounding high grounds in search of that hard bed of Greensand rock—locally called Penstone—lying close to the surface, beneath a *débris* of chert and rubble, which must have been of as great value to them for their various purposes, whether for millstones, querns, or the more prosaic erection of cottage walls, etc., as it is to the cottagers of the present day who live in the neighbourhood, and are constantly digging into the surface of the broken ground for similar purposes."*

While this is the general result expressed in the Report, it should be added that, owing to the limited tract investigated, several members of the Committee are of opinion that farther research is desirable before any conclusive evidence against a very early settlement can be arrived at. Whatever decision may ultimately be formed on this question, there is no doubt that openings have been made for stone, and Mr. Alfred Gillett told me several years ago that material for

* "Proc. Somerset Archæol. and Nat. Hist. Soc." vol. xv.

scythe-stones had been obtained from the Pen Pits, and it was a more compact rock than that used for the Devonshire batts at Broadhembury, near Honiton.* During an excursion made under his guidance to Penzlewood in July, 1881, we noticed that holes similar to the Pen Pits are now occasionally dug for the purpose of obtaining chert and rubbly greensand for mending roads.

This explanation of the origin of the Pen Pits makes it interesting to inquire into the meaning of other pits that have been regarded as dwellings.

Among the more important of these are Cole's Pits, near Faringdon. in Berkshire—old pits extending over fourteen acres. These have been considered to be the remains of early British habitations; and the largest, as we are informed by Mr. E. C. Davey, has been assigned to no less a personage than "King Cole." Mr. Godwin-Austen and Mr. Davey have, however, shown that the pits are simply the remains of old workings for sandstone and iron-ore, in the sponge-gravel of Neocomian (Lower Greensand) age.†

In Yorkshire Professor Phillips described a number of circular pits, considered to be the bases of British huts. He observes that "In general, as in the double series which encircles the summit of Rosebury Topping, only circular hollows appear—not unlike swallow-holes. But at Egton Grange, in Eskdale, the cavities, which vary in diameter from eight to eighteen feet, and in depth from three to six feet, have a raised border of earth and stones, with usually an opening on one side. Some have been built round within in the form of a well."

"Killing Pits, one mile south of Goadland Chapel; Hole Pits, a little south of Westerdale Chapel; a few near Ugthorpe; and a large group between Danby Beacon and Wapley, have the same general characters. In the last situation they are ranged in two straight lines, as if on two sides of a street. The pits are about ten feet in diameter."‡ Prof. Phillips described the "pit-houses" as tapering huts constructed of wood on a circular basis. In short, after the ground was excavated, it was supposed that branches of trees were placed to form a conical roof, which, perhaps, might be made weather-proof by wattling, a covering of rushes, or sods.

Referring to these pits, Mr. Clement Reid writes to me (7th Dec., 1882):—"All of them are undoubtedly old ironstone mines. Both [Mr. George] Barrow and I came to this conclusion when [geologically] surveying the country, and though the Rev. J. C. Atkinson, who, I believe, is the principal authority for the pit-dwelling theory, objected at the time, I have lately been corresponding with him, and in one of his letters he says, "I give up the idea of British settlements entirely now." Mr. Reid adds that "the pits are always associated with heaps of ironstone slag, and pieces of the stone are scattered about in the neighbour-

* "Geology of East Somerset," etc. (Geol. Survey Memoir), p. 139.

† "Quart. Journ. Geol. Soc.," vol. vi., p. 459; and "Trans. Newbury District Field Club," vol. ii. Reprinted, Wantage, 1874.

‡ "Rivers, mountains, and sea-coast of Yorkshire," p. 109.

hood. 'The raised border of earth and stones' is simply the waste tipped round the edge of the pit, as they always do at the present day. The 'opening on one side' was of course necessary for getting to the mouth. Nearly all the pits are constantly full of water in wet weather. The date of the ironstone workings is generally about the end of the fourteenth and early part of the fifteenth centuries."

"Though these 'British settlements' have to be given up, I found a *real* one on the [Yorkshire] moors. It consisted of a number of circular depressions a few inches deep, *not pits*, which were made simply by paring off the peaty turf so as to get a dry sandy floor. In each were a number of flint flakes and spoilt tools, very often calcined; the manufacture seems to have been carried on inside the hut, for very few occurred away from the circles. The flint is *black* flint, which must have come from South Lincolnshire or Norfolk."

Mr. Davey has mentioned (in his work previously cited) that "In the Ashmolean Museum, Oxford, is preserved a model of an entire ancient village which was recently disclosed at Standlake [near Witney]. The Curator informed me that some of the pits were four feet wide and two feet deep, while even the largest did not exceed six feet in diameter and four feet in depth."

On the Greensand hills of Devonshire there are numerous hollows which have been described as iron pits by Mr. P. O. Hutchinson. Thus he mentions hollows near Kentisbere and other places, which are sometimes called "Ash Pits." Others occur near Dunkeswell, varying from eight to ten feet deep, and from twenty to thirty feet in diameter. Bits of ironstone and hæmatite were noticed in the neighbourhood. He observes that, "There are numerous pieces of scoria to be found in the fields near Nortchcott, in the parish of Uffculme * * * indicating that there had been a smelting-place not far off. In a field at Tudborough, near Hemyock, the plough continually turns up cinders, and doubtless there had been a bloomary or melting-pit near them."*

In accounting for the groups of pits that occur in so many places, Mr. Hutchinson quotes† the following passage from Smiles' "Industrial Biography," which refers to some old pits found at Leeds:— "In seeking for ore, the excavator seems to have dug a pit about six feet in diameter, though this size of course much varied; and when he came down to the ironstone, he worked away all round as far as he could go without letting the sides fall in. Instead of advancing straight forward, and digging back or throwing back, as the phrase is, or instead of proceeding to make a gallery excavation, as the miners call it, he got out of his pit and then sunk another."

On the Mendip Hills the old mining operations are generally indicated by shallow pits sunk near to one another, or by long lines of excavations, when a vein has been followed at the surface.

According to Mr. W. Topley, the ironstone workings in the Weald were mostly bell-pits, about six feet in diameter at the top, and widen-

* "Trans. Devon Assoc.," vol. v., 1872, p. 48.
† "Trans. Devon Assoc.," vol. v., p. 48.

ing below; they were rarely more than twenty feet deep, and are generally filled with water. Sometimes they were connected by levels.*

It has been remarked that the so-called Pit-dwellings were so constructed in reference to soil that they will hold no water—an essential feature in the hypothesis. But, as Mr. Davey has pointed out, holes of all shapes and sizes have been termed pitsteads, from small and shallow excavations to pits 45 feet broad and 140 feet in depth!

In many parts of Norfolk, where the Glacial sands and gravel cover considerable areas, and have given rise to tracts of heath, old Pit-dwellings have been described. Among the localities mentioned are Weybourn, Edgefield, Aylmerton, Marsham, Roughton, Beeston, Mousehold, and Eaton. At Weybourn, Mr. H. Harrod estimated that there were about 1,000 pits, some containing burnt bones and urns. The pits were stated to be bowl-shaped, from 8 to 20 feet in diameter, 2 to 6 feet in depth, and mostly 12 feet by 3 in breadth.† The urns found were stated to be Celtic.

In a communication made to the Norwich Geological Society in 1868, the Rev. A. R. Abbott expressed his opinion that the pits in the neighbourhood of Runton and Weybourn were remains of early British (?) iron-workings, for the oxide of iron in the gravel. He obtained large lumps of iron silicate or slag. The pits were some of them circular, with the sides evidently formed of stones, and a hole in the centre, in which fires had been made.‡ Mr. Abbott has subsequently informed me (May 2nd, 1882) that the appearances were certainly such as would, in his opinion, have supported the view that there had been habitations on the same spot where smelting had evidently been carried on.

On Marsham Heath are numerous shallow pits varying from about 5 to 12 feet in breadth, opened in the Glacial gravel and sand, and now overgrown. I saw (in 1880) many of these in company with Mr. R. J. W. Purdy, who obtained the services of a resident keeper to dig in one of them. At the depth of a foot from the bottom of the pit undisturbed gravelly sand was reached, and nothing to indicate human occupation was observed. The man informed us he had been told by his father that "the soldiers" were encamped on the heath many years ago, and he pointed to some of the larger pits as belonging to officer's tents. Such was the tradition of the place.

Referring to the supposed vestiges of British residences in Norfolk, the Rev. George Munford has remarked that "the conjecture is very doubtful.§" Even the excavations called Grimes Graves on Weeting Heath, near Brandon, which were supposed to be cave dwellings of the early inhabitants of the district, have been shown by Canon Greenwell to be workings for flint that extend back to Neolithic times. And

* "Geology of the Weald," p. 334.

† "Norfolk Archæology," vol. iii., pp. 232—240, 1852.

‡ *Norwich Mercury*, Sept. 16th, 1868; see also C. Reid, "Geology of the Country around Cromer" (Geol. Survey), p. 134.

§ "Local Names in Norfolk," p. 5.

he has suggested that the Pen Pits may have had their origin in a similar process of mining.*

Edward King has alluded to the conical pits on Mousehold, near Norwich, with which he was inclined to class Pen Pits.† These may all have been sand or gravel pits.†

On Edgefield Heath there are several pits; one occurs west of the Holt and Edgefield Road, a little north of the 20th milestone. It was 10 yards across and 8 feet deep, and appeared to be simply an old gravel pit. Similar pits occur on East Rudham and Syderstone commons.

Diggings are frequently made in Norfolk for "stone," that is for flint boulders to be used for building purposes, and when a sufficient quantity of material has been obtained the pit may be abandoned. Such a method of working, especially on heath-lands, may have been more common in former years, when the boulder gravel was obtained for building the greater part of the Norfolk Churches, for many walls, and for paving as well as road-mending.

The irregular occurrence of the gravel, in shoals or masses of uncertain extent in finer gravel and sand, may partly account for the irregular workings. Moreover the boulder gravel often occurs at the surface resting on sand, and it may have been easier to open a fresh pit when stone was wanted, than to enlarge the old one and haul the material from it. Some old pits, as Mr. T. G. Bayfield has suggested to me, may have been made by charcoal-burners; others of course may have been used as the foundations of dwellings, but of this we want in Norfolk more positive evidence.

The miscellaneous information here brought together may perhaps be useful in stimulating further inquiry into the interesting subject of Pits and Pit-dwellings.

THE FLORA OF WARWICKSHIRE.

AN ACCOUNT OF THE FLOWERING PLANTS AND FERNS OF THE COUNTY OF WARWICK.

BY JAMES E. BAGNALL.

(Continued from page 88.)

COMPOSITÆ *(continued)*.

CARLINA.

C. vulgaris, *Linn.* *Carline Thistle.*

Native: On heaths, banks and pastures, in marly and calcareous soils. Rare. July, August.

I. Marly banks near Arley Village.

II. Oversley Hill, *Purt.* ii., 386; between Leek Wootton fields and Ashow; Welcombe Hills, near Stratford, *Perry Fl.*, 68; Green's Grove, Hatton, *Herb. Per.;* near Birdingbury, *R. S. R.;* Hatton, Harbury, *H. B.;* Wellesbourne; Lighthorne, *Bolton King;* Yarningale common; between Kineton and Edge Hills.

* "Jour. Ethnol. Soc.," vol. ii, 1871. † "Munimenta Antiqua," 1799, pp. 50—53.

ARCTIUM.

A. majus, *Schkuhr.* *Greater Burdock.*
Native: By roadsides and in woods. Very local. July to September.
I. Road by Packwood House; Knowle canal bank.
II. Radford; Hatton, *Y. and B.;* Chesterton! Radford Semele; Myton, *H. B.;* abundant in Honington Park! *Newb.;* Alveston pastures; on banks, road from Shipston-on-Stour to Stratford-on-Avon; Marl Cliff, near Bidford; bridle road, Red Hill to Binton; hilly pastures near Billesley Hall; hilly fields near Great Alne; in abundance near the canal, Holywell; Dilke's Lane near Kingswood; Lapworth; Umberslade, &c.

A. minus, *Schkuhr.* *Lesser Burdock.*
Native: By roadsides, on banks, in meadows and woods. Rather local. July to September.
I. Erdington; Sutton Park; Trickley Coppice; Marston Green; Maxtoke; Meriden Shafts; Solihull; Knowle, &c.
II. Warwick; Chesterton! *Y. and B.;* Woodloes near Warwick! *H. B.;* Honington! *Newb.;* Alveston pastures; Bidford; bridle road, Billesley to Wilmcote; Oversley Wood; Yarningale; Austey Wood, Wootton Wawen; Itchington Holt; Oakley; Combe Woods, &c.

A. intermedium, *Lange.* *Intermediate Burdock.*
Native: In woods, quarries, and by roadsides. Local. July to September.
I. Trickley Coppice, Middleton; quarry near Meriden Shafts; Merivale Park.
II. Moreton Morrel, *Y. and B.;* Snitterfield, *Herb. Per.;* Emscote, *H. B.;* Honington! *Newb.;* Alveston pastures; canal bank near Hatton Railway Station; near Haywoods; hilly field near Great Alne; near Bearley Cross; Combe Woods; Itchington Holt.

A. nemorosum, *Lej.*
Native: In woods and hedges. Rare. July to September.
II. "Damp woods, Honington, Warwickshire, August, 1872. F. Townsend." *Bot. Exch. Club Report,* 1872-4, Mr. Townsend states that this sub-species is frequent near Honington. Abundantly in a hedge near Lambscote, *Newb.;* road from Stratford-on-Avon to Shipston, near Atherstone-on-Stour; hilly field, near Alne.

SERRATULA.

S. tinctoria, *Linn.* *Common Saw-wort.*
Native: In woods and pastures, and by waysides. Local. July to August.
I. Canal near Earl's Wood, *W. H. Wilkinson;* near Olton Pool; meadows, near Blythe Bridge, Solihull; near Righton End, Bradnock's Marsh; Arley; Bentley Park.
II. Hatton; Beausale, *Y. and B.;* Salford Priors, *Rev. J. Caswell;* canal bank, near Brinklow, *R. S. R.,* 1875; Tredington, *Newb.;* road from Tachbrook to Harbury, *Herb. Bab.;* Umberslade, *W. B. Grove;* Twelveo' o'clock Riding, Combe Woods; Yarningale Common.

CENTAUREA.

C. nigra, *Linn.* *Black Knapweed.*
Native: In pastures, on waysides, banks, &c. Common. June to September. Area general.
Var. *radiata.* Locally common in lias soils.
I. Near Solihull; near Tanworth.

II. Myton; Hatton! *Y. and B.;* railway bank, Hill Wootton, *H. B.;* "form with all the flowers elongate, near Tile Mill, Honington," *Newb.;* between Stratford and Red Hill; Alveston pastures; lane between Alne and Spernal; Little Alne; Henley-in-Arden.

This is a form liable to be mistaken for *C. decipiens;* it is, I think, truly distinct from that, and quite as markedly distinct from the type.

C. scabiosa, *Linn.* *Great Knapweed.*

Native: On banks, by waysides, and in pastures. Rather local. June to September.

I. Lanes about Knowle; near Hartshill, &c.

II. Blacklow Hill, *Perry,* 1817; Salford, *Rev. J. C.;* Myton; Chesterton! Tachbrook, *H. B.;* Tredington; Lambcote, *Newb.;* Henley-in-Arden; Little Alne; plentiful about Stratford-on-Avon; Binton; Temple Grafton; Ashorn, &c.

C. Cyanus, *Linn.* *Corn Blue Bottle, or Corn-flower.*

Colonist: On railway banks, in cornfields and meadows. Local. June to September.

I. Witton; Maney; near Knowle Station.

II. Stoneleigh; Warwick, *Y. and B.;* abundant on railway banks near Warwick, *H. B.;* in a field about Bilton and Blue Boar Lane, *R. S. R.,* 1877; Salford, *Rev. J. C.;* Exhall; Wixford.

CHRYSANTHEMUM.

C. segetum, *Linn.* *Corn Marigold.*

Colonist: In corn and other cultivated fields. Locally abundant. June to September.

I. Packington, *Freeman, Phyt.,* i., 262; Bodmir; Sutton Park; Trickley coppice; Coleshill; Bradnock's Marsh; Hampton-in-Arden; Cornel's End.

II. In a field west end of Brailes Hill, *Newb.;* Iddicote, *Rev. J. Gorle;* cornfields near Binley; cornfields near Rugby; cornfields near Kingswood.

C. Leucanthemum, *Linn.* *Ox-eye Daisy.*

Native: On railway banks, waysides, heath lands. Common. May to August. Area general.

MATRICARIA.

M. Parthenium, *Linn.* *Common Feverfew.*

Denizen: On banks and waste places near villages. Local. June to August, or later.

I. Near Great Packington; Erdington; Berkswell; near Tanworth.

II. Salford Priors! *Rev. J. C.;* footway between Overslade and Bilton, *R. S. R.,* 1877; Honington; Lambcote, *Newb.;* Lapworth Street.

M. inodora, *Linn.* *Scentless Mayweed.*

Native: In fields, woods, on banks, heaths, and waysides. Common. July to September. Area general.

M. chamomilla, *Linn.* *Wild Chamomile.*

Colonist: In fields and on waysides. Locally abundant. July to September.

I. Fields near Coleshill; Meriden; Hampton-in-Arden; Knowle; lane from Righton End to Barston.

II. Brailes, *Newb.;* Whatcote, *Rev. J. Gorle;* Myton and Milverton, *H. B.;* footways near Wyken.

This plant seems as truly native as *M. inodora,* occurring in similar habitats and in equal abundance.

TANACETUM.

T. vulgare, *Linn.* *Common Tansy.*

Native: On banks and waysides near villages. Rather rare. July, August.

I. Stonebridge Road, near Coleshill; Sheldon. Lane from Meriden marsh to Stonebridge.

II. Oversley, opposite Alcester Mill, *Purt.* ii., 392; St. Mary's Churchyard and cottage walls, Warwick; Hatton Hill, *Perry*, 1817; side of the Avon, between Nicholas meadows and the aqueduct; between Leamington and Kenilworth, *Per. Fl.;* banks near Wyken, 1881.

This plant is merely a denizen in all stations where I have seen it.

ANTHEMIS.

A. cotula, *Linn.* *Stinking Mayweed.*

Colonist: In cultivated fields and on waysides. Common. June to September. Area general.

A. arvensis, *Linn.* *Corn Chamomile.*

Colonist: In corn and other cultivated fields. Rather rare. June to October.

I. Corn fields Marston Green; corn fields by Olton Pool; Sutton Park; near Meriden Shafts.

II. On the ridgeway on new-made earth mounds, *Purt.*, ii., 395; cornfields about Whitnash, *H. B.;* Kineton, *Bolton King.*

A. nobilis, *Linn.* *Common Chamomile.*

Native: On commons. Very rare. July.

II. Shrewley pool, in the parish of Hatton; *Bree, MS., N. B. G.;* Yarningale common! *H. B.*

ACHILLEA.

A. millefolium, *Linn.* *Milfoil or Yarrow.*

Native: On heaths, waysides, banks, pastures, &c. Common. Occasionally with purple flowers. June to October. Area general.

A. Ptarmica, *Linn.* *Sneeze-wort Yarrow.*

Native: On marshy heaths, damp waysides, and other like places. Locally common. July to September.

I. Sutton Park; Trickley Coppice; Middleton; Wishaw; Marston Green; Solihull and Knowle districts; Balsall Street.

II. Damp waysides near Warmington; Alveston Heath; Yarningale Common, &c.

ARTEMISIA.

A. vulgaris, *Linn.* *Mugwort.*

Native: On waste heathy places and hedge banks. Common. August, September. Area general.

Var. β, *coarctata*, Forcel.

On hedge banks in marly or Lias soils. Very local. August, September.

II. Abundant on Alveston pastures, 1880; Harbury, 1881.

This is, I believe, the first station from which this plant was recorded as British. The Rev. W. W. Newbould, to whom I sent it, was my authority for the nomenclature. It is figured in Reichenbach's *Flora Germ.*, tab. 1038.

FILAGO.

F. germanica, *Linn.* *Common Cudweed.*

Native: In fields, on heaths and waysides. Common. July to September. Area general.

F. minima, *Fries.* *Slender Cudweed.*
Native: On heaths and heathy footways. Rare. June to August.
I. Coleshill heath; heathy footways near Coleshill pool.
II. Kenilworth Heath, *Herb. Perry.*

GNAPHALIUM.

G. uliginosum, *Linn.* *Marsh Cudweed.*
Native: In moist places in woods, fields, waysides, and on heath lands. Locally common. July to September. Area general.
Var. *pilulare*, Chadshunt. *Bolton King!*

G. sylvaticum, *Linn.* *Upright Cudweed.*
Native: On heathy pastures and waysides. Rare. June to August.
I. Packington, *N. B. G.*, 636; Wolvey Heath, 1835, *Rev. A. Blox.*, *M.S. note in Purton's Flora;* waysides near Shirley; heathy pasture, Marston Green; Balsall common.
II. Between Wixford and Bidford, by the side of the road, *Purt.*, ii., 391; banks of canal in the parish of Coseley, *With.*, iii., 928; Kersley; Radford, near Stoneleigh, *T. K.*, *Herb. Perry;* Oversley Wood, *Cheshire*, *Herb. Perry;* heath at Haseley, *H. B.*

SENECIO.

S. vulgaris, *Linn.* *Common Groundsel.*
Native: In fields, on banks and waysides, &c. Common. Flowers the whole season. Area general.

S. sylvaticus, *Linn.* *Mountain Groundsel.*
Native: On banks and field borders. Locally common. July to September.
I. Between Birmingham and Erdington! *Perry*, 1817; Sutton Park; Middleton heath; Marston Green; Hampton-in-Arden; Cornels End; Hartshill, &c.
II. Alcester Field, between Alcester Lodge and New Inn! *Purt.*, ii., 405; Haywoods! *H. B.;* Allesley, near Hearsall Common.
This is an abundant plant in some of the districts near Birmingham, but is apparently very local in the southern part of the county.

S. squalidus, *Linn.*
Casual: On old walls. Very rare. August.
II. On old walls, Allesley village, *Bree;* walls, Guy's Cliff!
"Introduced from Oxford into the Rectory grounds, Allesley, afterwards establishing itself on the walls in the village" (*see W. T. Bree. Mag. Nat. Hist.*, iii., 150-1).

S. erucifolius, *Linn.* *Hoary Ragwort.*
Native: On banks, waysides, and in fields. Locally common. August, September.
I. Near Hampton-in-Arden; between Shirley Heath and Salter Street.
II. Lanes about Halford; Tredington (both forms); Whatcote; Lambcote, *Newb;* Umberslade, *W. B. Grove;* Banbury Road, near Warwick; Harbury; Alcester; Bearley, &c.
A frequent plant in South Warwick, rather rare in North Warwick.

S. Jacobæa, *Linn.* *Common Ragwort.*
Native: On banks, waysides, in fields, &c. Locally common. July to September, or later.
A frequent plant in North Warwick, but rare or very local in South Warwick.
A peculiar narrow-leaved form occurs in Cathiron Lane, near Rugby.

S. aquaticus, *Huds.* *Marsh Ragwort.*
Native: In marshes, on damp heath lands and waysides. Common. July to September. Area general.
I have found this in every district I have visited.

(To be continued.)

ON THE RELATION OF THE SO-CALLED "NORTHAMPTON SAND" OF NORTH OXFORDSHIRE TO THE CLYPEUS GRIT.

Abstract of a paper read before the Geological Society of London, Feb. 21st.

BY MR. EDWIN A. WALFORD, F.G.S., OF BANBURY.

The objects of the paper were said to be two-fold: in the first place, to show the existence of some hitherto unrecognised beds of the Inferior Oolite in North Oxfordshire, and then to endeavour to define their position by comparison with one of the uppermost of the Cotteswold subdivisions, the Clypeus Grit. The area under discussion was said to be the border-land between the S.W. or Cotteswold types and the N.E. or Northamptonshire types, and was for the most part embraced in sheet 45 N.W. of the Geological Survey, in the N.E. corner of which is situated the town of Banbury, whilst to the extreme S.W. lies Chipping Norton. The author first called attention to some remnants of a series of Oolitic limestones at Coombe Hill, near Deddington, which he considered to be the equivalent of the Oolite Marl. He then pointed out near Bourton-on-the-Water the intervention of some sandy limestones and carbonaceous clays between the Clypeus Grit and the Fuller's Earth: he thought they might possibly represent beds found above the Clypeus Grit near Chipping Norton. The beds marked in the map *5′ g 7′*, hitherto termed Northampton Sand, he said, were well shown in the new railway cutting at Hook Norton, and were capable of being split up into several divisions, the two thin base beds containing *Ammonites læviusculus* and corals: the next higher series (C) yielding a large fauna, amongst which were *Rhynchonella spinosa*, *Trigonia signata*, and *Trigonia angulata*, and a doubtful fragment of *Ammonites Parkinsoni*. These, with a higher series of sandy, marly, and siliceous limestones designated D and E, were proved to extend over the high lands to the S.W. It was shown that at one end of a ridge called Otley Hill the beds C, with probably some remains of a lower series, rested on the Upper Lias, whilst on the S.W. flanks of the ridge the Clypeus Grit was to be seen also resting upon the Upper Lias. A road section near Over Norton, he said, showed beds similar in lithological character to C and D of Hook Norton, resting upon the Clypeus Grit, and evidencing a fauna of a somewhat similar character. The author thought that the almost unfossiliferous series E, which had been called the Chipping-Norton Limestone, might probably be found to be the equivalent in time of part of the Fuller's Earth, or of some of those beds of the Inferior Bathonian of the Côte d'Or described by M. Jules Martin.

THE BRITISH TRAP-DOOR SPIDER
ATYPUS SULZERI.

This grand Spider, the only representative found in Great Britain of that most interesting family the Mygalidæ, is generally looked upon as a great rarity, but I am inclined to think that if entomologists would search for it, it would be found on or about most heaths, and in sandy lanes on the banks facing S. or S.W.

At Hampstead Heath, London, I first found it March 26th, 1876, scattered about in various parts of that once "happy hunting ground," but now, alas! many of the hillocks have been *levelled*, the hollows where bees and spiders loved to congregate have been filled up by "The Board" with *dust-bin* refuse, all the bog (through which it was such a pleasure to walk in search of *Drosera* and *Petasites*) has been drained bone dry, so that now the little *costers* from the East End can walk over dry shod though their feet have only nature's covering. With all these improvements (?) can we wonder that insects and flowers once found in plenty have quite disappeared, and yet *Atypus Sulzeri* holds its ground, perhaps from the fact of its boring and forming its wonderful "tube," just at the foot of a nice prickly and stunted gorse bush, not a pleasant place for a seat, or for the entomologist to dig the tube out.

I quite expected to find *Atypus* in this wild neighbourhood, and on April 12th, whilst minutely scanning a S.W. bank, I noticed a very small silken tube projecting from a hole in the hard sand; there was no mistaking it, and by a careful search on this and other S.W. banks, I noticed a large number of tubes of all ages, some of which I dug out measuring 10 inches in length, these I have "set" in a turf bank facing south, which I have made in my garden, where I hope to observe and gather some of the links in the little-known economy of this most interesting spider.

Ferndale, Woking Station. FRED. ENOCK.

THE ALLUVIAL AND DRIFT DEPOSITS OF THE LEEN VALLEY.

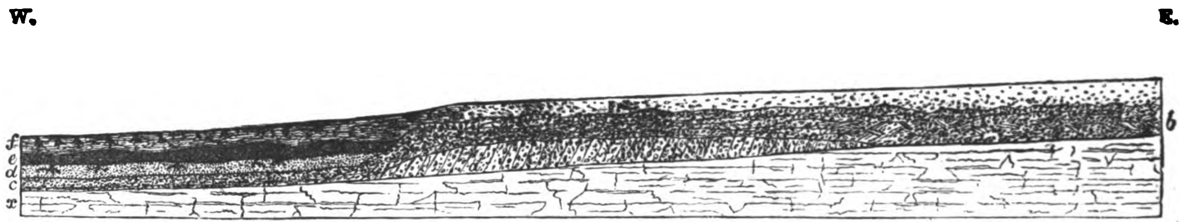
BY JAMES SHIPMAN.

(Continued from page 79.)

A similar succession of deposits was met with in the bed of the Leen at Old Basford, a mile and a half further up the valley. Here two such large excavations for gasholders were made side by side, affording a continuous section of the strata for a length of over 120 yards from east to west across the valley.* (Fig. 2.) The site of the excavations was midway between New and Old Basford, and just on the edge of

* For facilities kindly afforded me in my examination of these sections from time to time my thanks are due to Mr. M. O. Tarbotton, C.E., Engineer to the Nottingham Corporation Gas and Water Works, and to his courteous Clerk of Works, Mr. P. Phillips.

FIG. 2.



Section of the Alluvial and Drift Deposits of the Leen Valley at Basford.

Scale—One inch=66ft. horizontally, 35ft. vertically.

(*f*) Gray silt, or brick-earth, and dark surface loam (2ft.—3ft.)
(*e*) Peat bed (1ft.—3ft.)
(*d*) Gray and yellowish laminated sand (2ft.)
(*c*) Ferruginous gravel, containing thin seams of bright red sand (2ft.)
(*b*) "Torrential Gravel" and sand (10ft.)
(*a*) Glacial Drift (2ft.—6ft.)
(*x*) Lower Mottled Sandstone (Trias.)

the alluvial plain. The Leen itself flows about fifty yards west of where the excavations were made, that is, from the end of the section shown in Fig. 2. In this part of the Leen valley the relations of the various deposits of gravel, sand, and clay that underlie the alluvial plain could be seen to better advantage than at Radford. Another link in the chain of physical events which have happened in this valley since the Glacial period was disclosed, too, by this excavation. The deposits exposed by the cutting at Basford seemed to belong to three distinct stages in the history of the Leen valley. Placed in the order of their relative age we had—

3. Recent alluvial sand, silt, and peat.
2. Torrential gravel.
1. Glacial drift.

At Radford the ground was opened on the west side of the river. At Basford, however, the wells were sunk on the east side of the valley. As at Radford, the most recent deposits of the Leen were found to occupy a hollow scooped out of the solid rock. Here, too, only one side of this alluvial hollow was seen in the section, and it descended gently towards the present course of the stream. The oldest deposit met with at Basford was the Boulder Drift. This was composed of a mixture of red, brown, white, and greenish-yellow sand—a mottled, tenacious mass, studded with pebbles of all sizes up to small, well-rounded boulders. No regular bedding or stratification could be discerned in the mass. The pebbles were imbedded at all angles, instead of lying more or less horizontally, as they would have done if the deposit had been calmly accumulated under water. Here and there, however, puckered strings of pebbles showed that the mass had been kneaded and crumpled by some powerful force acting laterally, and that the deposit had been then still further compacted by enormous pressure from above in such a way that the pebbles were now tightly wedged into the matrix. The deposit had clearly been formed by some powerful physical agent scouring the surface of the country and pushing the materials in front of it as it went along until they lodged in sheltered hollows, as in this case. That agent was undoubtedly *ice*. This deposit, then, takes us back to the Great Ice Age, when Britain, in common with the whole of Northern Europe, was enduring climatal conditions very much like what now prevail in Greenland and the Arctic regions. The pebbles in this Drift consisted chiefly of quartzites, along with pebbles of millstone grit, coal measure sandstone, and occasionally lumps of the underlying sand rock, caught up and incorporated in the mass by the ice-plough. A good deal of the matrix of this Drift was evidently derived from the wearing down of the Lower Mottled Sandstone, which forms much of the ground to the north and west. But the coarse, bluish-white sand or pounded grit, that it contained must have had a different source. The Drift was from two to six feet thick, and rested on a slightly uneven surface of the Lower Mottled Sandstone, towards the bottom of the eastern slope of the valley. This Drift deposit was again met with close by in an excavation for a cistern 300ft. long, parallel with the gasholders. It was the same mixture of rusty brown and gray sand as before, decidedly contorted in places, and came to an end in the direction of the river just where the more recent alluvial deposits set in.

The continuation, apparently, of the same deposit was also disclosed by a cutting made at the back of Springfield Bleach Works, at Old Basford, on the same side of the valley. The deposit of sand and pebbles, seen occupying a shelf cut out of the Lower Mottled Sandstone at Spring Close, Lenton, twenty or thirty feet above the alluvial plain, is probably of this age. Here, too, there is evidence of the action of ice, for not only are the pebbles tightly wedged together in the sandy matrix in the most confused manner, but the surface of the underlying soft sand rock has been swept into small puckers in two or three instances by the pressure which produced corresponding flexures in the overlying gravel. It is not unlikely that the narrow strip of Drift that runs up the western margin of the alluvial flat at Bulwell belongs to this age, though, being rarely exposed, it is difficult to get any details of it, any more than that it is largely composed of the ground-up Permian limestone and marl on which it rests, and suddenly thickens where it occupies old hollows in the underlying rocks. The gravel that caps the low cliffs on the east side of the valley is probably also Glacial Drift. It consists of the usual varieties of quartz and quartzite, with flint chips, and a sandy matrix derived from the rock on which it rests. It is occasionally seen to occupy pre-existing hollows and ruts in the rock, is frequently contorted, and mostly very compact, being sometimes cemented by ferric oxide. No bones or other organic remains have been found in these ancient Glacial deposits of the Leen, though mammalian bones have been met with in similar deposits in some other river valleys.

The position of the Boulder Drift in the bottom of the Leen Valley shows that this valley, like most other river valleys in Britain, had been excavated to its present depth, and deeper, before the close of the Glacial Period. Resting partly on the Boulder Drift, and partly on a broad shelf of rock cut back out of the Bunter sandstone that forms the east side of the valley at Basford was some gravel distinct from either the modern river deposits on the one hand, or the Drift on the other. This gravel was about 5ft. thick, and passed up into five or six feet of loose, pebbly sand, that may have been washed down later. The deposit consisted of brown and yellow clean sand in obliquely-laminated patches, surrounded and interbedded with very short, irregular seams and "pockets" of pebbles. The oblique lamination and the confused arrangement of the pebbles in this deposit, all clearly due to the action of water alone, and not to that of ice, considered in connection with the position of this deposit on the side of the valley at a higher level than the later alluvial deposits, combine to suggest that this gravel is the "tumultuous gravel" found occupying the sides of other river valleys in England and Scotland. It was formed when the volume of water borne down the valley must have been many times greater than it is now. Some of the irregularities of the bedding may be due to the melting of lumps of ice or snow, which may have got buried along with the sediment. However this may have been, the oblique lamination seemed to indicate the influx of water from the side of the valley, as well as an onward movement down the valley. Its pebbles were the same as occur in the Drift, from the destruction of which it was most likely derived.

There was evidently a long interval of time between the formation of the Drift at the bottom of the valley and the accumulation of this torrential gravel, during which a considerable amount of gravelly material was probably carried away altogether, leaving those scattered patches and terraces of rusty brown gravel higher up the valley slopes. It was during this interval that the ice-cap that had previously shrouded the land melted away, and the climate became less severe.

Once more the Leen appears to have begun to deepen its bed, and to form the "valley within valley" which its later Post-glacial or "recent" deposits were found to occupy. The lowest stratum of these deposits consisted of rusty-coloured coarse gravel, containing thin seams of red sand derived from the wearing away of its rocky bed, and full of flakes and pebbles of red hematite, as at Radford. This gravel was overlaid by a bed of light gray sand, very evenly laminated, and maintaining a tolerably uniform thickness all round the cutting. Above this came a band of peat, full of the stems of young trees, twigs, and leaves, all more or less decayed; while the roots of many of the trees descended into the underlying sand bed. The peat varied from one to three feet in thickness. Many of the tree stumps were vertical, or nearly so, just as they must have grown. On the west side of the cutting the stool of an oak, about twelve inches in diameter, gnarled, but black and quite decayed, was met with at the bottom of the peat. The peat passed up into about three feet of lead-gray silt and dark surface-loam. The materials that composed the brown gravel resembled those of the Drift, except that the latter contained no hematite. Nor does the red hematite occur in any other of the gravelly deposits that line the valley, so far as I have observed. One curious fact connected with these Post-glacial deposits remains to be noticed. Between the rusty coloured gravel and the solid rock on which it rested at Old Radford were two or three small patches of peat (shown in the sketch, Fig. 1)—apparently all that was left of a more extensive layer that once lined the sides of the rocky ravine which the Leen then occupied. At that time (1879) I could hardly believe these fragments of peat were *in situ*, and examined the spot carefully to see if they had not somehow fallen down from the overlying peat bed during the work of excavating. On making my usual visit to the cuttings at Basford one day in the spring of this year, however, I was met by one of the superintendents of the works with the startling announcement that they had come upon a mass of peat imbedded right down in the heart of the sandstone rock (*i.e.*, the Lower Mottled), underlying the alluvium, and therefore, presumably of Triassic age! As I expected, it turned out that they had met with a small patch of peat nestled in a hollow in the surface of the old rocky bed of the Leen, and just underneath the ferruginous gravel, showing that before and perhaps partly during the formation of the brown gravel the Leen Valley nourished a luxuriant vegetation, of which only the merest fragments had been thus accidentally preserved.

I have already stated that no bones or other remains of animals have been found in the Glacial deposits of the Leen Valley. While examining the right bank of the stream, just north of Bulwell Spring, two summers ago, however, I chanced to notice a bone embedded in the gravel, through which the Leen here cuts its way. The gravel itself is probably Post-glacial, and the bone was found eight or ten feet above the level of the water. Prof. Boyd Dawkins, M.A., F.R.S., who was so good as to examine the bone for me, found it to belong to the "small domestic ox of the *Bos longifrons* type, an animal introduced into this country in the Neolithic Age, and which still survives in the small Scotch, Welsh, and Irish cattle." Prof. Dawkins adds that "its bones are commonly met with in the pre-historic and historic refuse heaps, but never in undisturbed Pleistocene strata."

It now only remains for me to point out some of the chief inferences to be drawn from the evidence furnished by these interesting sections. The Drift deposits of the Leen Valley carry us back to the time, many thousands of years ago, when Arctic conditions prevailed in Britain, and immense glaciers descended slowly towards the coast, leaving patches and mounds of rocky *debris* in the more sheltered hollows, or at the spots where two or more ice-streams coalesced. All the evidence afforded by the Drift deposits of the Leen Valley points to the conclusion that the ice which formed them crossed the valley more or less obliquely, and came from a north-north-westerly direction—or in other words, from the southern extremity of the Pennine Hills. The Leen Valley then presented much the same general outline as it does now, except that the bottom of the valley was in some parts a ravine, in others a ‿-shaped hollow, now filled with alluvial gravel and silt. There is abundant evidence round our sea-coasts that the British Isles stood higher out of the water then than they do now, and England was united to the Continent. It was about this time that the Creswell Caves, only a few miles farther north, afforded shelter, now to the Palæolithic hunter, now to the hyæna, the woolly rhinoceros, the lion, the reindeer, the wolf, and other wild beasts that have long since ceased to inhabit these islands. It seems probable that the Drift once lay much thicker in the Leen Valley than it does now, and may even have choked it up altogether for a time. A long interval appears to have elapsed between the accumulation of the Drift and the deposition of the "tumultuous gravel," during which the ice melted away, and the climate became somewhat ameliorated, though perhaps still rigorous.* It was probably during this interval, and when the valley was filled with frozen snow, that the coarse red sand and pebbles which forms the

* Prof. James Geikie, F.R.S., "Pre-historic Europe," p. 387, *et seq.*

terraces between Basford and Bulwell was deposited. The Leen now began to deepen its channel, and to carve out the hollow in the older deposits now occupied by the more recent gravel, sand, and silt. The climate soon became so far ameliorated that vegetation flourished down to the very bottom of the valley, and peat began to accumulate. The growth of plants at the bottom of the Leen Valley seems to suggest that the land had once more been raised after submergence. Only small fragmentary patches of this earlier growth of peat escaped the denudation that afterwards took place. How and when the red hematite was brought into the valley and came to be so mixed with the rusty coloured gravel at the bottom of the alluvial deposits remains a mystery. Then came the deposition of the gray sand in regular even layers, as if it had been quietly precipitated along the level bottom of a broad stream, many times broader than the Leen is now. Again, there appears to have been an elevation of the land, for we find the stools of oak trees with their rootlets embedded in the sand in such a way that deposition must have ceased for a time, and the area became dry ground. By-and-bye the climate, which during the growth of the oak trees does not appear to have been very favourable, became more equable, and favoured the growth of pines and other plants which ultimately became choked with peat. Once more the ground was more or less continuously submerged, perhaps caused by increase in the rainfall, and the bottom of the valley became covered with the sheets of slit or clay which now mantle the alluvial plain, and which must themselves have taken many centuries to form.

METEOROLOGY OF THE MIDLANDS.

THE WEATHER OF MARCH, 1883.

BY CLEMENT L. WRAGGE, F.R.G.S., F.M.S., ETC.

This was a month remarkable for constant cold and wintry weather with abundance of frost and snow. At some stations no rain fell, and the entire precipitation consisted of snow, hail, or sleet. Mean temperature was about 35·3, and at Orleton it was "more than 5 degrees below the average of 20 years." Evidently the extraordinary weather was brought about by the peculiar distribution of pressure; by cyclonic depressions travelling from the north of Russia in a west-south-westerly direction, hence taking a course the very opposite to that usually followed, and sweeping round the south side of an anti-cyclonic area, which persistently held its ground over Lapland and Northern Scandinavia. The highest reading of the barometer was 30·738 on the 4th, and lowest 29·250 on 25th—26th. The air was at times very dry, and mean relative humidity was about 82%. Northerly winds prevailed.

* * * * * *

As I hope shortly to resume my travels I must now, for a season, bid the observers farewell. Personally I tender my warmest thanks to one and all for the assistance they have given me; and I join with the Editors of this magazine in expressing our best acknowledgments. My interest in the "Midland Naturalist" will remain unabated, and I hope to send occasional notes in the course of my wanderings.

CLEMENT L. WRAGGE.

STATION.	OBSERVER.	RAINFALL. Total for M. In.	Greatest fall in 24 hours. In.	Date.	No. of rainy d.	SHADE TEMP. Absolute Maximum. Deg	Date.	Absolute Minimum. Deg.	Date.
OUTPOST STATIONS.									
Spital Cemetery, Carlisle	I. Cartmell, Esq., F.M.S. ..	1·42	0·52	19	7	55·7	2	18·7	9
Blackpool (a)—South Shore..	C. T. Ward, Esq., B.A., F.M.S.	1·31	0·45	19, 29	9	56·0	4	22·8	15
Newton Reigny, Penrith (a)..	T. G. Benn, Esq.	2·18	0·72	29	12	56·6	1	16·5	9
Scarborough (a)............	A. Rowntree, Esq.	1·78	0·27	19	18	51·8	5	23·5	10
Llandudno (a)	J. Nicol, Esq., M.D.........	1·73	0·45	29	13	52·8	8	26·0	24
Cardiff (a)............	W. Adams, Esq., C.E.	0·60	0·12	19, 20	10	55·6	81	21·2	24
Altarnun, Launceston	Rev. J. Power, F.M.S.	2·51	0·65	15	10	54·0	2, 6	15·0	10
Sidmouth (a)	W. T. Radford, Esq., M.D.	1·19	0·36	29	18	55·7	5	23·7	10
Guildford............	C. U. Tripp, Esq., F.M.S. ..					53·0	81	17·0	11, 19
Les Ruettes Brayes, Guernsey (a)	A. Collenette, Esq., F.M.S.	2·39	0·70	14	17	52·2	1	27·9	9
MIDLAND STATIONS.									
HEREFORDSHIRE.									
Burghill (a)	T. A. Chapman, Esq., M.D.	0·84	0·36	19	11	56·8	30	17·2	10
SHROPSHIRE.									
Woolstaston	Rev. E. D. Carr	1·14	0·41	19	18	52·0	30, 31	19·0	9, 10
Stokesay (a)............	Miss La Touche	0·98	0·29	19	12	54·8	4, 5	10·8	10
Bishop's Castle	E. Griffiths, Esq.	1·19	0·43s	19	12	55·0	1	14·0	10
More Rectory............	Rev. A. S. Male............	1·04	0·2.s	19	16	52·0	2, 4	15·0	8
Dowles, near Bewdley	J. M. Downing, Esq.	1·33	0·54	20	8	62·0?	1	11·0	10, 24
WORCESTERSHIRE.									
Orleton, near Tenbury (a)....	T. H. Davis, Esq., F.M.S. ..	1·38	0·47s	19	18	57·0	5	16·8	10
West Malvern	A. H. Hartland, Esq.	1·14	0·60	19	12	54·0	30, 31	19·0	28
Evesham (a)	T. J. Slatter, Esq., F.G.S...	1·17	0·63	19	10	51·0	:0	17·0	10
Pedmore	E. B. Marten, Esq.	1·14	0·53	19	9	56·0	31	14·0	9
Stourbridge	J. Jefferies, Esq.	1·06	0·51	19	6	55·0	30	13·0	9
STAFFORDSHIRE.									
Rowley Regis	C. Beale, Esq.............	1·06	0·51s	19	10	49·0	30	19·0	9
Dennis, Stourbridge (a)......	C. Webb, Esq.	1·04	0·45s	19	13	53·5	5, 30	14·0	10
Kinver	Rev. W. H. Bolton	1·13	0·32	19	10	53·0	30	18·0	9
Walsall............	N. E. Best, Esq.	1·54	0·70	19	12	49·0	30	19·0	9, 10
Lichfield	J. P. Roberts, Esq.	1·44	0·61	19	12	61·0	31	14·0	9
Wrottesley (a)	E. Simpson, Esq.	1·35	0·55	19	9	52·1	30	17·0	10
Heath House, Cheadle (a) ..	J. C. Philips, Esq., F.M.S.	1·19	0·48	19	13	54·1	4	20·5	10
Tean (b)	Rev. G. T. Ryves, M.A., F.M.S.	1·26	0·47	19	14	55·0	4	15·0	10
Oakamoor, Churnet Valley (a)	Mr. Williams	1·25	0·34	26	10	54·7	4	18·1	28
Beacon Stoop, Weaver Hills (a)	Mr. James Hall	1·38				50·2		15·5	
Alstonfield	Rev. W. H. Purchas	0·89	0·43s	19					
DERBYSHIRE.									
Stony Middleton	Rev. Urban Smith	1·21	0·30	20	9	55·0	3, 4	11·0	9, 10
Spondon	J. T. Barber, Esq............	1·23	0·39	19	12				
NOTTINGHAMSHIRE.									
Park Hill, Nottingham (a) ..	H. F. Johnson, Esq.	1·11	0·35	19	9	55·7	5	18·7	10
Strelley (a)	T. L. K. Edge, Esq.	1·21	0·34	19	13	5[illegible]·5		15·2	10
Hodsock Priory, Worksop (a)	H. Mellish, Esq., F.M.S. ..	1·15	0·39	19	12	55·5	30	5·3	10
Tuxford	J. N. Dufty, Esq., F.G.S. ..	0·84	0·23	7	10	52·0	31	14·0	10
RUTLANDSHIRE.									
Uppingham............	Rev. G. H. Mullins, M.A., F.M.S.	0·84	0·30	19	11	52·8	5	19·8	10
LEICESTERSHIRE.									
Loughborough (a)............	W. Berridge, Esq., F.M.S...	0·87	0·34	19	11	56·2	4	15·1	10
Town Museum, Leicester	J. C. Smith, Esq.	0·95	0·36	19	4	55·0	30, 31	16·0	10
Ashby Magna	Rev. Canon Willes	0·92	0·34s	19	11	54·0	4		
Waltham-le-Wold	Edwin Ball, Esq.	0·93	0·28	19	14	50·0	4	17·0	10
Coston Rectory, Melton (a) ..	Rev. A. M. Rendell........	1·20	0·30	19	15	52·9	30	5·5	10
WARWICKSHIRE.									
St. Mary's College, Oscott ..	Rev. J. W. Browne	1·28	0·63	19	5	54·6	30	18·1	10
Henley-in-Arden	T. H. G. Newton, Esq.	1·32	0·63s	19	14	57·0	5, 30	18·0	24
Park Hill, Kenilworth (a) ..	T. G. Hawley, Esq.	1·23	0·51	19	14	54·7	30	17·1	10
Kenilworth (a)	F. Slade, Esq., C.E., F.M.S.	1·27	0·56	19	13	54·1	30	15·9	10
Rugby (a)............	C. H. Hodges, Esq.	0·88	0·35	19	11	56·4	31	14·0	24
NORTHAMPTONSHIRE.									
Pitsford, Northampton	C. A. Markham, Esq.	1·35	0·35	19	14	55·0	30	14·0	10
Towcester	J. Webb, Esq.	0·90	0·33	19	12				
Kettering............	J. Wallis, Esq.	1·22	0·30	8	12	53·0	30	20·0	10
BEDFORDSHIRE.									
Bedford (a)	H. J. Sheppard, Esq.	0·80	0·13	17	12	55·2	30	20·2	24
OXFORDSHIRE.									
Radcliffe Observatory, Oxford (a)	The Staff............	0·95	0·48	.8	9	56·2	5	20·5	24
WILTSHIRE.									
Marlborough (a)	Rev. T. A. Preston	1·29	0·54	19	10	55·2	5	18·5	24
GLOUCESTERSHIRE.									
Cheltenham (a)	R. Tyrer, Esq., B.A., F.M.S.	1·31	0·57s	19	12	57·8	4	16·5	24

(a) At these Stations Stevenson's Thermometer Screen is in use, and the values may be regarded as strictly intercomparable. (b) Glaisher's pattern of Thermometer Screen employed at these stations.

Reviews.

Out of Doors. By the Rev. J. G. WOOD. New Edition. 342 pp., 6 plates, 6 woodcuts. Price, 7s. 6d. Longmans and Co.

MR. WOOD'S heart is so thoroughly in his work that in his natural history rambles, whether they be in Regent's Park or in some rural spot, he thoroughly carries his readers with him, and makes them long for the summer-time, when they too can search for insects "under the bark," or study the habits of "the green crab," the "wood ant," or "my toads." Of the eighteen essays included in this book we like best those on "A Sand-quarry in Winter," and "Our Last Hippopotamus"—a description of the (vain) attempt to rear a baby-hippo. born in the Zoological Gardens.

Colin Clout's Calendar. By GRANT ALLEN. 237 pp. Price, 6s. Chatto and Windus.

UNDER this fanciful rustic title our new scientific prose-poet, Mr. Grant Allen, publishes a series of about forty charming essays, chiefly botanical, on such subjects as "Primrose Time," "Clover Blooms," "Thistledown," "The Kerning of the Wheat," etc. To all lovers of nature such a book as this ought to be a continual pleasure.

Correspondence and Gleanings.

BOTANY OF MALVERN.—The following plants, most of which however, must, I think, be regarded as "introductions," but which are new to or rare in this district, I have met with during the past year:—*Myosurus minimus*, *Barbarea præcox*, *Camelina sativa* var. *sylvestris*, *Medicago denticulata*, *Medicago denticulata* var. *apiculata*, *Medicago maculata*, *Crepis biennis*, *Lolium temulentum* var. *arvense*, *Ceterach officinarum*.—R. F. TOWNDROW, Malvern Link.

CUCKOO FLOWER.—Your correspondent (p. 84) appears to apply the name "Cuckoo Flower" to the Arum (*Arum maculatum*), and quotes Clare in support—

"And *gaping* Cuckoo Flower, with *spotted leaves*,
Seems blushing of the singing it has heard."

And—

"Bedlam Cowslips and Cuckoos,
With *freck'd lip* and *hooked* nose,
Growing safe near the hazel of thickets and woods."

The words I have italicised appear to apply, in the first quotation equally well, and in the second far better, to the early purple Orchis (*Orchis mascula*), and, I believe, it is to this plant that the lines refer. Certain it is that here, in North Oxon, the adjoining county to Northants, I have heard *Orchis mascula* termed "Cuckoo Flower," while I never knew *Arum maculatum* called by any other name than "Lords and Ladies," which is doubtless, as your correspondent remarks, "the most widely distributed of its many titles."—OLIVER V. APLIN, Great Bourton, near Banbury, 9th April, 1883.

WE UNDERSTAND THAT MR. CLEMENT L. WRAGGE, having first reorganised the Ben Nevis observing system and arranged his museum in the new building at Stafford, intends to follow up the ocean meteorological work of the "Challenger," under the auspices of the Scottish Meteorological Society, during a third voyage to Australia. He hopes moreover to add to his Ethnographical and General Natural History collections, and, being anxious to make the best of his travels in a scientific point of view, solicits, and will gladly receive any notes, recommendations, or suggestions, from any of the associated Societies. Address, until May 25th, Farley, near Cheadle, Staffordshire; thence, till August 1st next, 6, East Mayfield, Edinburgh; and afterwards, until further notice, 96, King William Street, Adelaide, South Australia.

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.— ANNUAL MEETING (adjourned)—April 3rd.—The Retiring President (Mr. J. Levick) delivered his address, in which he gave some useful advice, derived from his own experience, relating to the collection, preservation, and exhibition of microscopic fresh-water life. He advocated the examination of one's captures on the spot in order that gatherings of no value might not be taken, and showed how this could be done to a great extent with the aid of a simple pocket lens; he observed that he had generally no difficulty in deciding as to the presence or absence of amœbæ, for example, in the gathering by that means alone, and that he had enabled many who could not find an amœba even with the aid of a microscope to see them without one. He described his garden-pond, in which he kept an unfailing supply of such rarities as *Melicerta annulata, Tubicolaria naias, Œcistes umbella*, as well as Floscules, Stephanoceros, Tardigrades, Desmids, and many other microscopic organisms in abundance. Finally, he gave directions for the efficient display of these creatures beneath the microscope in all their beauty. The address, which abounded with useful hints, will be published by the Society at an early date. BIOLOGICAL SECTION— April 10th.—Mr. J. E. Bagnall exhibited mosses: *Tortula muralis*, var. *rupestris* (rare), *T. convoluta, T. revoluta, T. aloides* (local), *T. unguiculata*, var. *apiculata* (rare), *Encalypta streptocarpa* (rare); Hepaticæ—*Pellia epiphylla, Conocephalus conicus*, in fine fruit; Lichen—*Usnea barbata*, var. *hirta* (new as a record for Warwickshire), all from the Arley district; for Dr. F. Arnold Lees, *Pterygophyllum lucens*, in fruit (rare), from near Bewdley, Worcestershire; for Mr. J. Saunders, Luton, *Brachythecium albicans* and *Camptothecium lutescens* in fruit. Mr. W. H. Wilkinson exhibited Lichens: *Ramalina fraxinea*, var. *ampliata, R. fraxinea*, var. *fastigiata, R. farinacea, Physcia prunastri, P. ciliaris, Parmelia pulverulenta, P. caperata*, and *P. parietina*, all growing on trees, from Blockley, Worcestershire. Mr. J. Morley exhibited for Mr. T. Clarke, Wild Flowers from Tanfield, on the banks of the Ure, North Riding of Yorkshire, *Helleborus fœtidus, Helleborus viridis*, and *Daphne laureola*. Mr. J. F. Goode exhibited *Colletonema neglectum* and *Vaucheria geminata*, from Handsworth. MICROSCOPICAL MEETING—April 17th.—Mr. J. E. Bagnall exhibited *Viola hirta*, from Alveston pastures; *Hypnum pratense*, from Earlswood (rare); *Diplophyllum albicans*, in fruit, from Chalcot; *Scapania irrigua*, from Earlswood, new to Warwickshire; also for Mr. Bolton King, *Herniaria hirta*, from Christchurch; *Asparagus officinalis*, from Waterford; *Viola Symei*, from co. Clare, and other rare plants. Mr. W. G. Blatch, exhibited a species of Sclerotium, an imperfect state of a fungus, from dried stems of Hollyhocks. Mr. W. B. Grove then read a paper on "The British Species of Pilobolidæ, with a synopsis of the European species, and a description of a new one from this district." After speaking of the position which the Pilobolidæ hold among the Mucorini, he described the characters which separate the two genera of which that tribe consists, viz., Pilobolus and Pilaira. This was followed by a minute description of the morphology and physiology of Pilobolus, especially with reference to the formation of the sporangium and its projection. Mr. Grove recorded an instance in which a specimen of the fungus, under one-tenth of an inch in height, threw its sporangium by an explosive action to a distance of 4ft. 10in., and that a bell-glass, twelve inches high, beneath which some specimens were growing, was covered with the projected sporangia on all sides to the very top. He then gave a short description of the genus Pilaria, followed by a summary of the history and bibliography of the subject, and, finally, a list of the nine European species, three of which, *Pilobolus œdipus*, *Pilobolus Kleinii*, and *Pilaira Cesatii*, were here recorded as British for the first time, and a description of a new species, *Pilaira inosculans*, found by him in Worcestershire, near Quinton. GEOLOGICAL SECTION—April 24th.—Mr. J. Bagnall exhibited *Viola hirta*, var. *florealbo* (a rare form), from Wootton Wawen, and *Viola sylvatica*, var. *Reichenbachiana*, from Preston Bagot, a new locality. Mr. W. J. Harrison, F.G.S., then gave an interesting lecture on "The Ancient Life-History of the Earth" to a large audience. The lecturer described a number of fine photographs and diagrams which were exhibited by means of the optical lantern, and consisted of views showing the chief varieties of geological action, and also a large number of sketches of the principal fossils of the Palæozoic period.

BIRMINGHAM AND MIDLAND INSTITUTE SCIENTIFIC SOCIETY.—March 23rd.—The members had an excursion to Gloucester. The party walked on to Whitcombe and Birdlip, then through Cranham Wood, to the Roman Camp on Spoonbed Hill, and returned through Upton St. Leonard's to Gloucester. April 4th.—Mr. D. Hooper read a paper on "The Chemistry of the British Coinage." After briefly describing the history of coins, he gave a full description of the processes through which they passed at the Mint, also the methods used in testing the various metals used for the coinage.

NORTHAMPTONSHIRE NATURAL HISTORY SOCIETY—March 15th.—A general meeting held at the Town Hall, at which Mr. S. J. Newman read some notes upon "Man's agency, direct and indirect, in exterminating some species and extending the range of others; an agency by which thousands of different species of the animals, plants, and insects—in fact, representatives of the whole flora and fauna—are being distributed or re-distributed about the world; an agency by which one and another rare bird and beast or insect is becoming extinct and lost to us in its living state for ever." All this was going on so rapidly (said the reader) that in one generation we saw vast tracts of Australia turned into sheep walks, or a thousand miles of prairie changed to a huge cornfield, or a whole country half-bared of its forests for speculating builders. Unless we were quick in getting precise lists of the natural habitation of the various species, and of their original geographical distribution, they would become so mixed up over the face of the globe (unless, indeed, exterminated), as to make the task of working out the analogy between their structure or habits and their natural surroundings too difficult a problem to be satisfactorily solved, if not impossible. It was this relation of cause to effect to which we look for aid, and, indeed, as our sole guide in working backwards the succession of life, and thus to grasp the laws which have resulted in forming in their present state the whole animal and vegetable life now on the world, with their countless variations of shape, colour, structure, and habits. If it were so necessary to learn the native geographical distribution of animals and plants, if we would understand why their forms were as we now saw them, then it was important that the work should be done speedily, before the movements of man in his restless journeyings from continent to continent have disturbed too much the balance of Nature, as with his goods and chattels, his corn and cattle, he unwittingly conveys many a seed or insect to a new home, and before he has portioned out all the world into cornfields for food, pasture for cattle, and forests for his wood, and when neither in Devonshire or elsewhere would be left a bit of tangled and straggling (useless, but beautiful) wild hedgerow, or a bit of virgin forest the world over. Mr. Newman then glanced at a few of the many changes which man's work and movements were bringing about in our day—an influence which has been at work ever since the unknown day when Adam, in the garden, was instructed "to dress and to keep it." Since then more and more had every living thing been compelled to bend to man's will until now, save in the untouched regions, strange changes in the distribution of species were going on in all the world. A series of illustrations of plants which have spread to various parts, especially in the New World and the Colonies, was given, and it was shown how these also introduced strange variations in the fauna. It would take too long to enumerate a tithe of the insects which had increased with the increased cultivation of their food-plants. In many other ways, too, their numbers had been affected. The clothes-moths were so exclusively attached to our woollen materials that we might wonder whether or how they existed before we provided them with house and food. And how did the mite, at present peculiar to cheese and flour, exist before cheese was made or flour ground? Again, how did the liver-fluke perform its strange changes before the sheep was brought by men into localities frequented by *Limnæus truncatulus?* We might suppose the sheep brought with them the fluke, and the embryos resulting from them found the *Limnæus truncatulus* the most suitable residence for their intermediate stage. Perhaps the fact that the fluke was often found in a species of snail not favourable to its proper development was a proof that it had not been here long enough to be quite settled in its habits. Thus we had the introduction of sheep affecting a certain snail, and no doubt in many another unlooked-for and strange way the agency of man had affected species, for all forms of life were closely connected. Mr. Newman went on to describe some unlooked-for and unfortunate results due to mistakes in acclimatisation efforts, and also to the more direct war of extermination, giving details of the rapid decrease of many species of animals, birds, etc. In conclusion, he said these notes might serve to call attention to the way in which floræ and faunæ were rapidly losing their distinctive features, and how largely man is, and had been responsible for the existence, continuance, and proper balance of all life upon the earth. What would be the final result of all the changes they could not see, but there appeared to be looming a time when the diversified beauties of Nature would be irretrievably lost, and the earth would be mapped out into districts most suited for the growth of such foods as were most beneficial to man (when upon this point the doctors agreed), rapid communication giving quicker interchange of produce. Strange theories had been whispered that the maze of canal-like markings and lines seen in Mars, and the land apparently massed round the more temperate zones, indicate some such advanced stage of civilisation. Mankind was yearly subduing our earth more and more to his will, and, if left to himself, man's works would sooner or later affect for good or evil all life upon our earth.—The Rev. S. J. W. Sanders proposed a vote of thanks to the author of the paper, which was seconded by Mr. J. Eunson, and carried unanimously.

NOTTINGHAM NATURALISTS' SOCIETY.—At a recent meeting of this Society Mr. C. T. Musson read some "Notes on the Future Work of the Society," in the course of which he pointed out that he thought the Society had not kept up to the standard of scientific work that it might have done. They ought to be able to draw up a pretty accurate list of the fauna and flora of this district of the county. He proposed to do this by means of half-day excursions. They ought to go out with some definite object in view; this had not always been the case hitherto.—Mr. Thos. Cave, M.R C.V.S., then read an interesting paper on "Foot and Mouth Disease," variously known as "murrain," "Eczema epizoötica,' "foot and mouth disease," and "smack." April 17th.—Mr. Charles L. Rothera B.A., read a paper entitled "Some Physiological Relationships between Animals and Plants."

SOCIOLOGY.*

A few remarks seem called for by me on this the interesting occasion of the first meeting of "The Sociological Section," for the study of Mr. Herbert Spencer's system of philosophy. My difficulty is absence of ability and presence of responsibility in introducing so large a subject, and especially the want of necessary time for condensation and co-ordination. In enthusiasm I am second to few.

The *raison d'être* of the Section may be best gathered from the following letter that was addressed unofficially to Mr. Herbert Spencer.

Wood House, Handsworth Wood,
near Birmingham,
19th March, 1883.

Sir,—I hope that you will pardon this intrusion at a time when all your energies are devoted to your *opus magnum*. Any interruption, however trivial, must in many cases be simply an annoyance.

But I trust that the exceptional circumstances under which I write may not be uninteresting to you, and my letter shall be as brief as I can make it.

A few gentlemen, several of whom are members of The Birmingham Natural History and Microscopical Society—among the Honorary Vice-Presidents of which we have already the advantage of including your name—have resolved, with the approval of the Society, to form a section to be called "The Sociological Section, for the study of Mr. Herbert Spencer's system."

The proposed Section will consist chiefly of Naturalists and professional men, all of whom are interested in the Synthetic Philosophy, and sincere admirers of its author.

We feel that as the Natural History Society has a very good Biological Library, including your works, together with Microscopes, Specimens, etc., and as its objects are cognate it is the most fitting home for us.

We believe that new members will be drawn to the parent Society on the formation of the new Section, out of which our ranks will be recruited, and that altogether the arrangement is a satisfactory one on both sides.

We hope to make our Section attractive to thinkers who recognise the doctrine of Evolution, and we want to make it successful. If, however, the meetings only give us "a wave of pleasure," that will be something.

Our proposed plan is to meet monthly for eight or nine months in the year, to go through in turn all your writings—reading up, of course, privately in the interim—holding discussions, and having papers thereon.

Not to begin with too abstruse a subject, we think that the consideration of the "Education" may profitably occupy us for May and June, and in the early autumn we hope to commence with "First Principles."

* Abstract of an Address delivered to the Sociological Section of The Birmingham Natural History and Microscopical Society by W. R. HUGHES, F.L.S., President of the Section, at its first meeting at the Mason College, Birmingham.—Thursday, 3rd May, 1883.

My object in addressing you is to ask the great favour of your informing me whether you think well of our intention, and if so, can you, if you think fit, kindly give us—at any time that may be convenient to you—the benefit of any suggestions?

We are modest in expecting any marked practical results from the establishment of our new Section, but we all feel "that the character of the aggregate is determined by the characters of the units," and we are content "to see how comparatively little can be done, and yet to find it worth while to do that little."

I have the honour to be, Sir,
Your faithful and obedient Servant,
(Signed) WILLIAM R. HUGHES.

Herbert Spencer, Esquire.

The very valuable and interesting reply received from Mr. Herbert Spencer is as follows:—

38, Queen's Gardens, Bayswater, W., March 20th, 1883.

Dear Sir,—I wish that others who write to me would all assign as good a reason as that given in your letter of the 19th.

The contents of it give me great satisfaction. My aims from the beginning have been directed towards the application of philosophy to the guidance of life, individual and social; and I rejoice to perceive at length a practical recognition of the truth that Sociology must be studied from the evolutionary point of view, and that political conduct can be rightly guided only when a rational theory of Society has been established. I wish you all success in your undertaking, which cannot but result in some good, even if but little.

In respect of suggestions which you invite, I will say only that I think the growth and prosperity of any organisation is bound up with the doing of work of some kind or other. Mere receptivity will not suffice: there must be independent activity. In this case, where the aim is the diffusion of a doctrine, the work may properly take the form of further elaboration of its component truths by further investigation of evidence. Particular points should be taken up by individual members or groups of members, with the view of gathering together evidence bearing on them, and setting forth the conclusions. As you indicate "Education" as one of the first objects to be dealt with, you might, in connection with it take up the alleged relations between ignorance and crime, and education and morality. There is the evidence afforded by the different communities of Europe and America. There is the evidence afforded by different classes in the same community. There is the evidence afforded by different localities in the same community. In each of these inquiries there is ample scope for effort, and great need for it. Various special questions, with the accompanying suggested investigations, will arise in the course of your reading; and my belief is both that you will succeed best as a Society, and will unquestionably do most good, if, along with the discussion of principles, you carry on inquiries concerning the results of conformity and nonconformity to them.

I am, faithfully yours,
(Signed) HERBERT SPENCER.

William R. Hughes, Esq.

P.S.—It occurs to me that for a Biological Society there is a class of questions specially appropriate to be taken up in connection with Sociology—I mean the modification of men's natures consequent upon social conditions. There is a large group of inquiries to be made respecting the effects produced upon the physique by this or that kind of treatment, now tending to kill the feeble, now to preserve the feeble; tending to check this or that disease, or to leave it its free course. There is another large class of questions concerning the mental effects of legislation of this or that kind—the fostering or the repression of this or that sentiment, and this or that intellectual power, and the consequent changes of character and capacity produced in nations by political causes, Whatever may come of the establishment of this Section, I think you will all agree with me that it is a subject of great gratification to those members who constitute its nucleus that they have been honoured by the approval of Mr. Herbert Spencer in the course that they have taken. It is no small matter that in the midst of most important and absorbing work he should have recognised and encouraged us so warmly and kindly. His letter is in truth an important and original essay. It is very interesting also to state that Mr. Herbert Spencer in a subsequent letter requested to be furnished with a few copies of our formation Circular, which was addressed to the members of the Society. He says, "Some of my American friends have taken like steps over there; and it would be encouraging to them to find this manifestation of sympathy in their aims here also."

Need I say anything of the master himself to those who are his admiring students? Need I say anything of the eminent Englishman living among us at this time, modestly, unselfishly, and devotedly labouring, without State aid or grants from learned Societies, at the gigantic task he has set himself, of working out and co-ordinating a system of philosophy which "he alone of British thinkers has ever attempted"—he who has been recognised by Darwin as "our great philosopher"—by Professor Tyndall as "the apostle of the understanding"—by Professor Huxley as "one of the profoundest of living English philosophers"—and of whom George Henry Lewes "considered it questionable whether any thinker of finer calibre had appeared in our country." Nor are opinions less warm abroad. Professor John Fiske, of Harvard University, the talented author of "Outlines of Cosmic Philosophy, based on the Doctrine of Evolution," states in that work "that in power of psychological analysis Herbert Spencer has been surpassed by no thinker that ever lived, and has been rivalled only by Aristotle, Berkeley, and Kant." Surely these encomiums are sufficient to entitle the author of the Synthetic Philosophy to the profound admiration and respect of all Naturalists who acknowledge the doctrine of evolution, and follow at a distance in the steps of his friend and co-worker, the illustrious Darwin.

But a higher practical tribute to the genius of Mr. Herbert Spencer was paid by the French nation, when not long since the Minister of Instruction had his famous "Essay on Education"—on which alone his claim to fame might fairly rest—translated into French for gratuitous public distribution. Nor must the great American people be forgotten, for they have, I believe, expressed in a more substantial manner their recognition of the value of his writings. The enthusiastic and hearty reception recently accorded to Mr. Herbert Spencer in New York is evidence of the high opinion which the Americans entertain of his worth.

Why do I refer to these matters? Matters which are perfectly well known to, and rejoiced in, by all Spencerians. Simply because I fancy that many who from want of opportunity or inclination or other accidental causes have not made acquaintance with Mr. Herbert Spencer's writings, have sometimes acquired a prejudice against them.

> Was noble man but made ignoble talk.
> He makes no friend who never made a foe.—*Tennyson.*

To use an illustration of his own: "While yet in its nurse's arms, the infant, by hiding its face and crying at the sight of a stranger, shows the dawning instinct to attain safety by flying from that which is unknown and may be dangerous." That illustration, which is doubtless very applicable to later life, is, as you are aware, from the "Education," and I venture to think that if we followed the example of our French neighbours and printed that Essay alone for gratuitous distribution many lives would be annually saved, and that there is not a single person of average intelligence who reads it but would in some way derive benefit from it. Whether we admit it or reject it, it cannot be doubted that Mr. Herbert Spencer's writings are acquiring a wonderful influence in this country, on the Continent, and in America. Scarcely a newspaper or magazine can be taken up but there appears an article which borrows force from his deductions or quotes one of his aphorisms on the doctrine of evolution. "The adaptation of the organism to its environment"—the "egoism and the altruism" —that wonderful description which he gives of life as "the definite combination of heterogeneous changes, both simultaneous and successive, in correspondence with external co-existences and sequences"—or simpler, "the adjustment of internal to external relations"—are familiar in our mouths as household words. If time were not important I should be glad to quote from "First Principles" Mr. Herbert Spencer's views on Religion and Science—from the "Social Statics" his views on progress, and from the "Study of Sociology" his views on government. But these are, of course, well known to most of the members of this Section.

Of the Synthetic Philosophy, that vast system which, commencing with "first principles"—the knowable and the unknowable—carries its students through the principles of Biology, Psychology, Sociology, and Morality (which last and greatest work of all—a portion of which only, "The Data of Ethics," has as yet been published—we most fervently trust its learned and gifted author may live to accomplish), gives a rational conception of the Cosmos, and applies the doctrine of evolution to all the phenomena, organic and inorganic, which go to build up our planet, time also allows me only just to allude to generally; but I think I may paraphrase the words of Mr. Alfred Russel Wallace applied to the author of the "Origin of Species," and say, "that if other principles should hereafter be discovered, or if it be proved that some of his subsidiary theories are wholly or partially erroneous, this very discovery can only be made by following in his (Mr. Herbert Spencer's) steps, by adopting the method of research which he has taught us, and by largely using the rich store of material which he has collected."*

* "Tropical Nature and other Essays," by Alfred Russel Wallace, p. 253. London: Macmillan and Co., 1879.

Perhaps the most effective and appreciative criticism that has ever appeared of Mr. Herbert Spencer's system was that given by the late Professor W. Stanley Jevons, whose untimely death is still fresh in our memories. In an article entitled "John Stuart Mill's Philosophy Tested" in the "Contemporary Review" for November, 1879, he said:—"To me the Spencerian Philosophy presents itself in its main features as unquestionably true; indeed it is already difficult to look back and imagine how philosophers could have denied of the human mind and actions what is obviously true of the animal races generally. . . . . . . Paley pointed out how many beautiful contrivances there are in the human form tending to our benefit. Spencer has pointed out that the Universe is one deep-laid framework for the production of such beneficent contrivances. Paley called upon us to admire such exquisite inventions as a hand or an eye. Spencer calls upon us to admire a machine, which is the most comprehensive of all machines, because it is ever engaged in inventing beneficial inventions *ad infinitum*. According to Mill we are little self-dependent gods fighting with a malignant and murderous power called Nature, sure one would think to be worsted in the struggle. . . . . . According to Spencer, as I venture to interpret his theory, we are the latest manifestation of an all-prevailing towards the good,—the happy. Creation is not yet concluded, and there is no one of us who may not become conscious in his heart that he is no automaton, no mere lump of protoplasm, but the Creature of a Creator."*

"To Monsieur Comte," the author of the "Positive Philosophy," says Mr. Herbert Spencer, "is due the credit of having set forth, with comparative definiteness, the connection between the science of life and the science of society." He maintained that a knowledge of all the facts connected with the growth and development of individual man must be understood before the facts of the growth and development of aggregates of men—in other words, of societies—could be correctly understood. In his classification of the sciences he therefore placed Biology before Sociology.

For a very admirable opinion of the value of the teaching of Sociology under many of its aspects, I cannot resist quoting the observations of one of the most distinguished of living philosophers and exponents of the Doctrine of Evolution. In that memorable Address, which many of us had the good fortune to listen to, from Professor Huxley in the Town Hall on the occasion of the opening of this noble College on the 1st of October, 1880, he said at the conclusion:—"Within these walls the future employer and the future artizan may sojourn together for awhile, and carry through all their lives the stamp of the influence then brought to bear on them. Hence, it is not beside the mark to remind you that the prosperity of industry depends, not merely upon the ennobling of the individual character, but upon a third condition, namely, a clear understanding of the conditions of social life on the

* "Contemporary Review," November, 1879. 'John Stuart Mill's Philosophy Tested, by Professor W. Stanley Jevons,' pp. 537–8.

part of both the capitalist and the operative, and their agreement upon common principles of social action. They must learn that social phenomena are as much the expression of natural laws as any others; that no social arrangements can be permament unless they harmonise with the requirements of social statics and dynamics; and that in the nature of things there is an arbiter whose decisions execute themselves.

"But this knowledge is only to be obtained by the application of the methods of investigation adopted in physical researches to the investigation of the phenomena of society. Hence, I confess I should like to see one addition made to the excellent scheme of education propounded for the College, in the shape of provision for the teaching of Sociology. For though we are all agreed that party politics are to have no place in the instruction of the College, yet in this country, practically governed as it is now by universal suffrage, every man who does his duty must exercise political functions; and if the evils which are inseparable from the good of political liberty are to be checked—if the perpetual oscillation of nations between anarchy and despotism is to be replaced by the steady march of self-restraining freedom—it will be because men will gradually bring themselves to deal with political as they now deal with scientific questions; to be as ashamed of undue haste and partisan prejudice in the one case as in the other, and to believe that the machinery of society is at least as delicate as that of a spinning-jenny, and not more likely to be improved by the meddling of those who have not taken the trouble to master the principles of its action."

The recurrence of the word politics in Mr. Herbert Spencer's letter and its postscript, and in the preceding reference to it, may possibly lead some to suspect that we are in some sense a political society. Such, of course, is not the case. We are all students of Sociology, and the basis of our formation is as expressed in our circular.

"The Section originated in a wish to unite, for the purpose of mutual help, those who were already students of Mr. Herbert Spencer's system, but were unknown to each other, and to introduce to the Synthetic Philosophy those already engaged in some special biological study, but as yet unfamiliar with the principles common to all departments of Natural History."

The Science of Society admits of very wide generalisations which no other science offers, and it cannot be doubted that perhaps among the many interesting questions arising out of that study, Education, Religion, Politics, Art, Science, and Literature, will all have a share of attention. *Apropos* of this I venture to quote a few of the concluding words of Mr. Herbert Spencer to his work on the study of Sociology. He says:—"And here let me point out distinctly the truth already implied, that studying Sociology scientifically leads to fairer appreciations of different parties, political, religious, and other. The conception initiated and developed by Social Science is at the same time Radical and Conservative—Radical to a degree beyond anything which current Radicalism conceives; Conservative to a degree beyond anything conceived by present Conservatism."*

And he goes on to point out at length—which I must not stay to trouble you with—that when there has been grasped the truth that Societies are products of evolution, then there will be realised a proper conception of such Societies, and that as Mr. Herbert Spencer says, "thus the theory of progress, disclosed by the study of Sociology as science, is one which moderates the hopes and the fears of extreme parties."

(To be continued.)

NOTE.—By the kind permission of Mr. Herbert Spencer, the Sociological Section is allowed to use on its Proceedings the Device at the head of this Address, which has been impressed at the side of the binding of the volumes of the Synthetic Philosophy since their first issue. The Device appears to indicate the evolution of life. Beneath are the crystals of the volcanic rocks which underlie all creation. Superimposed is the alluvial soil and recent mould. Springing from the latter are two forms of vegetable life—a Cryptogam (non flowering) and a Phenogam (flowering) plant respectively. The last is a Dicotyledon, the highest form of vegetable life. This appears in bud, leaf, flower, and fruit. Creeping up and feeding upon the flowering plant is a larval form of invertebrate life (caterpillar); suspended from the central portion is the *pupa* (chrysalis), and resting upon and crowning the flower is the *imago* (perfect insect).—W. R. H.

MUSHROOM-GROWING.

[This account has been furnished to the Editors by a friend who has had extraordinary success in cultivating mushrooms indoors and out, and they think some of their country readers will appreciate the publication of so successful a method.]

You ask me to write you a treatise on mushroom growing! But the subject has already been so thoroughly discussed in many of our Horticultural publications that I am afraid I can give you no fresh information, and for my pains shall only be accused of plagiarism. However, having been now for some years a tolerably successful grower, I have no right to keep the secret (?) to myself, but will try and make the system as plain to you as it is easy to me. There used to be an old theory that "horse-*droppings*" were the only material of which a mushroom bed could successfully be made, and for some years I laboured under the same delusion myself, until the difficulty of procuring such a material, pure and simple, drove me to the more primitive and certainly more effective practice of using stable manure, straw and all, just as it leaves the stable—(the horses should be corn-fed, and the manure as fresh as possible). With such an appliance failure should be unknown. The art, if I may so term it, lies in the after treatment. I am in the habit of leaving the manure, when brought and roughly forked out of the wagon, to ferment for two or three days, and then turning it some five or six times until the rank

* "The Study of Sociology," 9th edition, p. 394, 1880.

heat *and smell* has subsided. Each time it is turned, like good housewives, we turn "sides into middles," and as the turning proceeds, shake in a little rubbish, such as weeds, or long grass from the bottom of an untidy fence, together with a slight sprinkling of good rich loam. This tends much to sweeten the compost, which after the turnings I have enumerated will have become what gardeners term quite "short." It is then in a fit state to form a bed, and we proceed thus: mark out a space in a good open situation (by *no* means under trees) four feet wide, and in length according to the quantity of manure; shake it thoroughly as you go on, so that the ingredients may be well incorporated, treading it firmly and beating it well with the back of the fork, so that it may be perfectly solid by the time it is finished. The best form for the bed is that of an equilateral triangle for out-door cultivation, and under cover I prefer a slight slope to a level surface. I then insert pointed sticks at intervals all over the bed, and leave it for three or four days, by which time the heat will probably be at its strongest. It is desirable that the manure during its preparation should not be exposed to much rain, as any excess of moisture is fatal to the spawn. After this we withdraw the sticks daily to feel the temperature, and as soon as it begins to decline and becomes about equal to that of milk fresh from the cow, say 70° to 80° Fahr., we insert lumps of spawn about double the size of a walnut six or eight inches apart all over the bed, "tucking" it in about three inches under the surface. The bed is then left for a few days, and if the heat still continues to decline gradually, it may be moulded over with good loamy garden soil, free from stones, to the depth of some three or four inches, and the work is done. I need not tell you that the beds must be kept dark, or in other words, covered with straw or dried bracken, which will protect them from cold winds and rain, as well as from being scorched by the sun, either of which would be prejudicial to success. Beds of this description may be made at any time of the year; but for a main crop and for length of bearing we find September one of the best months, and in ordinary seasons mushrooms will appear about the beginning or middle of March following, continuing till the end of June or beginning of July. One word of caution about *gathering* the mushrooms. I use the word advisedly. They should be always gathered (giving them a slight twist), but never on any account should they be *cut;* the old stems thus left in the bed only breed insects, which prey upon the young mushrooms, and will often destroy a whole crop. Care, too, should be taken in gathering the crop not to loosen or disturb adjacent ones, as they never take root again, and only wither away. I think if you follow these simple directions you may almost insure a crop, more or less; but some seasons are undoubtedly more favourable than others to the growth of all Fungi. I have observed them closely now for some years, and not only are they influenced by the seasons, but you will invariably find that they grow quicker and more luxuriantly when the moon is increasing than when it is decreasing. I know that frequent complaints are made of failures in mushroom-growing; but these arise only from want of care in the preparation of the material, and when mushrooms are once established, or rather when their cultivation is thoroughly understood, it is astonishing in what queer places they will make their appearance from time to time. I have not unfrequently had them pushing up in quite small flower pots, when the soil in which the plants were potted had been mixed with the remnant of some old exhausted mushroom bed. Under cover, say under the stage of a greenhouse, which is a very useful place to turn to such account during the winter, the temperature should range between 50° and 55°, but never exceed the latter, or the produce will become weak and "spindly," and very soon cease altogether. Close covering with some loose material will to a great extent prevent evaporation; but should the surface of the beds become very dry, a slight syringing with salt and water is all that will be required.

AN IMPROVED SYSTEM OF ARRANGEMENT IN PROVINCIAL MUSEUMS.

BY F. T. MOTT, F.R.G.S.

It will be generally admitted that the majority of provincial museums are not quite ideal either in their selection of objects, or in their method of display and arrangement. I wish to suggest a plan suitable for general adoption, by which the largest amount of information may be conveyed in the most attractive form, and at the least expense.

For the sake of convenience let us consider what should be done in the single department of Ornithology. A provincial museum generally possesses a number of stuffed birds, but these are *not* generally objects of beauty and delight, and the uninstructed public walk round bewildered, making much of the spots on an Argus-pheasant, or the protuberance on the head of a hornbill, but getting little information about birds in general. It has often been urged that provincial museums should devote their attention solely to the Natural History of their respective districts. But the objections to this are that visitors would get too exalted a notion of the importance of the local fauna in relation to that of the whole world, and that much valuable information, only to be got from foreign forms, would be lost. It has also been recommended that while the local fauna is treated as a distinct department, there should be a typical collection of the fauna of the globe entirely separate from that of the locality. I would suggest, as the most desirable system, a combination of these two proposals, in such a way as to utilise the advantages of each without the awkward and arbitrary separation into two departments. Let a range of good wall-cases be provided not less than eight feet high, three feet deep, and divided into five feet bays, each bay glazed with a single sheet of plate-glass. Let one or more of these bays be devoted to each order, according to its size and importance. On the ground line of these cases place the collection of local birds, and let the *life-history* of these be illustrated in the most complete and elaborate manner. The permanent residents and summer visitants should be shown (male and female) with their nest, eggs, and young, in perhaps two or three stages, set up in a pictorial manner, showing the position and materials of the nest, the manner in which the old birds provide food for the young, and the mode in which the half-fledged brood begin to seek their own living. The winter visitants should be shown (male and female only) without nest or young, and the casuals by such single specimens as can be obtained. Every specimen exhibited in this department should have been actually procured in the district, no imported or foreign skins being admitted. It would be competent for each provincial museum to work up this department very completely, and it would be highly interesting and instructive to all visitors. Taking the ground line for the local birds, and giving it an average height of three feet six inches, let there be a clearly-marked division, not necessarily a *straight* line (a wavy and irregular one would be both more convenient and more artistic), but a distinct division at about that height; and on this second stage let those birds be exhibited which are *British*, but have never been found in that locality. These should be shown with less pictorial elaboration, in pairs, male and female, but generally without nests or young. Above these let there be exhibited a few of the most striking and typical foreign birds, set up in a simple manner, without any pictorial details. Each order would be distinct, and there would be the best opportunity of comparing the local birds with those of Britain generally, and of the whole world; while a real notion of the life of birds would be conveyed by the full portraiture of those forms with which the local visitors would be most familiar. In those cases in which an order is not represented in the locality at all, an additional piece of instruction would be conveyed by leaving a blank space of say six to twelve inches on the ground line, with a printed card stating the fact that the order, *Steganopodes* for instance, is not represented in this locality. All specimens or groups of one species should be very distinctly labelled, and to avoid the spottiness produced by a number of white labels, the labels should be lightly tinted with some neutral and harmonious colour, or with the same colour as the ground, or tree stump, or foliage on which the group is placed; the English name in plain black letters a quarter of an inch high, the scientific name in type of half that size, and the locality or native country, are all the particulars which should be given on the labels. A cheap popular guide-book should be prepared, giving further details.

A museum arranged on this principle in all its departments of Natural History, would be novel, and would certainly have more local interest than museums commonly possess. It is a system which is *practicable* and not too costly. Local specimens can be obtained at little expense, and a local fauna can be exhibited thoroughly and completely. It is generally wiser to do a little well than to attempt much and make a muddle of it. But when in addition to the little well done you can have all that would otherwise be inefficiently done, and lose nothing, the advantages seem to be all on one side. Objection has been taken to the suggested arrangement on artistic grounds. It has been said that the horizontal lines of division would be artistically objectionable, and that it would be more pleasing to arrange all the birds of one order in one artistic group. There is a certain truth in this, but the *first* object of a museum is *instruction*. The artistic effect will depend upon the skill of the curator, who may easily make the three irregular lines strong enough, and yet not so strong as to be objectionable; and when the whole of an order is grouped together there is the very practical danger that he will select simply the showiest birds in order to produce an attractive effect. A Free Public Museum must be *made* attractive or the public will not frequent it. The object to be attained is this—to convey as large an amount of information as possible to those who can only take in its teachings by the eye as they pass along the galleries, and at the same time to make it easy for the student to get more detailed information when he requires it.

The proposed arrangement might be simplified by introducing two stages only instead of three. In this case the local specimens would occupy the ground line as before, and above them would be placed selected specimens of the same order from all parts of the world, the British forms not being separately grouped. Another modification might be adopted with the three stages by making the middle one represent, not the British forms, but those of the Palæarctic region, in which Britain is included. The stages may be marked by difference of prevailing colour, or merely of pictorial elaboration.

Nine out of ten of the visitors who pass through a museum will not give much time or thought to the study of what they see. But a good deal of information may be forced upon them by labels which they *must* read, by pictorial groups which tell attractive stories, and by comparisons which are too obvious to be missed. But then the labels must be in bold type, and in English. Such pedantries as *Pisces fluviatiles*, instead of "Freshwater Fishes," are simply intolerable in a popular museum. The pictorial groups must be pictures of family life, not merely rocks and grasses with single specimens stuck upright among them. In the comparisons which the public are asked to make the things to be compared must be close together, staring them in the face, not in separate cases right and left of them.

The arrangement suggested above provides for all these methods of driving home the truths of Natural History into the minds of casual visitors. It is applicable to all the departments of a museum, so that if it were adopted a uniform plan might be carried through the collections from end to end, giving a systematic completeness which is rarely found in museums at the present time. It utilises the breaks and blank spaces in every series, making them distinct items of knowledge in a manner scarcely ever attempted, and in fact almost impossible with the usual methods of arrangement. It is an elastic system, admitting of many variations while retaining the fundamental principle, and of all really effective systems it is the least expensive, because it depends mainly upon objects procurable in the locality. That provincial museums should give primary attention to local objects is now a recognised principle among nearly all those authorities who have studied this subject. In the Transactions of the Hertfordshire Natural History Society for October, 1881, is an excellent article on Provincial Museums, by Mr. John Hopkinson, F.L.S., in which the opinions of many of the leaders of modern science are quoted, all pointing in this direction. Having recently been engaged in discussing this matter with the managers of the Leicester Museum, I took steps to ascertain the present opinion of the best authorities. Fifty printed circulars were posted to gentlemen of well-known scientific repute, mostly Fellows of the Royal Society, asking for their views as to whether, in provincial museums, local or general collections should receive primary attention. The whole of these fifty gentlemen were good enough to return the circular duly marked, and in many cases with notes appended enforcing and explaining their views. Forty of them were distinctly and strongly in favour of the local collections taking primary rank and being worked up to the utmost completeness. Unfortunately, however, this evidence did not prevail; the old-fashioned system was adhered to, and the Leicester Museum has lost the opportunity of being a leader in museum reform, and a model for the Midland Counties of what present scientific opinion demands. The Derby and Nottingham Museums have made some excellent attempts at reform, but in my judgment they are not on the whole successful. The Nottingham Museum is imperfectly lighted, and the handsome central cases, being tall and very close together, make a sort of labyrinth, in which one loses the thread of the arrangement. I hope the Birmingham Museum will take all these lessons to heart and give us the model for which we wait. I hope also that particular attention will be given to the lighting of its rooms and galleries, both by day and night. The reflection of windows or gaslights from the glass of the cases destroys half the value of their contents. Finally, it must not be forgotten that museums should aim at a good deal more than the casual instruction of chance visitors. A model museum should be associated with a school of science, and should possess, in addition to its mounted and exhibited collections, duplicate collections of skins, etc., arranged in drawers, for removal to the lecture theatre, and for handling and examination by students. This department is at least as important as the other.

CUCKOO FLOWERS.

It is singularly interesting to notice the many different objects of nature that are associated in the minds of the peasantry with the appearance of the cuckoo. In the case of plants, the fact of their flowering about the time that the first note of this welcome harbinger of spring is heard usually constitutes the basis for their being designated Cuckoo flowers; but not only plants are so associated, for there are cuckoo lambs born about the time that the bird appears; the well-known cuckoo spit insects, and the Wryneck (*Yunx torquilla*) called also Cuckoo's mate, it being alleged that the bird always accompanies the cuckoo in its migrations.

The following plants have come under my notice as being so connected, but in recording them I make no pretensions to include all that are thus popularly associated with the Cuckoo by the peasantry of the Midland Counties, there being probably in other districts, at present inaccessible to me, some other plants not noticed. First stands the Ragged Robin or Cuckoo flower (*Lychnis Flos-cuculi*) which has the honour of having the name Latinised, thus bearing evidence in support of the application of the term which connects it with the Cuckoo. It would appear from Miss Baker's "Glossary of Northamptonshire Words and Phrases" that the appellation is extended to *Lychnis diurna*, and she quotes Clare in support of this assertion—

> "And oft while scratching through briary woods,
> For tempting Cuckoo flowers and violet buds."
>
> (See "Village Minstrel.")

This quotation would apply with equal propriety to *Orchis mascula*, which, Mr. Aplin remarks (see p. 117), is termed Cuckoo flower in North Oxfordshire, suggesting, further, that it was the plant referred to by Clare, instead of *Arum maculatum*. For its reference to *Arum* I was also indebted to Miss Baker's Glossary, and not having before heard of its application to *Orchis*, took it for granted that Miss Baker was right, without inquiring particularly into the matter; but on more mature consideration I feel convinced that *Arum* is not the plant referred to. Probably the difficulty of ascertaining the correct names of the plants spoken of by the rustics under these popular titles, without the opportunity of seeing an actual specimen—the descriptions of them *given by the rustics* being oftentimes very vague—may have led the author into some errors, of which this is an example.

The association of cuckoos with Bedlam Cowslips (*Primula elatior*) would lead one to expect to find the two plants in flower at the same time; therefore, it cannot be *Orchis maculata* (the Spotted Orchis), whose leaves, though more distinctly blotched with purple than those of *Orchis mascula*, are occasionally found unspotted, and moreover, the plant does not usually flower until the cowslips have disappeared. The "frecked lip" and "hooked nose" spoken of by Clare would be far more plainly discernible in *Orchis* than in *Arum*, the spotted base of the labellum being the "frecked lip," and the curved spur the "hooked nose."

The most common name that I have met with for *Orchis mascula* and *O. morio* is that of "king fingers."

If, however, we assume that Mr. Aplin is right, and Miss Baker and myself were wrong in applying the term Cuckoo flower to *Arum* instead of to *Orchis*, in the words quoted from Clare (see p. 84), it has certainly been associated with the Cuckoo for more than 200 years, the older authors, such as Culpeper and Parkinson, speaking of it as Cuckow's point, and the Cuckow's pintle. I have discovered that several of the local names enjoy a very limited circulation, and possibly such may be the case here.

Many authors speak of *Cardamine pratensis* and *Cardamine hirsuta* as Cuckoo flowers. Personally, I do not remember having ever heard them called by any other names than those of Lady's smock (*Cardamine pratensis*) and Land cress (*Cardamine hirsuta*). Shakespeare says—

> "When daisies pied, and violets blue,
> And *Lady smocks* all silver white,
> And *Cuckoo bu ls* of yellow hue,
> Do paint the meadows with delight,
> The Cuckoo then on every tree sings cuckoo."

The cuckoo buds mentioned by Shakespeare are said to be the golden stars of the pilewort (*Ranunculus Ficaria*), and Miss Baker states that the term is extended so as to include other species of Ranunculus, such as *bulbosus* and *acris*, and probably also *Caltha palustris*.

Here, at Hampton, I am informed that the wood sorrel (*Oxalis Acetosella*) is called Cuckoo flower, and also *Anemone nemorosa*, which is further designated Cuckoo's maat—the broad pronunciation of meat—it being alleged that the bird feeds upon the plant.

For some time past I have been engaged in recording notes on the names by which plants, birds, insects, or any other objects of nature are known among the rural population of our Midland Counties, noting also such scraps of folklore and relics of superstition as come under my notice, it having occurred to me that unless they were speedily collected the progress of education, now so liberally dispensed to our country lads and lasses, would in process of time sweep them all away, so that they would become totally lost.

My present opportunities for this work are extremely limited, so that I beg to take advantage of the present occasion for soliciting assistance from other members of the Midland Union.

All information that I may thus receive *from other members* shall be noted, and duly acknowledged, it being my intention after having collected further information on the subject to send the matter for publication in the "Midland Naturalist."—Robt. Rogers, Hampton-in-Arden, Warwickshire.

[Since writing the above I have extracted the following from Parkinson's "Theatre of Plants." Speaking of the names of the Wood Sorrel or *Oxalis Acetosella*, he says:—"Of some Panis Cuculi, Cuckowbreade, eyther because the cuckowes delight to feed thereon or that it beginneth to blossome when the cuckow beginneth to utter her voyce." —R. R.]

THE FLORA OF WARWICKSHIRE.
AN ACCOUNT OF THE FLOWERING PLANTS AND FERNS OF THE COUNTY OF WARWICK.

BY JAMES E. BAGNALL.

(Continued from page 107.)

COMPOSITÆ (*continued*).

BIDENS.

B. cernua, *Linn.* *Nodding Bur Marigold.*
Native: In or near pools, ditches, and canals. Local. August, September, or later.
I. Sutton Park; Middleton; pool near Maxtoke Priory; Solihull and Knowle Canal; near Packington; Meriden marsh; Balsall Street, &c.
II. Oversley; Sambourne; Middle-town, *Purt.* ii., 389; River Avon, Leek Wootton fields; Bagington Bridge; mill pool, near St. Nicholas Church, Warwick, *Perry Fl.*, 69; small pool, Itchington Holt.

B. tripartita, *Linn.* *Tripartite Bur Marigold.*
Native: In or near pools, canals, &c. Local. August, September.
I. Maxtoke, *Blox.;* Rotten Park Reservoir, *W. B. Grove;* Knowle Canal bank; pool near Knowle; canal near Olton; side of drain, lane to Box trees near Hockley.
II. Canal bank by Barby Road, *R. S. R.*, 1874; Myton; Emscote, *H. B.;* Salford! *Rev. J. C.;* Lighthorne, *Bolton King:* canal bank near Stratford; Holywell, &c.

INULA.

I. Helenium, *Linn.* *Elecampane.*
Alien: In fields and woods Rare. August.
I. Lower Whitacre, *Bree, Mag. Nat. Hist.*, iii., 165.
II. Studley, in the Castle fields; Grafton, *Purt.*, ii., 410; near Luddington; Woodloes, *Herb. Per.;* Shortwood coppice, near Tardebigg, several plants, 1876.

I. Conyza, *DC.* *Ploughman's Spikenard.*
Native: On dry banks in marly soils. Very local. August, September.
I. Lane from Shustoke to Maxtoke.
II. "*(Conyza squarrosa)* roadside between Warwick and Myton;" "hilly field on the footroad from Emscote to Leamington," *Perry Fl.*, 70; Kenilworth; bank between Warwick and Snitterfield, *H. B.;* Salford! *Rev. J. C.;* Whatcote, *Rev. J. Gorle;* Wellesbourne and Lighthorne, *Bolton King;* Bidford; Lapworth Street.

I. dysenterica, *Linn.* *Greater Fleabane.*
Native: In marshes, ditches, and marshy woods. Locally common. July to September.
I. Sutton Park; Middleton heath; New Park; Hartshill; Merivale; Coleshill: Hampton-in-Arden, &c.
II. Honington! *Newb.;* Salford! *Rev. J. C.;* Alveston pastures; Harbury; Alveston; Drayton; Pillerton Priors, Tile Hill.

I. Pulicaria, *Linn.* *Small Fleabane.*
Native? In damp places by roadsides. Very rare. August to October.
I. About Wishaw, near Coleshill, *Perry Fl.*, 71.
II. Hill Morton, near Rugby, *Baxter, Purt.*, iii., 65; field at Myton, near Warwick, August, 1834, *Herb. Perry.*

BELLIS.

B. perennis, *Linn.* *Common Daisy.*
Native: On pastures, heath lands and waysides. Common. March to October. Area general.

ERIGERON.

E. acris, *Linn.* *Blue Fleabane.*
Native: On banks and in fields. Rare. July, August.
II. At Allesley and Meriden, *Bree, Purt.*, ii., 396; near the Royal Oak public house on the roadside between Allesley and Meriden; *W. T. B., MS., N. B. G.;* Springfield, near Stratford-on-Avon; Wootton Wawen; Wilmcote; Barden Hill! *W. Cheshire; Herb. Perry;* on railway banks between Brandon and Coventry; Willenhall; Moreton Morrell, *H.B.*

SOLIDAGO.

S. virga-aurea, *Linn.* *Common Golden-rod.*
Native: On heath lands and waysides. Very local. August, September.
I. Sutton Common; lanes about Solihull; lanes near Hockley and Monkspath, Shirley.
II. Between Wootton fields and Stoneleigh, *Perry*, 1817; Kenilworth, *Bree, Mag. Nat. Hist.*, iii., 165.

TUSSILAGO.

T. farfara, *Linn.* *Common Coltsfoot.*
Native: On railway banks, wayside heaps, and in woods in marly soils. Common. February to April. Area general.
[*Tussilago hybrida.* Hoo Mill, on a willow bed, *Purt.*, ii., 408; Bidford Grange, *Bree, Mag. Nat. Hist.*, iii.]

PETASITES.

P. vulgaris, *Desf.* *Common Butter-bur.*
Native: On river banks and in ditches. Locally common. April, May.
I. Knowle Canal bank, near Earlswood.
II. Stoneleigh; Burton Green, *Y. and B.;* Honington! Tredington! *Newb.;* Salford! *Rev. J. C.;* Ditch Hill; Morton churchyard; canal side near Hill Morton, *R. S. R.*, 1877; Claverdon; Stratford, *H. B.;* Alveston Pastures; Wootton Wawen.

[*P. fragrans*, Presl. *Sweet-scented Coltsfoot.*
Alien: Banks and quarries. Rare. April.
II. Canal bank, Warwick; sand quarry, Warwick! *H. B.;* near Emscote, *Herb. Perry.*]

[*P. albus*, Gaert. *White Common Butter-bur.*
Alien: In moist places. Rare. April.
II. Arbury Hall naturalised; *T. Kirk, Herb. Brit. Mus.;* Guy's Cliff! *H. B.*]

EUPATORIUM.

E. cannabinum, *Linn.* *Common Hemp-Agrimony.*
Native: By rivers, streams, and ditches, and on banks. Locally common. July to September.
I. Sutton Park; Middleton; Marston Green; Olton pool; coppice in Shelley Lane; Blythe Bridge, near Solihull, &c.
II. Lane between Pigwells, and lane to Wedgenock Park; Fern Hill, *Perry*, 1817; Oversley, near the bridge! Red Hill, *Purt.*, ii., 387; Alveston Pastures; Salford Priors; Harbury Heath.

CICHORIUM.

C. Intybus, *Linn.* *Wild Succory.* *Wild Endive.*
Native: On the borders of fields, waysides, etc., in Lias and marly soils. Local. July to September.
I. Tamworth Castle; *With.*, ed. 3, 694; as a casual on railway banks; Sutton Park, 1866.
II. Between Warwick and Stratford; on the road from Tachbrooke to Harbury, *Perry Fl.*, 67; Brown's Over, near Rugby, *Rev. A. Blox.*; Lawford Fields by lime works, *R. S. R.*, 1874; roadside between Newbold and Harborough Magna, *R. S. R.*, 1877; Birdingbury, *H. B.*; Moreton Morrell; Temple Grafton; Exhall; near Stratford-on-Avon.

LAPSANA.

L. communis, *Linn.* *Common Nipplewort.*
Native: On hedge banks, waysides, fields, &c. Common. June to August. Area general.

HYPOCHÆRIS.

H. glabra, *Linn.* *Smooth Cat's-ear.*
Native: On gravelly waysides. Very rare. June to August.
I. Found on gravelly ground near Middleton, *Ray Syn.*, ed. 3, 166; Washwood Heath, Warwickshire, *With.*, ed. 2, ii., 859.
I have carefully examined all likely places in the Middleton district, but have not been successful in finding *H. glabra* at present; and as the Washwood Heath station is now occupied by buildings the plant has become extinct there; it may, however, be found yet in Ray's station.

H. radicata, *Linn.* *Long-rooted Cat's-ear.*
Native: On banks, heaths, meadows, waysides, &c. Common in the Tame basin. Rare or local in the Avon basin. May to October.
Absent over wide areas in the southern part of the county.

LEONTODON.

L. hirtus, *Linn.* *Hairy Hawk-bit.*
Native: On heaths and heathy waysides, Local. May to September.
I. Sutton Park; Middleton heath; Hartshill; near Knowle and Solihull; pastures, Hampton-in-Arden.
II. Honington, *Newb.*; Beausale Common, *Y. and B.*; near Harbury; Bishop's Itchington.

L. hispidus, *Linn.* *Rough Hawk-bit.*
Native: In pastures, and on heaths and waysides. Locally common. June to September. Area general.
I have found this plant in every district I have visited.

L. autumnalis, *Linn.* *Autumnal Hawk-bit.*
Native: In pastures, on heaths and heathy waysides. Common. July to October, or later. Area general.

PICRIS.

P. hieracioides, *Linn.* *Hawk-weed Ox-tongue.*
Native: On waysides, waste places and fields in Lias and marly soils. Local.

II. Lawford Road, near Rugby, *Rev. A. Blox.;* near Harborough Magna, *Rev. A. Blox.;* near Birdingbury wharfe, *H. W. T.;* lanes about Lambcote, Honington, and Halford, *Newb.;* Whatcote, *Rev. J. Gorle;* Lillington; Whitnash, *Y. and B.;* Billesley; Wilmcote; Bearley; Drayton Bushes; Binton; Bidford.

HELMINTHIA.

H. echioides, *Gaertn.* *Bristly Ox-tongue.*

Native: On waysides, field borders, quarries, &c. Local. July, August.

II. Whitnash; Chesterton! *H. B.;* Kineton! *Bolton King;* Honington, *Newb.;* Lawford Road, near Victoria Station, *R. S. R.*, 1877; Drayton Bushes; Billesley; Bishopton; quarries near Binton Bridges; quarries near Bidford; quarries, Exhall; Itchington Holt; near Pillerton Priors.

TRAGOPOGON.

T. pratensis, *Linn.* *Yellow Goat's-Beard.*

Native: On banks and waysides. Rare. June to August.

I. Marston Green; near Escole Green.

II. Railway bank, Milverton; Hill Wootton; Warwick, *H. B.;* Studley.

Var. β *minor*, Fries. Locally common.

I. Oscot, *Rev. J. C.;* lanes about Solihull; railway bank, Witton; railway bank, Hampton-in-Arden; Hartshill, &c.

II. Lillington, *H. B.;* Willenhall, *T. Kirk, Herb. Brit. Mus.;* Tredington; Lambcote; Stratford, *Newb.;* Bidford Grange; Salford Priors; Rowington; Itchington, &c.

Not unfrequent on railway banks in all parts of the county.

[**T. porrifolius,** *Linn.* *Salsify.*

Casual: On railway banks, in meadows and pastures. Rare. June.

II. At Mr. Martin's, Gorcot Hall, *Purt.*, ii., 365; on the railway bank near Leamington, *H. B.*]

But for Purton's notice of the plant I should not have considered this plant worthy of record; it has no claim to a place in the flora.

TARAXACUM.

T. officinale, *Wigg.* *Common Dandelion.*

Native: On waysides, banks, pastures, and heath lands. Very common. March to September. Area general.

Var. *b*, *erythrospermum*, DC. More local.

I. Sutton Park; Hampton-in-Arden; Marston Green; Withybrook, near Nuneaton; Knowle; Umberslade.

II. Warwick; Wootton; Kenilworth, *H. B.;* Yarningale common; Henley-in-Arden; Billesley; Princethorpe.

Var. *c*, *lævigatum*. Rare.

I. Sutton Park; Withybrook, near Nuneaton.

II. Yarningale Common; near Chesterton Wood, 1878.

Var. *d*, *palustre*, DC. In marshes. Local.

I. Sutton Park; waysides and damp pastures, Middleton; Withybrook; Ballard's Green; Arley; Hampton-in-Arden; marshy field near Packwood Mill.

II. Haseley; Beausale Common; Wroxall! *H. B.;* Yarningale common; near Chesterton Wood.

(To be continued.)

MIDLAND UNION OF NATURAL HISTORY SOCIETIES.

The Sixth Annual Meeting will be held at Tamworth on June 12th and 13th, 1883.

The Council will assemble on Tuesday. June 12th, at Twelve o'clock, in the Banqueting Hall of Tamworth Castle.

The Annual Meeting will be held at Three o'clock p.m., in the Banqueting Hall, the President of the Union, Egbert de Hamel, Esq., in the chair.

The Meeting will be opened with an address from the President, after which the reports of the Council and the Treasurer will be received.

The Darwin Gold Medal for 1882, awarded last year for Zoology, will be presented to Professor A. M. Marshall, M.A., M.D., D.Sc., and W. P. Marshall, M.I.C.E., for their paper on the Pennatulida.

Invitations from Societies in the Union for the Annual Meeting in 1884 will be considered, work for the coming year discussed, and general business transacted. At the conclusion of the meeting members will be (by the kind permission of the resident, Thomas Cooke, Esq.) conducted over the Castle, after which an inspection will be made of the ancient fortifications, the Church, the Moat House, and other points of interest in the town. Those Members who prefer Botany to Archæology will have the option of an excursion in boats on the River Anker.

The Conversazione will be held in the Town Hall on Tuesday, June 12th, from 7.30 to 10.30 in the Evening, when there will be an Exhibition of objects of general scientific interest, including a microscopical display exhibiting life from its lowest to its highest forms, together with collections representing the various branches of Natural History, Archæology, etc.

During the Evening there will be a series of short Lectures given in an adjoining room on Living Objects, Geology, and Astronomy, each subject being illustated with lantern slides. *Morning Dress.* Admission, including refreshments, 2/6, by ticket to be obtained of the local Honorary Secretary. The holders of Conversazione Tickets will be entitled to attend the General Meeting of the Union, and the subsequent Archæological Excursion in the Town, with the option of obtaining a ticket for either of the two Excursions on the following day.

Reception Room.—The rooms of the Natural History, Geological, and Antiquarian Society in George Street will be open as a Reception Room for the members of the Union and visitors, and letters may be addressed there.

Excursions.—On Tuesday, June 12th, a party will be formed for visitors not Members of the Council to visit some of the local manufactories, starting at Twelve o'clock from the Society's Rooms. At the conclusion of the General Meeting (4.30 p.m.) members and their friends will be shown the principal objects of interest in the Town, while those who prefer the River Excursion will assemble at the same time at the Club Boat House by Bolebridge.

On Wednesday, June 13th, there will be two Excursions, viz.: one to Hartshill and the other to Lichfield and district.

The Hartshill Excursion will leave for Polesworth Church and Nunnery, proceeding from here to the old Roman way called Watling Street, thence branching off to Merevale Abbey, across the Park (inspecting the newly-discovered Cambrian Rocks *en route*) to Bentley Common, where a short halt will be made; the party will then proceed through Bentley Wood to Oldbury Fort, the Tumulus, Castle, and Quartzite Quarries of Hartshill, Mancetter Church, and the old Roman Station of Manduessedum. A Luncheon or Meat Tea will be provided at Atherstone, at 4.30, from which point the party will return home by the Watling Street to Tamworth.

The Lichfield Excursion will proceed to Drayton Manor, the seat of Sir Robert Peel, Bart., who has granted permission for the Members of the Union to view the celebrated Picture Gallery and American Gardens, thence along the Watling Street in a north-westerly direction to the Tumuli at Hints and Offlow, and on to the Roman Station Etocetum; leaving here, the party will proceed to Lichfield, traversing the Icknield Street for a short distance *en route*. On arrival at Lichfield the Members will be conducted over the Cathedral and other objects of interest in the town. The return journey will be by Barrow Cop Hill, Whittington Heath (one of the new Military Depôt Centres), to Hopwas Wood, through which the party will walk, and so home.

Tamworth will be reached in the evening by each party before 7 o'clock so as to catch the various trains.

Both Excursions will start from the Castle Hotel at 9.30, and from Tamworth Railway Station Yard at 9.45 a.m. on the morning of the 13th.

The price of Tickets for each Excursion will be 10/-, including refreshments at one point during the day, and must be applied for not later than Friday, 8th June, to the local Honorary Secretary, Mr. William George Davy, Elford, Tamworth.

Correspondence.

A Note on Frogs.—On March 3rd last I observed a quantity of frog spawn in a pond, and at the same time some disgusting looking remains of frogs, chiefly legs, on some flattened rushes at a short distance from the bank. I have seen frogs fighting and squeezing each other. Is it known whether they are cannibals and eat each other? A country-woman who lives near was of opinion the frogs were "picked by the crows," *i.e.* rooks, from a neighbouring rookery, but she had not actually seen them do so. The pond is frequented by waterhens, and it is possible that, being short of other food, they may have slain the frogs, leaving the legs, etc. Mr. Morris gives an instance of a waterhen killing and eating young pheasants all but the leg and wing bones. Perhaps some reader, learned in reptiles, may know more about the mattter.—A. E. J.

Prolific Rat.—I learn that in the nest of a rat, killed at the Ben Nevis Distillery, Fort William, on the 22nd instant, were found fifteen young ones. Is it not usual for the rat to have but nine at a birth?—Clement L. Wragge, May 28th, 1883.

Blue Caps.—What is the plant spoken of by Clare, the flowers of which he calls blue caps?—

"Blue caps so divinely blue,
And poppies of bright scarlet hue."

MS. Poems.

—R. Rogers, Hampton-in-Arden.

The Blackheaded Gull.—There is scarcely a field between Barnetby and the Trent and Humber which is not the feeding ground, at this time of year, of the Blackheaded Gull (*Larus ridibundus*). They assemble by hundreds at the end of March to breed at the Gullery, at Twigmore, near Brigg, and also in fewer numbers on a rabbit warren near Frodingham, and leave again at the end of June. The eggs are laid on the ground, sometimes in a slight nest of rushes, sometimes on the bare earth; they vary very much in colour and markings. The nests are so near together that caution is necessary to avoid stepping on the eggs or young birds, and visitors can scarcely hear each other speak for the noise of the old birds screaming overhead. A keeper is employed to watch them as carefully as game, lest the eggs should be stolen and sold as being those of the plover. They are frequently seen in small flocks all the winter as far as thirty miles inland, feeding in wet ploughed fields.—A. E. J.

Pen Pits.—I have been reading the paper by Mr. Woodward, in the May number of the "Midland Naturalist," on the Pen Pits. I had never heard of these pits till a month or two ago, when I met with a book called "A Tour in Quest of Genealogy," by a Barrister (Mr. Fenton), published in 1811. The writer and a friend visited the pits under the guidance of an old inhabitant of Stourton, and from his account it appears there was the same difference of opinion then as to their use and origin as there is now, some supposing them to be quarries, and others habitations. I see the Committee report "an entire absence of pottery or any other trace of human occupation," while Mr. Fenton states "that at the bottom of several of the pits querns had been found;" but this is only what *he was told*, and, if true, does not *prove* the pits were dwellings—they might have been merely manufactories. If, however, the querns were worn by use it would be a different matter, and this point is worth paying attention to should further investigations be made by the Committee and querns be found. As to the question of pits generally, I suppose the safest conclusion to come to is, that some are and some are not dwellings. I cannot think that such pits as those on the top of Ingleborough, Yorkshire (where I have been), could be mere quarries. The top of the hill has been surrounded by a wall of rough stones, and the pits within the enclosure have margins of the same kind. They certainly give the idea of huts, or perhaps sheds (Pens?) for small cattle which must have been kept in the camp when an enemy was at hand.—G. H. Nevinson, Leicester.

Wild Ducks at Barnetby Junction.—On April 3rd, having to wait at the above station in the north of Lincolnshire for about an hour and a half, I made my way, with a friend, to the large ballast pit which lies parallel to the line. I had seen from the window, as we passed in the train, a coot on the shore, and was anxious to get a nearer view of it if possible. The pond can be no great depth, as it is intersected in all directions by beds of reeds and rushes, except towards its southern end, where there is a fine open space. We walked cautiously along a path, next the line, and came across several pairs of coots feeding on the top of the water, croaking to each other, and often diving with a flip which was most amusing to watch. They appeared quite unconcerned at our presence; not so several pairs of the common wild duck and two or three pairs of teal, which rose, and after wheeling round, settled at the far side of the pond, hiding among the rushes. On reaching the other end we caught sight of a pair of a different kind, which rose from amongst the reeds, but soon settled again; the drake was brown, with a broad white band on each side and a rather fan-shaped tail, with a blackish head; the duck, brown and white, but not so distinctly marked. On returning a few days later I saw them again, almost in the same place, so perhaps they were preparing to build. It was suggested to me that they might be Shovellers, which species has at times been caught in a decoy at Ashby, about fourteen miles distant "as the crow flies;" and the description in "Morris's British Birds" tallies with their appearance, as far as one could judge from a limited view at a little distance. Later in the summer I hope to have an opportunity of finding out whether any of these ducks remained to breed; they were quite indifferent to the noise of the trains, and the pond is otherwise very quiet, bounded on the opposite side by a bank and running stream.—A. E. J.

Notes from Woking.—Owing to the continued cold weather, but few insects have been observed during the past month. On April 18th I heard the Cuckoo (*Cuculus canorus*), Night-jar (*Caprimulgus Europæus*), and a *native* informed me he heard the Nightingale (*Philomela luscinia*); but the knowledge of Natural History, or the power of observing (*except* their neighbour's business) possessed by the natives about here is very small, for everyone whose attention I have called to the strange note of the Night-jar will persist in asserting that "it ain't the Night-jar, never heerd o' that thing—it's Frogs!" April 23rd commenced with bright sun, and very warm—*Anthophora acervorum* dashing about in a most frantic manner. About noon, the sky overcast, and wind bitterly cold. From 6 to 7 p.m. we had a very heavy fall of snow, which did not clear off the ground until 11 a.m. next morning; at 3 p.m. a heavy hail storm for 10 minutes, some of the stones measuring ⅜-inch diameter; this gradually changed to rain, and at 7 p.m. was accompanied with some sharp peals of thunder. April 26th.—I noticed a sand-bank facing south-east, from which the "face" had fallen away, so exposing to view numerous burrows of some species of *Andrena*, but on digging I found a *dead* Bee, nearly fully developed, at the bottom of each burrow: no doubt the very warm weather we had in February brought the Bees on, and the hard frost which followed killed the whole colony. April 30th.—I took a beautifully marked variety of the March Crosswing (*Anisopteryx æscularia*), an insect generally taken at the end of February. At 12.30 p.m. my wife called my attention to a Pond-skater (*Hydrometra lacustris*) skimming about in a fountain basin in our garden, and as we had only filled it with water the previous day we concluded that this insect had flown from the Basingstoke Canal, which lies some 300 yards to our north-west, the wind blowing from that direction. I have never known this insect take such a long or high flight, having to pass over two roads with houses. Its sight too must be wonderfully keen to have seen the water in the basin which is but 4ft. 6in. in diameter. The elytra and wings of this insect are very interesting, and the peculiar arrangement of the veins or wing bones is well worth careful study. May 4th to 5th.—We had 5 degrees of frost.—Fred. Enock.

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—GENERAL MEETING.—May 1st.—Mr. Bolton exhibited *Podophrya limbata* (Saville Kent's Manual, pl. 48, fig. 5), from fresh water near Birmingham, the only previously-recorded habitats having been marine; and *Clathrulina elegans*, brought from U. S. A. by Mr. R. Hitchcock, together with *Limnias annulatus*, an unidentified rotifer, Vorticella, etc. Mr. J. E. Bagnall exhibited Mosses:—*Orthotrichum rivulare*, in fruit, *O. saxicola*, *Tortula mucronata*, in fruit, and *Hypnum chrysophyllum*, all rare, from near Wootton Wawen; *Tortula latifolia*, in fruit, *T. marginata*, *T. revoluta* (rare), from near Sherborne, and other mosses; Hepaticæ:—*Lophocolea cuspidata*, from Preston Bagot (new to Warwickshire), *Metzgeria furcata*, from Wootton Wawen, and other plants. Mr. W. B. Grove exhibited Fungi:— *Sordaria fimeti*, *Nectria mammoidea*, *Ditiola radicata*, *Trametes serpens* (Berk.), all from Sutton, and new to Warwickshire; *Helminthosporium subclavatum*, (Sacc.), new to Britian; *Ascobolus glaber* and *A. furfuraceus*, from Sutton; and on behalf of Mr. Soppitt, *Dinemasporium graminum*, on dead grass leaves. SOCIOLOGICAL SECTION.—May 3rd.—The first meeting of this Section of the Society, for the study of Mr. Herbert Spencer's System of Philosophy, was held at the Mason College. The President (Mr. W. R. Hughes, F.L.S.), occupied the chair, and there was a large attendance, including several ladies. The President explained that the new Section had originated in a wish to unite, for the purposes of mutual help, those who were already students of Mr. Herbert Spencer's system, but were unknown to each other; and to introduce to the Synthetic Philosophy those already engaged in some special biological study, but as yet unfamiliar with the principles common to all departments of natural history. He read a letter from Mr. Herbert Spencer expressing cordial sympathy with the objects of the Section, and adding some valuable suggestions as to the course of work to be undertaken by the Section. An abstract of part of the President's Address, together with the above-mentioned letter *in extenso*, will be found at pp. 121-7. The President's Address was followed by a discussion upon the first two chapters of the "Essay on Education," introduced by Mr. Greatheed. Mr. Greatheed warmly sympathised with Mr. Spencer in his views upon the English Public School System, and deprecated the spending of so many years in the study of the dead languages. Professor Sonnenschein thought that the "Essay on Education" overstated the case against the study of the Classics, and did not even lay sufficient stress upon the importance of modern languages. Professor Haycraft advocated specialisation at an early stage of the school career, and Mr. S. D. Williams was strongly opposed to it, urging a good general education, and afterwards specialisation. Dr. Hill agreed in the main with Mr. Spencer's opinion that the study of Science is the most essential of all studies. Mr. Alfred Hayes (Hon. Sec.), whilst admitting its frequent abuse, defended the study of the dead languages on several grounds. After the discussion a series of slides was exhibited—under the superintendence of Mr. W. P. Marshall, Mr. J. E. Bagnall, and Mr. Greatheed—illustrating the cellular structure common to all forms of life. BIOLOGICAL SECTION, May 8th.—Mr. J. E. Bagnall exhibited Hepatics—*Jungermannia inflata*, in fruit (rare), *Cephalozia divaricata*, Sm., (rare and new to Warwickshire), both illustrated by microscopical preparations, and other hepatics; Lichens—*Cladonia rangiferina*, Coleshill (rare), *Parmelia olivacea*, Coleshill (new to Warwickshire), and other lichens; also male and female plants of *Empetrum nigrum*, from Sutton Park. Mr. W. G. Blatch exhibited two linnet eggs, one much paler than the normal form which was taken from the same nest, and also unmarked. Mr. W. B. Grove exhibited fungi—*Helminthosporium stemphylioides* (new to England, previously recorded for Scotland), *Torula ovalispora*, *Coniothyrium glomeratum*, *Menispora ciliata*, *Helotium pruinosum*, *Triposporium elegans* (all new to Warwickshire), *Peziza cyathoidea*, and *Reticularia umbrina*, all from Sutton; and *Ascobolus furfuraceus*, from Edgbaston. Mr. A. W. Wills then read a paper upon the "Reclassification of the Conjugate Algæ." After referring to the gradual increase in degree of differentiation which we can trace in the vegetable kingdom, starting from a uniform mass of unnucleated protoplasm, he spoke of the three classes into which the freshwater algæ may be divided, viz.:—(1.) Those in which the spores are produced by changes in the contents of a single cell; (2.) Those in which the spores originate in the union of the contents of two apparently similar cells; (3.) Those in which the spores are produced by the fertilisation of the contents of one cell by those of another dissimilar cell. The Conjugate Algæ belong to the second group. He then detailed the attempt which has recently been made by Dr. M. C. Cooke, to rescue the members of this g oup from the chaos into which they had been thrown by Continental species-mongers. A note by Dr. M. C. Cooke was then read in reply to certain observations made by Mr. C. B. Plowright in his paper on the "Re-classification of the Uredines," read before this Society in February last. GEOLOGICAL SECTION, May 22nd.—Mr. Mansell, jun., exhibited a rolled fragment from the red marl from Harborne, showing pseudomorphs of salt crystals, and some probable glacial scratches Mr. C. J. Watson exhibited some fine crystals of selenite from Shotover Hill, Oxford. Mr. T. H. Waller, B.A., B.Sc., then read a very interesting and instructive paper on "The Felspars." He stated first the general characters of the group, and then described in detail the composition and optical properties of each variety, as orthoclase, albite, anorthite, oligoclase, Labradorite, etc. He also described the various methods used to distinguish them by chemical tests, and by the microscope. The paper was illustrated by many hand specimens, and by microscopical sections. The paper was highly appreciated by the members present, and was followed by a discussion, during which Mr. Allport exhibited and described some fine pseudomorphs of felspar crystals.

OXFORDSHIRE NATURAL HISTORY SOCIETY.—On April 27th in University Museum, the first meeting of the summer term was held. Professor Westwood, M.A., presided, and exhibited a series of Stylops, a parasite found on the Bee. Mr. Battye showed a five-leaved form of Herb Paris, from Wytham Woods, which the Secretary, Mr. Druce, said was almost the commoner form this year in the Beckley locality. A. R. B. Battye, Esq., was elected Secretary of the Ornithological Section, *vice* Rev. H. A. Macpherson, who has recently left Oxford. An abstract of the Report on North Oxfordshire Ornithology for 1882, by Mr. Oliver V. Aplin, was read. The early part of year was noticeable for its extreme mildness, and the Chiffchaff (*Phylloscopus rufus*) was reported as staying the winter at Bodicote. Some additional localities for the Great Spotted Woodpecker (*Dendrocopus major*) were mentioned, and also that a nestling bird was taken in a wood on the borders of the county in June. The early spring did not appear to have influenced the summer birds of passage in any great degree. The late stay of House Martins was observed—young birds being still in the nest on October 17th. The occurrence was announced of the Fire Crested Regulus (*Regulus ignicapillus*) in the county (the first on record), an adult male example having been captured near Banbury. Reference was made to the Crested Grebes at Clattercutt Reservoir (*vide* "Midland Naturalist," 1882, pp. 275-276) and to a Blackheaded Gull (*Larus ridibundus*) shot in July. Notes on the autumn migration (*vide* p. 57-58) were read. The young broods of Partridges varied very much in different parts of the district. In some places the coveys were large and the birds well grown early in September, while in other small broods of undersized birds, and too often old birds entirely without encumbrances, were found. The Red Legged Partridge was certainly on the increase, and was met with not uncommonly. A Grey Phalarope (the tenth specimen on record) was procured near Banbury in December. Mr. Aplin also communicated a note on the occurrence of a Puffin (*Fratercula arctica*) near Woodstock, in November, and sent to Mr. Darby alive. Also on a peculiar variety of the Mole taken at Souldern in June. The colour of this specimen appeared at first sight to be a dusky cream, but on raising the fur it was found to be of a light though pale *apricot* colour, each hair having a dusky tip. The colours were warmer and deeper on the lower than the upper parts. Another specimen recently examined was of a darkish silver grey. A paper on bats by the late Frank Norton, Esq., which had been arranged and edited by the Rev. H. A. Macpherson, was then read, and will appear in a future number of the "Midland Naturalist."

SOCIOLOGY.*

[Continued from page 127.]

Mr. Herbert Spencer has over and over again insisted on the necessity of scientific culture in general as a preparation for the study of Sociology, and above all culture of the Science of Life. He says: "This is more particularly requisite because the conceptions of continuity, complexity, and contingency of causation, as well as the conception of fructifying causation, are conceptions common to it and to the Science of Society. It affords a specially fit discipline, for the reason that it alone among the sciences produces familiarity with these cardinal ideas—it alone presents the data for them in forms easily grasped, and so prepares the mind to recognise the data for them in the Social Science where they are less easily grasped though no less constantly presented. . . . . The Science of Life yields to the Science of Society certain great generalizations, without which there can be no Science of Society at all."†

It seems to me most appropriate that in Birmingham—whose motto is "Forward" and whose progress has ever been in harmony with it—once the home of Priestley, the discoverer of oxygen, one of the early pioneers of Evolution, and that in connection with a Natural History Society like ours, the oldest scientific society in the town, which has made Biology one of its principal studies, and which offers certain special facilities as regards its Library and appliances, there should be established a Section for the study of Sociology.

(1.) As regards the town, I submit from numerous circumstances which I will proceed to set out: its special suitability as a centre for the study of a somewhat advanced type of Society. From its peculiar topographical position in almost the central part of England, situated on the New Red Sandstone, at an average altitude of 450ft. above the mean sea-level (*a*) of undulating surface, covering a large area, and not generally overcrowded (*b*), salubrious (*c*), and enjoying an immunity from

(*a*.) According to Dr. Hill, F.I.C., the Medical Officer of Health for Birmingham, in his Report of the Health of the Borough for 1881:—"The elevation of the borough, that is its height above the mean level of the sea, varies between 310 and 600 feet, the lowest point being at Saltley, and the highest at Edgbaston. This lofty position is in many respects a considerable advantage, especially when associated, as it is in the case of Birmingham, with a porous soil consisting of the upper division of the Bunter or Mottled Beds of the Trias or Upper New Red Sandstone."

(*b*.) Mr. Hughes submitted a table showing the average number of persons per acre in four large towns, as follows, for the year 1881:—Birmingham, (incorporated 1838) 47·78; Leeds, (1661) 14·33; Liverpool, (9th King John) 106·4; Manchester (1838), parliamentary limits, 61·90. Mean, 57·51.

(*c*.) Mr. Hughes submitted a table, compiled from Dr. Hill's Report above referred to, exhibiting the mean death-rate per 1,000 persons living in nine large

* Abstract of an Address delivered to the Sociological Section of The Birmingham Natural History and Microscopical Society by W. R. HUGHES, F.L.S., President of the Section, at its first meeting at the Mason College, Birmingham.—Thursday, 3rd May, 1883.

† "The Study of Sociology," ninth edition, p. 322, 1880.

any serious and persistent class of epidemics;—contiguous to a geological field of exceptional interest, and to a country remarkable for its beautiful and varied scenery, its botanical richness, and its fertile agricultural produce;—in a county rendered famous by one of the greatest poets that any age has ever witnessed;—in a scene of developments in mechanical science with which are associated the names of James Watt, Matthew Boulton, and other worthies who have laid the foundation of the world's prosperity;—in a scene of art manufactures and industries, of beauty and utility, made everywhere famous by the works of Chance, and Elkington, and Gillott, and Hardman, and Mason, and Tangye, and Winfield, and hosts of others;—from the town being independent of any specific forms of trade such as cotton, woollen, etc., and not subject to recurrent panics or waves of depression arising out of or common to those specific forms of trade;—from the many and varied kinds of manufactures and trades which the town possesses, involving commercial relations with all parts of the globe;—from the facilities that these several manufactures and trades give for acquiring independence of position, and with it independence of character and thought;—from the town being within easy access of the Metropolis, but not in any way overshadowed by it, and particularly from its constituting the centre of an elaborate plexus of railway ramification, affording free and rapid communication with all parts of the Kingdom, and as a consequence bringing with it a varied and abundant food supply (*d*); —from its local water supply being both wholesome and plentiful;—from frequent immigration from other and distant localities;—from the town being undemoralised by antiquities or obsolete charities;—from the number, variety, and excellence of its educational, scientific, and literary institutions (*e*);—from the perfect freedom which all religious communities possess, and the vitality displayed by them;—from the active and energetic political and civic life which has always characterised its citizens;—from the remarkable development in almost every direction which the town has

towns for the nine years from 1872 to 1881, both inclusive, as under:—London, 22·56; Liverpool, 27·77; Birmingham, 23·48; Manchester, 28·07; Leeds, 24·34; Sheffield, 23·57; Salford, 27·37; Newcastle, 24·64; Norwich, 22·57. Mean of twenty large towns for the same period, 23·72.

(*d*.) A single illustration will suffice. Before the railway system was inaugurated, fish, as an article of diet, must have been (except to the wealthy) comparatively rare in Birmingham. Now, from its central position, the town has one of the most abundantly and variedly-supplied fish markets in the kingdom.

(*e*.) The Birmingham and Midland Institute was established in the year 1854, since which period upwards of 40,000 students have attended its Scientific, Literary, and Educational Classes, exclusive of the attendance at the Weekly Lectures in Session. The Mason Science College, which was founded by the generosity of the late Sir Josiah Mason so recently as the year 1880, has now (1883) more than 300 students. Both these institutions are open to male and female students.

exhibited during the present century (*f*);—from the number and variety of its annual exhibitions (*g*) inducing a healthy spirit of emulation both local and distant (witness the Exhibitions of Paintings and Industrial Arts, the Agricultural Exhibition, and the Exhibitions of Domesticated Animals;—the Horticultural Exhibitions, including specialities in certain flowers, some of which Exhibitions originated here, or are of acknowledged excellence);—from the large spirit of voluntary beneficence displayed by its inhabitants of all creeds and classes (witness the annual Hospital Sunday and Saturday collections (*h*) for the Charities of the town, both of which originated in Birmingham);—from the recreations of the people being both intellectual (witness the triennial Musical Festivals (*i*) of European celebrity, the Free Libraries, and the Art School) and physical (witness the numerous athletic and similar clubs);—from the fact that the extremes of wealth and poverty are not so marked as in many large towns, but that the number of thriving artizans is more numerous (witness the large

(*f.*) Mr. Hughes submitted a table showing that the population, which was 4,000 in 1690, had grown to 73,670 in 1801, and had increased at an average rate of about 24 per cent. in each decennial period from 1801 to 1881. At 1851 it stood at 232,841, and at 1881 it stood at 402,296. Speaking generally, the population had increased about a hundred-fold in two hundred years.

(*g.*) Mr. W. P. Marshall, M.I.C.E., has called attention to the fact that "The Bingley Hall Exhibition of Manufactures," which was organised by the Local Committee of the British Association at Birmingham in 1849, as a special local attraction for the members of the Association, was the parent of the Great Exhibition of 1851. Prince Albert, who had then the subject of an International Exhibition actively in his mind, having heard of this Birmingham Exhibition, made a special visit to the Exhibition, 12th November, 1849 (travelling down from London by a special train in 2½ hours, and he expressed himself greatly pleased and interested, making a close inspection and questioning the manufacturers about the work exhibited. It was understood he was greatly struck by the successful accomplishment of the exhibition, and that the result gave aid of importance in reference to the suggested Great International Exhibition of 1851.

(*h.*) The "Hospital Sunday" Annual Collections,—for the suggestion which led to their establishment the town is indebted to the late Mr. Thomas Barber Wright,—were commenced in the year 1859, since which period the sum of £109,564 has been paid over (subject to a nominal deduction for expenses) by the Committee towards the support of the medical charities of the town. The "Hospital Saturday" Annual Collections were subsequently established, on the suggestion of Mr. J. Samson Gamgee, F.R.S.E., in the year 1873, since which period the sum of £44,112 has been paid over by the Committee for the same purposes.

(*i.*) The Birmingham Musical Festivals (held triennially) were established in the year 1768 for the benefit of the General Hospital, in aid of which noble charity the managers had paid over up to the year 1882 the sum of £116,576. From a musical-art point of view their influence has been considerable. The "St. Paul" and the "Lobgesang" of Mendelssohn were given in 1837 and 1840, and the immortal "Elijah" was specially written for Birmingham, and produced at the Festival of 1846, under the conductorship of its author. The "Eli" and "Naaman" of Costa in 1855 and 1864, and the "Redemption" of Gounod in 1882, were specially written for these Festivals, and produced under the conductorship of their respective authors. Numerous minor works of importance have also been written for or first produced at these Festivals.

number of voters on the register as compared with other large towns) (*j*);—most especially from the conspicuously-characteristic earnestness with which work of all kind is undertaken in Birmingham;—and from a number of analogous factors all of which have their influence, I cannot help—after eliminating to the best of my ability all necessary bias—arriving at a conclusion that, while possessing greater differentiation in its inhabitants as regards trades and occupations than those of many other towns, Birmingham also presents unusual advantages for the physical, intellectual, and moral development of its citizens. Its development is of a type peculiar to a large industrial organization, and is in marked contrast to that kind of development which would obtain under a military, or ecclesiastical, or agricultural organisation. In other words, the progress of the town is quite in accordance with the laws of evolution. It illustrates in a large sense the adaptation of the organism to the environment. Many Sociological generalizations made here may, I think, therefore be regarded as typical and unique. And as many of the factors that I have enumerated act and re-act, it follows that Birmingham has most important influence in the work—both immediate and remote—to which it puts its hand.

It would take up too much of your time for me to mention many illustrations. I just allude to one or two that occur to me. From an educational point of view Birmingham, by its Education League, was, for the suggestion from which originated this movement, in advance in obtaining the establishment of Board Schools; from a political point of view the action of Birmingham on the passing of the Reform Bill of 1832 was most important, and must not be overlooked; nor its action subsequently in political matters. The example of beneficence in Birmingham as regards the Hospital Sunday Collections has spread to other large towns, and even to the Metropolis. The action of its Corporation as to the issue of a funded stock, and in many other forms of its work, has been adopted as a model by other Corporations. In any movement having for its object the advancement of the civil and religious freedom of the people, Birmingham has usually been in advance.

Since the foregoing was written, my friend Mr. Greatheed has called my attention to a recent most interesting lecture by Professor Lapworth, F.G.S., of the Mason College, entitled "The Geology of the Midlands." After pointing out the advantages resulting from the insular position of England, and the "perfect mine of wealth" contained in her rocks, he further showed the contrast between the

(*j*.) Mr. Hughes submitted a table showing the average number of Parliamentary and Municipal Electors in four large towns for the three years ended 1883, as under: Parliamentary Electors—Birmingham, 63,693; Leeds, 50,179; Liverpool, 62,898; Manchester, 54,861;—mean, 57,908. Municipal Electors—Birmingham, 74,392: Leeds, 58,422; Liverpool, 70,675; Manchester, 58,899;—mean, 65,597. Percentage of Parliamentary Electors to population—Birmingham. 15·83; Leeds, 16·23; Liverpool, 11·40; Manchester, 13·93;—mean, 14·35. Percentages of Municipal Electors to population—Birmingham, 18·49; Leeds, 18·90; Liverpool, 12·79; Manchester, 14·96;—mean, 16·29.

scenery and strata of the Eastern and Western Counties, the peaceful nature of the former, and the harsh and rugged character of the latter, and finally pointed out that "in the Midland District we stood midway between these two types—half-way down the great geological scale—that there was one district where these two kinds of rocks were to be met together, and there was only one large town where they could be seen. The district was the Midland District—the town was Birmingham."

Apropos of the same generalization, Mr. Greatheed has directed my attention to two recent articles in the *Révue des deux Mondes** attributing George Eliot's powers partly to her Midland sympathies. Indeed George Eliot herself, in reply to some questions of an American lady, writes:—"It is interesting, I think, to know whether a writer was born in a central or border district—a condition which always has a strongly determining influence. I was born in Warwickshire, but certain family traditions connected with more northerly districts made these districts a region of poetry to me in my early childhood."†

I feel that I have only touched on the foregoing points very crudely and roughly, but I think Sociological students will accept some of the conclusions, and that they will probably agree with me that no more generally interesting field for the study of Sociology exists than the town in which we live.

(To be continued.)

SOME NOTES ON OXON BATS.‡

BY THE LATE FRANK NORTON, ESQ.

ARRANGED AND COMMUNICATED BY THE REV. H. A. MACPHERSON, B.A.

I.—General Observations.

(*a*). *Predatory Habits.*—Early in the year bats haunt the vicinity of rivers and pools, to prey upon the different species of Ephemeridæ, which abound at that season; but towards the end of May they repair to the lanes and hedges, in search of cockchafers, and the cockchafers being local in appearance, I have seen hundreds of noctules in a single field at the same time. In autumn they frequent old ivy-covered walls and ruins for the moths which crowd to the blossoms of that plant. The long-eared bat especially delights in the neighbourhood of ancient buildings, such as Carisbrooke Castle, or Godstow Priory.

(*b*). *Breeding Habits.*—The other great business besides that of hunting seems to be the propagation of their species, at which time they are very active, pursuing one another through the air with wonderful velocity and discordant shrieks, chasing one unhappy female to the entrance of their abode, where she is joined by one or two more, and the *melée* becomes perfectly bewildering. I have watched their frolics by the hour on a fine evening at a small row of hollow beeches near Oxford, where scores of bats make their abode, and have seen about thirty bats wheeling round the trees at the same time.

* *Revue des deux Mondes*, Mar. 1, 15, 1883, Art. "George Eliot," par M. Emile Montegut.

† Mathilde Blind's Life of George Eliot, 1883, page 12.

‡ Read before the Oxfordshire Natural History Society, April 27th, 1883.

(*c*). *Habits during Repose.*—When the blush of early morning tinges the sky, the bat retires to its seclusion in the hollow trees or ruined buildings, there to await the approach of night. If one of these haunts be discovered, you will find the bats all hanging downwards in a great cluster, probably for the sake of warmth, forming a shapeless mass of black skin and brown fur. The smell of these domiciles is absolutely pestilential, due more to the accumulation of excrement at the bottom of their haunt than the actual smell of the bats themselves. I generally find that the trees are monopolised by the great bats, of which the other sorts are rather afraid, while the common bat delights in slated roofs, and the whiskered and long-eared bats keep to the chinks and crevices of old barns and ruins, generally congregating in clusters, but sometimes living solitary.

II.—The Common Bat.

(*a*). *General.*—The common bat frequents lanes, gardens, and the sides of woods, because small insects abound most in such places. Its dark brown fur is liable to considerable variation, the male being usually rather smaller and more brightly coloured than the other sex.

(*b*). *Capture.*—The pipistrelle is devoid of fear, and will charge a stick or an umbrella with the greatest perseverance, returning again and again until it is cut down. I have taken a great number with a common butterfly net—as many as seven in an evening.

(*c*). *Habits in Confinement.*—Pipistrelles are easily tamed, and appear to be quite at home if suffered to fly at large in a room where there are plenty of flies. I have had many a one during the summer months, one of which used to live under an old hat hanging on the kitchen wall. Though the doors were almost always open, it never strayed far away. About the middle of the day it used to come out and hawk for flies (which were generally on the *qui vive* about that time), darting into the swarms of flies which rose from the floor or table, and never failing to secure one. I have tried to observe how this feat was performed, but that was always a very difficult matter to decide, from the celerity of the operation. So far, however, as I could judge, the bat struck the fly a blow with its wing, which disabled it, and then seized it before it reached the ground, using its tail as a basket until it had obtained a firm hold.

III.—The Great Bat.

(*a*). *General.*—In its trait of flying at a greater elevation than that adopted by the other species, the noctule is very swift-like, hunting in the same region of air as *Cypselus apus*, continually uttering its shrill quarrelsome cry.

The noctule feeds chiefly on Coleoptera, *e.g.*, on Dor beetles, cockchafers, and other crepuscular insects which are always captured on the wing. It is very hard to say how this is effected. I have suspended a cockchafer from a fishing-rod, where the noctules were flying, in order to solve the problem. The tail of the great bat is certainly brought very much into play. Though the beetle has been placed on a large hook, my failure to capture any noctules in this way leads me to suppose that the prey is usually taken by the jaws, for were the hook enclosed by the wing, the hook would retain its hold, as I shall presently show when speaking of the whiskered bat.

(*b*). *Capture.*—One way of taking them, which I have occasionally found to answer, is to hold up a fishing-rod just under the line of flight, when the animal will almost always stoop towards it, and a dexterous blow of the rod lays him prostrate. Another way is to wait until the bat leaves its home in the hollow tree, when by holding a gauze net under the orifice you may capture the whole colony.

(*c*). *Habits in Confinement.*—Noctules possess a very rank and nauseous smell, which becomes intolerable when any number are confined in restricted quarters. But the noctule is very careful of its personal appearance. I have kept several examples in captivity, and they invariably took the greatest pains to have an even parting down the back, which was thus obtained. The noctule suspended itself from the roof of the cage, head downwards; then leaving hold with one foot proceeded to comb out the fur on one side with its long claws previously damped by the application of its tongue, repeating the operation on the other side in the same way. When this task had been satisfactorily performed, each wing was carefully smoothed out, and ears and tail were cleaned. In the absence of live food, noctules will accept shredded meat.

(*d*). *Description, etc.*—The colour of the noctule is normally a dark chesnut brown, but it is very liable to variation, owing, I think, to age and development. I have taken specimens pied with grey, also with black, and sometimes a light colour round the neck. The young (two at a birth) are black and covered with down; they accompany their parent during her flight, clinging to her fur with their claws. When these bats are taken in the spring they are thin and comparatively light; in the autumn the females become exceedingly fat. The lips are much distended in the male, enclosing two lobes of fat. When the animal is provoked it exposes these glands, which give out a musky odour, but what their real function is I have failed to ascertain.

IV.—The Whiskered Bat.

(*a*). *General.*—This species is rather rare in the neighbourhood of Oxford; at all events it is seldom identified. That such is the case is partly, I think, due to the localities it frequents, viz., the surface of pools and rivers, over which it skims at an elevation of some two inches above the water. It feeds chiefly on Ephemeridæ and those small moths the larvæ of which feed on the sedges and other water-plants that line the river. One peculiarity of this bat, which readily distinguishes it from the host of others which occasionally swarm in the neighbourhood of rivers, is its curious cry, which exactly resembles the clicking of a cog-wheel and chain, and which is constantly repeated as it flits along.

(*b*). *Capture.*—This is a very difficult bat to catch, as it flies so low that it is useless to use a gauze net; if shot, it often falls into the water, when, from its small size, it is difficult to discern it in the dark. It may, however, be caught with a rod and line baited with a moth or fly, the hook catching in the bat's wing, as it strikes down at the moth; this method of obtaining examples should be practised from a bridge, and the moth should be allowed to hang about an inch from the water. My discovery of this bat at Oxford was purely accidental. One evening, as I was returning from fishing, I noticed a great number of bats flitting over the river by Medley Lock. Standing on the water's edge, I struck at them with my fishing rod as they flew past. Very soon I had a crowd of bats fluttering round my rod; one I knocked into the water, another into the sedges. Subsequently I identified them by comparison with examples already existing in the Oxford Museum.

(*c*). *In Confinement.*—This bat is difficult to tame, as it does not take at all kindly to raw meat; whilst the moths which constitute its natural diet are not easily procured in sufficient numbers.

V.—The Long-eared Bat.

(*a*). *General.*—This is considered by some writers to be the most abundant of our bats, but personally I have never found it so, being able to procure a common bat almost at any time during the warmer months, whilst I rarely ever see the long-eared bats except in certain localities, almost without exception the environs of churches or other ancient buildings. During flight the delicate ears are extended straight forwards, and must, I think, assist the long-eared bat considerably in hunting up the moths and small nocturnal beetles on which it feeds. I have watched long-eared bats in the act of hovering over the blossom of the ivy which usually crowns old buildings, either waiting until a moth that has previously settled happens to take wing, or steadily picking it off.

(*b*). *Capture.*—This bat has a peculiarly dashing flight which renders it almost an impossible mark for a gun, and the way in which the stroke of even my large net is avoided is quite surprising. This faculty is, I believe, due to the ears, which, going so far in front of their owner, forewarn it, and give it time to avoid the net by a dexterous movement. This bat, like the pipistrelle, often flies at noonday, when it may sometimes be captured basking on a wall.

[In common with the noctule and the pipistrelle, the long-eared bat haunts Hyde Park and Kensington Gardens.—H. A. M.]

(*c*). *In Confinement.*—This bat is very easily tamed when once it can be persuaded to eat raw meat; as a rule it requires the expenditure of a large amount of patience to coax a long-eared bat to eat, but when once that object is attained the trouble will be amply repaid by the interesting traits of the captive.

The best sort of bat cage that I myself am acquainted with is a rather deep box, say six inches deep by sixteen inches broad, set up on one end, with a piece of perforated zinc nailed on to the front. A hole should be cut in the back, large enough to put the hand in, to be used as a door. There should also be a false bottom to the cage with two separate trays, which should be alternately in use and drying. Water must always be placed in the cage, as bats are very thirsty creatures, and always run to the vessel to drink directly they wake.

[I may remark that Mr. Norton obtained Bechstein's bat at Godstow, and the Serotine at Shanklin, in the Isle of Wight. Both these examples were presented to the Oxford Museum by Mrs. Norton. The Serotine is interesting as differing in colour from those presented in 1865 by Mr. Bond, though according well with the Isle of Wight Serotines described by the Editors of "Bell's Quadrupeds." The other bats in the Oxford Museum not yet alluded to are—Daubenton's bat (no locality given); Reddish Grey bat, obtained at the church of Poyning, Sussex, by Mr. J. R. Griffith, in 1863. Among numerous examples of the Pipistrelle presented by the Hon. Mrs. Norton is one of a reddish dormouse colour, apparently approaching the colour of a specimen of this species described by Mr. Borrer in the "Zoologist." —H. A. M.]

MIDLAND UNION OF NATURAL HISTORY SOCIETIES.

TAMWORTH MEETING, JUNE 12TH AND 13TH, 1883.

The Sixth Annual Meeting of the Union was held at Tamworth during the second week in June, a date which seems now to be finally recognised as the most suitable for an engagement combining indoor work with outdoor recreation.

The Council Meeting was held (by kind permission of Thomas Cooke, Esq.) in the Banqueting Hall of Tamworth Castle, at 12 o'clock, on Tuesday, June 12th. Delegates from sixteen Societies were present; Reports were received from the Hon. Secretaries and from the Management Committee; the draft of the General Report was discussed, and a grant of ten guineas was made towards the funds of the "Midland Naturalist;" a further donation of £2 for the same object being announced from the surplus funds of the late Nottingham Literary and Philosophical Society.

The Annual General Meeting was held in the same room at three o'clock—the President of the Union (Egbert de Hamel, Esq., of Tamworth) in the chair. Among those present at the Council Meeting and General Meeting were—the Rev. H. Norris, Dr. Fleming, Mr. Edward Argyle, the Rev. W. Macgregor, Rev. H. Dale, Rev. C. B. Maude, Mr. Thomas Cooke, Mr. A. A. Clarson, Mr. S. Spruce, F.G.S., Mr. A. Lucy (Tamworth), Rev. J. Thornewill (Burton), the Rev. O. M. Feilden (Oswestry), Professor Milnes Marshall, M.A., M.D., D.Sc.

(Manchester), Mersss. W. R. Hughes, F.L.S., T. H. Waller, B.A., B.Sc., W. P. Marshall, M.I.C.E., J. Levick, J. Morley, C. R. Robinson, J. Rabone, J. Insley, C. J. Watson, J. F. Goode, C. J. Woodward, B.Sc. (Birmingham), C. Cochrane and H. Pearce, F.L.S. (Stourbridge), S. J. Newman and B. Thompson, F.G.S., F.C.S. (Northampton), F. E. Lott (Burton), F. T. Mott, F.R.G.S. (Leicester), A. Stephenson, M.D. (Nottingham), W. Mathews, C.E. and E. Wheeler, C.E. (Peterborough), Dr. F. W. Crick (Bedford), W. Madeley (Dudley), B. Sturges Dodd W. Watchorne and T. Goldsmith (Nottingham), the Hon. Secs. to the Union, Messrs. W. G. Davy, of Tamworth, and W. J. Harrison, F.G.S., of Birmingham, besides a large number of local members and friends.

The minutes of the Nottingham Meeting having been read and confirmed, the President delivered an Address dealing principally with the history and archæology of Tamworth and its neighbourhood. This Address will appear in the August Number of the "Midland Naturalist."

Mr. F. T. Mott, F.R.G.S., proposed, Mr. T. H. Waller, B.A., B.Sc., seconded, and it was resolved "That the thanks of this meeting be given to Egbert de Hamel, Esq., for his able and interesting address, and that it be printed in the 'Midland Naturalist.'"

Mr. W. J. Harrison then read the

REPORT OF THE COUNCIL.

In accordance with a resolution passed at the last annual meeting at Nottingham, the report of the Council for 1882 was (in addition to its appearance in the organ of the Union, "The Midland Naturalist") printed in a separate form, with much additional information, and circulated widely among the members of the various Societies.

By another resolution the Hon. Secretary was empowered to send a copy (in bronze) of the Darwin Medal to the family of the late Mr. Charles Darwin, in whose honour the medal was instituted. This has been done, and the following kind reply has been received from the present head of the Darwin family:—

Basset, Southampton, December 14th, 1882.

Dear Sir,—I have the pleasure to acknowledge the receipt of your letter and the copies of the last report of the Midland Union of Natural History Societies, together with the bronze medal of my late father. Will you be kind enough, when you have an opportunity, to express to the Council and Members of the Union the sincere thanks of my family and myself for their kind thought in sending us this copy of the medal. I am pleased to say that it is a striking likeness of my father. My father felt much the honour that was done to him by the foundation of this medal, and was much interested in the success of the Union It would have given him sincere pleasure to know of the good work done by those gentlemen to whom the medal has been awarded. This medal will be placed with others belonging to my late father, and will always be much valued by my family.

Thanking you for the part you have taken in the matter,

I am, Dear Sir, yours faithfully,

W. Erasmus Darwin.

W. Jerome Harrison, Esq., F.G.S.

The subject assigned for the Darwin Prize for 1883 was "Archæology," and the Council have to report, with regret, that no papers on that subject have been contributed to "The Midland Naturalist" within the specified time; the medal for 1883 cannot, therefore, be awarded. The fact is, however, not a matter of much surprise, as but three of the Societies in the Union profess to include Archæology in the list of subjects to which the attention of their members is directed.

Fortunately, however, there is a medal to award at the present meeting: the Darwin Gold Medal, won in 1882 by the Messrs. Marshall, for their excellent paper on "The Pennatulida," was not ready in time to be given at the Nottingham meeting, but, having recently been struck from the dies prepared with so much ability by Mr. Joseph Moore, of Birmingham, is now ready to be handed over.

The subject for the Darwin Prize of 1884 is Botany, and, knowing the large number of able botanists within the ranks of the Union, the Council anticipate the publication of much good work. All papers must be sent in to the Editors of "The Midland Naturalist," or to the Hon. Secretary of the Union, on or before the 31st of March, 1884. The Council regret to announce the dissolution of two Societies during the past year. The Nottingham Literary and Philosophical Society had done excellent work for many years in Nottingham, and the leading part which its members took in the management of the successful meeting of the Union held last year at that town will be long remembered; but with the opening of the new University College there, some of the supporters of the Society seem to have considered its work as completed (surely a mistake!), and the result has been the winding up of the affairs of the Society. The Council gratefully acknowledge a gift of £2 towards the expenses of "The Midland Naturalist" from the surplus funds of the Society.

The Small Heath (Birmingham) Literary and Scientific Society belonged for a short period to the Union. It seceded two years ago, and its secession has been followed by its death.

Notice of withdrawal from the Union has been received from the Shropshire Archæological and Natural History Society, and from the Banburyshire Natural History Society. If these withdrawals be considered as accomplished facts, then the following twenty-two Societies, including about 2,500 members, now form the Midland Union of Natural History and Scientific Societies:—

Bedfordshire Natural History Society and Field Club.
Birmingham Microscopists' and Naturalists' Union.
Birmingham Natural History and Microscopical Society.
Birmingham Philosophical Society.
Birmingham and Midland Institute Scientific Society.
Birmingham School Natural History Society.
Burton-on-Trent Natural History and Archæological Society.
Caradoc Field Club.
Cheltenham Natural Science Society.
Dudley and Midland Geological and Scientific Society and Field Club.
Evesham Field Naturalists' Club.
Leicester Literary and Philosophical Society.
Northamptonshire Natural History Society.
Nottingham G. R. S. Naturalists' Society.
Nottingham Naturalists' Society.
Nottingham Working Men's Naturalists' Society.
Oswestry and Welshpool Naturalists' Field Club.
Oxfordshire Natural History Society.
Peterborough Natural History and Scientific Society.
Severn Valley Naturalists' Field Club.
Stroud Natural History Society.
Tamworth Natural History, Geological, and Antiquarian Society.

Each of the Societies in the Union has held meetings of its members during the winter evenings, and field excursions during the summer. That much good and pleasure have resulted from the intercourse, in this manner, of those having congenial thoughts and aims cannot be doubted, while the General Annual Meeting of the Union ought to widen this useful work by bringing together workers in science from all parts of the Midlands. It seems probable that where there are several Societies in the same town, or in the same district, a joint meeting, at least once during the year, would be of mutual service. Among the interesting local events of the year is the formation, by the Birmingham Natural History Society (at the instance of W. R. Hughes, Esq., F.L.S.), of a Sociological Section, which has already advanced along comparatively new lines in two directions—*(a)* in taking up the study of the works of Herbert Spencer, and *(b)* in conducting an excursion to "George Eliot's Country"—the district round Nuneaton—applying scientific methods, in short, to literary pursuits. The excursion of the same Society to Oban, which will take place in a fortnight after the reading of this report, will be signalised by the application of the most modern methods of research to the examination of the fauna of the sea which washes the western coast of Scotland. Another event of the past year has been the reorganising of the "Sections" of the Leicester Literary and Philosophical Society on a popular basis. This Society is the oldest in the Union, and the important work which it carries on in aiding the Leicester Museum, and in bringing down to Leicester scientific lecturers of the highest eminence during the winter, necessitates a subscription of one guinea per annum. The "Sections," however, which meet frequently for the practical study of Botany, Geology, etc., have now been thrown open to earnest students at a subscription of half-a-crown. Many excellent lectures are delivered every winter by local members of the various Societies, and the Council would suggest to the Hon. Secretaries of the different Societies that they should ascertain if local lecturers of ability connected with their Society would consent to deliver their lectures elsewhere, and communicate the lecturer's name, subject, etc., to the General Hon. Secretary of the Union; in this way an interchange of lectures might be effected which would be very beneficial.

Science Teaching in Elementary Schools.—The introduction by Mr. Mundella of a new educational code has given an impetus to the great work which is being carried on in the schools of the Birmingham School Board. An excellent laboratory and lecture room has been completed in connection with a new school, and this forms the head-quarters of the system by which 2,500 children (of ages from eleven to fifteen) are instructed in Mechanics, Magnetism and Electricity, Domestic Economy, and Animal Physiology; more than 200 teachers also receive instruction. An examination for seven valuable scholarships and numerous prizes was lately held by Professor Poynting, M.A., of the Mason College, who reports as follows: "I think that the general style of work sent in was very satisfactory. The average number of marks obtained was not quite so high as last year, as the subject was far more difficult, and the paper I set was also much harder, but I think that quite as much ability was shown on the part of the candidates, and that the evidence of careful teaching was quite as strong. The paper worked by the first boy was an excellent one, and showed considerable power." Surely the Birmingham Societies ought to reap a goodly crop from this field in years to come! Visits of inspection have been made during the year by Mr. Mundella, M.P., Mr. Rathbone, M.P., Lord Norton, the Royal Commissioners for

Technical Education, Professor Gladstone, F.R.S., W. Lant Carpenter, Esq., F.L.S., and other eminent men. The fine Optical Lantern presented by Messrs. R. and G. Tangye has been used with great success in showing scientific illustrations to large evening audiences, and Mr. Richard Tangye has continued to evince his great personal interest in the work. His desire for its extension is shown by his recent offer to the adjoining School Board of Smethwick to pay half the salary of a science demonstrator if they will introduce the system into their schools.

Geology.—Last year's report contained a reference to a paper written by your Honorary Secretary (and published in the Proceedings of the Birmingham Philosophical Society) upon the Quartzite Pebbles of the Midlands, in which they were referred to local sources. A paper by Professor Bonney has recently appeared in the "Geological Magazine" (May No.), in which he strongly controverts this view, and refers these pebbles to Scotch rocks, mainly on the ground of the mineralogical resemblances between the two which are revealed by the aid of the microscope. On the other hand, Professor Hull, the original author of the theory which derived these Midland pebbles from the Old Red Conglomerates of Scotland, writes to the same Magazine, giving up this theory and adopting Mr. Harrison's in its entirety. This is a subject on which local help would be most valuable. About 200 copies of Mr. Harrison's paper have been distributed to Midland geologists, and he will be pleased to forward a copy to anyone desiring to study the subject. Another paper by the same author describing the work of that best of scientific societies, the Palæontographical, has been reprinted from the "Journal of Science," and 2,500 copies have been presented to the Union for distribution among its members. The meeting at Tamworth is specially fortunate in that it permits of an examination of the Cambrian rocks which were discovered last year by Professor Lapworth and Mr. Harrison: the famous quartzite ridge which runs from Hartshill to Nuneaton offers a geological problem of the highest interest and importance. No fossils have as yet been found in it; it is underlaid by volcanic rocks probably belonging to the Charnwood series; it is overlaid by Cambrian shales which *do* contain fossils, though they are, as yet, few in number, and of wide range. What is the age and true geological position of the quartzite? This will be a hard nut to crack, and will doubtless furnish material for the hammers of Midland geologists for many years to come. Let us be thankful for it!

Boulders.—In boulder work the event of the year has been the notice by Dr. Crosskey of many remarkable striations on the basalt of the Rowley Hills near Dudley; boulders of the same rock, similarly striated, have lately been found near Birmingham.

The Organ of the Union.—"The Midland Naturalist" has continued to appear with regularity under the management of its editors, Mr. E. W. Badger and Mr. W. J. Harrison. Five volumes have now been completed, and during the last year the following papers have appeared in it:—"The Flora of Warwickshire" (continued), by J. E. Bagnall; "Summer Migrants," by O. V. Aplin; "Fungi of the Neighbourhood of Birmingham," by W. B. Grove; "Meteorology of the Midlands" (continued), by C. L. Wragge; "Report on Pennatulida" (continued), by W. P. and A. M. Marshall; "Minerals of the Midlands" (continued), by C. J. Woodward; "Botanical Rambles," by J. E. Bagnall; "On a Dragon Fly," by Silvanus Wilkins; "*Floscularia regalis*," by Dr.

Hudson; "Breeding of the Grebe," by O. V. Aplin; "Nomad Fungi," by W. B. Grove; "Underground Fungi," by M. J. Berkeley; "A Visit to Glen Clova and Callater," by G. Claridge Druce; "Geology of Wyre Forest," by A. H. Atkins; "Ben Nevis in Mid-winter," by C. L. Wragge; "Truffles in Shropshire," by W. Phillips; "Dredging at Oban," by J. F. Goode and W. P. Marshall; "Migratory Birds in North Oxfordshire," by O. V. Aplin; "Hedgerows of Leicestershire," by F. T. Mott; "Fertilisation of Saxifrages," by J. G. Ogle; "Drift of Leen Valley," by J. Shipman; "*Arum maculatum*," by R. Rogers; "Ornithological Notes from Leicestershire," by T. Macaulay; "On Pen Pits," by H. B. Woodward; "Northampton Sand of North Oxon," by E. A. Walford; "British Trap-door Spider," by F. Enock; "Sociology," by W. R. Hughes; "An improved System of Arrangement in Provincial Museums," by F. T. Mott; and "*Lychnis Flos-cuculi*," by R. Rogers. In addition, a large number of notes, gleanings, correspondence, and reviews have appeared; a monthly table (involving much expense in its preparation) of meteorological observations from more than sixty stations has been printed, and the general high character of the Magazine for correctness and care in printing has been maintained. Year after year complaint has been made, in the Report, of the scanty support received by the "Midland Naturalist" from the members of the Union, whose organ it is. The falling off in subscribers has been such that the publishers have given notice to the Council that it is their intention to terminate the agreement under which they now publish the Magazine at the end of the present year. As some remedy for this state of things the Council has made a grant of Ten Guineas to the funds of the Magazine, and earnestly calls upon every member of the Union to render to the periodical a hearty support.

A cordial invitation from the Peterborough Natural History and Scientific Society has been received, inviting the Union to hold its Annual Meeting at Peterborough in June, 1884; and your Council recommend the acceptance of this kind invitation. The district will be, to most of the members, a new and doubtless a most interesting one, while the energy and ability which have been displayed in the management of the local Society place the success of the meeting beyond a doubt. For the meeting of 1885 a movement is taking place among our Societies in the west, which it is to be hoped will result in their uniting to invite the Union to visit some western town in that year, while from Bedford and Oxford invitations will probably come for either that year or the next.

Your General Hon. Secretary—Mr. W. Jerome Harrison, F.G.S.—has served the Union in that capacity for the greater part of the time which has elapsed since its formation, while he has acted continuously as one of the editors of "The Midland Naturalist" for the same period. At the earnest request of the Council, Mr. Harrison has consented to continue to serve the Union for another year, Mr. T. H. Waller, B.A., B.Sc., of Birmingham, becoming his coadjutor. In recognition of his work, your Council has elected Mr. Harrison Vice-President of the Union.

The Local Secretaries for the coming year will be Messrs. J. W. Bodger and W. Mathews, C.E., of Peterborough, gentlemen who are well known to many of those who regularly attend the Annual Meetings as earnest supporters of the Union. In conclusion, the Council desire to thank the members of the Tamworth Society for the admirable arrangements which they have made for the success of the present meeting, and to express on behalf of the visitors from other Societies here assembled their appreciation of the care and trouble which have been taken to give pleasure to the members here assembled, and to promote the objects of the Midland Union.

It was resolved, on the motion of Mr. S. J. Newman, seconded by Mr. B. Thompson, F.G.S., F.C.S., "That the Report be received, adopted, and printed in the "Midland Naturalist."

PRESENTATION OF THE DARWIN GOLD MEDAL FOR 1882.

The President then handed the Darwin Gold Medal for Zoology to W. P. Marshall, Esq., M.I.C.E., and Professor Milnes Marshall, M.A., M.D., D.Sc., &c. (of Owens College, Manchester).

The receipt of the Medal was acknowledged by Professor Marshall in a very able speech, in which he specially called attention to the fact that the labours of the great man whose name was associated with that Medal were carried on, for the most part, without the aid of expensive or complicated apparatus and methods of experiment; the cause of Science could be advanced by every worker who possessed a love of nature coupled with powers of observation of common things.

THE MEETING-PLACE FOR 1884.

A cordial letter of invitation from the Peterborough Natural History and Scientific Society was read, and this was ably supported by the two delegates from that town who were present—Messrs. Wheeler and Mathews.

On the motion of Horace Pearce, Esq., F.L.S., and Dr. F. W. Crick, it was unanimously resolved that the Annual Meeting of the Midland Union for 1884 be held at Peterborough. In accordance with this vote the Union will next year visit a district entirely new to most of its members; a district extremely rich in antiquarian monuments, and abounding in attractions for the geologist, the botanist, and the entomologist. By this vote too the Union acquires as its new President a most eminent divine—the Very Rev. J. J. Stuart Perowne, D.D., Dean of Peterborough—one of the foremost members of the "company" by whom the New Testament revision was carried out.

THE HON. TREASURER'S REPORT.

Mr. E. de Hamel, who on this occasion filled the dual office of President and Treasurer, then submitted the following

Statement of Accounts,

which, on the motion of the Rev. O. M. Feilden and Mr. Lott, was duly adopted.

Dr.

Receipts.	£	s.	d.	No. of Mbrs.	Subn.	£	s.	d.
To Balance Brought Forward	5	0	8					
„ „ Birmingham Philosophical Society for 1882	1	10	0					
„ Shropshire Archæological (two years compounded)	2	10	0					
„ Dudley and Midland Geological and Scientific Society	1	5	0					
						10	5	8
„ Oswestry and Welshpool Naturalist Field Club				40	3	0	10	0
„ Birmingham Philosophical Society				140	3	1	15	0
„ „ and Midland Institute Scientific Society				224	1	0	18	8
„ Severn Valley Naturalist's Field Club				65	3	0	16	3
„ Birmingham Natural History and Microscopical Society ...				312	3	3	18	0
„ Caradoc Field Club				62	3	0	15	6
„ Dudley and Midland Geological and Scientific Society ...				100	3	1	5	0
„ Northamptonshire Naturalists' Society and Field Club ...				200	3	2	10	0
„ Oxfordshire Natural History Society				20	3	0	5	0
„ Peterborough Natural History and Scientific Society				112	3	1	8	0
„ Leicester Literary and Philosophical Society				282	3	3	10	6
„ Nottingham Naturalists' Society				94	3	1	3	6
„ „ G.R.S. „ „				23	3	0	5	9
„ Tamworth Natural History, Geological, and Antiquarian Society				103	3	1	5	9
„ Birmingham Microscopists' and Naturalists' Union				44	3	0	11	0
„ Nottingham Working Men's Natural History Society				30	1	0	2	6
„ Banburyshire Natural History Society				70	3	0	17	6
„ Evesham Field Naturalists' Club				35	3	0	8	9
„ Birmingham School Natural History Society				50	1	0	4	2
„ Cheltenham Natural Science Society				96	3	1	4	0
„ Stroud Natural History and Philosophical Society				56	3	0	14	0
„ Bedfordshire: Arrears, £2 17s. 6d. } £5 0s. 6d.				86	3	0	0	0
„ Burton-on-Trent „ £2 3s. 0d. }				72	3	0	0	0
				2,416		£34	14	6
„ Nottingham Literary and Philosophical Society to "Midland Naturalist"						£2	0	0

Cr.

Expenditure.	£	s.	d.
By Treasurer's Expenses, Stamps, etc.	0	14	4
„ Secretary's „	1	16	6
„ Wright, Dain, Peyton, & Co., Printers, Bill for 1882-3	20	18	0
„ Joseph Moore, Darwin Medal: One Gold, £8 15s., One Bronze, 3s. 6d.	8	18	6
„ Balance in Hand	2	7	2
	£34	14	6
„ Balance against Darwin Die Fund	£0	17	6

The usual votes of thanks to the officers of the Union having been passed, Mr. de Hamel was re-elected Hon. Treasurer, Mr. W. J. Harrison General Hon. Secretary (Mr. T. H. Waller agreeing to act as his coadjutor), and Messrs. J. W. Bodger and W. Mathews (of Peterborough) were elected as Local Hon. Secretaries for the ensuing year. The meeting terminated with votes of thanks to the officers and members of the Tamworth Society, who had worked so hard to make the meeting a success—a vote which was acknowledged by the able Local Secretary, Mr. W. G. Davy—and to the President of the Union (E. de Hamel, Esq.) for his able and courteous conduct in the chair.

LOCAL EXCURSIONS.

On the morning of the 12th, and while the Council was sitting, many visitors were conducted over some of the local seats of industry, including Messrs. Hamel's tape mills, some large potteries, &c. After the conclusion of the General Meeting the visitors were escorted over the Castle by the resident, Thos. Cooke, Esq. Admiring the magnificent view from the battlements of the keep, peering down into the well in the basement, examining the dungeon and the chapel room, and playing a sort of "hide-and-seek" in the (apparently countless) ghostly and other chambers which, interspersed among ramifying staircases, constitute this grand old pile, an hour was pleasantly passed. Issuing from the Castle about five p.m., a large party were conducted over the magnificent parish church of Tamworth by the Rev. H. Dale; the ascent of the church tower was made by a very remarkable double winding staircase, almost unique of its kind in Britain. The Moat House—a most picturesque Elizabethan mansion—was next inspected, and, finally, the old earthwork, known as "Offa's Dyke," was scrutinised at its point of best preservation.

THE CONVERSAZIONE.

Diligent hands had been at work, and when the members of the Union entered the Town Hall of Tamworth at the hour of opening on Tuesday evening, June 12th, they found themselves in a suite of rooms which appeared well suited for the purpose of a scientific conversazione, but which had only been made so by much hard work. The following extract from the *Tamworth Herald* gives a good general idea of the programme laid before visitors:—"The appearance of the large room was a treat long to be remembered. Arranged round the building were cases of birds of all sizes, colours, and species, from the huge and magnificent Eagle to the more humble Wren, the Robin, and the Sparrow. On the right-hand side of the room was a very fine collection of British birds, lent by Mr. R. W. Chase, of Birmingham, who, during the evening, explained their various habits, &c. Around the end of the building and covering the opposite wall were cases of birds lent by local friends, and it is needless to observe that they formed a source of pleasure, interest, and admiration not only amongst Ornithologists, but likewise amongst the public generally. Several tables were arranged in the centre of the room at which an exhibition of microscopes, by members of the Birmingham Natural History and Microscopical Society, illustrating life—both vegetable and animal—from its earliest to its latest stages, took place. A series of slides showing the microscopic structure of rocks was also exhibited. At the end of the table a great curiosity was shown by Mr. J. Rabone, namely, "Shakespeare's brooch." Numerous pictures of old Tamworth were exhibited in the corridor, whilst in the lecture room were to be seen Norremberg's polariscope and an experiment illustrating the porosity of stone, lent by the Midland Institute Scientific Society; geological specimens, exhibited by Mr. Horace Pearce, F.L.S., F.G.S.; geological specimens, exhibited by the Rev. W. Robinson; relics discovered at Stapenhill, an ancient burial-ground near Burton-on-Trent, lent by the Burton Archæological Society; Roman pig of lead, found at Hints, near

Tamworth; coins and pottery, discovered at Alvecote, near Tamworth; coins, temp. William I. II., some minted at Tamworth, found near the fortifications of the town, 1876; ancient document and leaden case, found in south wall of Tamworth Church; charters of Tamworth; town regalia; communion service, from disused chapel, Statfold; Egyptian and Icelandic curios; a collection of tokens and a large number of miscellaneous exhibits. During the evening Mr. W. J. Harrison, F.G.S., delivered two lectures on astronomy and geology, each being illustrated with lantern slides. The proceedings were enlivened at intervals by music, and the large number of ladies and gentlemen who attended were loud in their expressions of appreciation and admiration of the result of the efforts of the local committee."

SECOND DAY.—WEDNESDAY, JUNE 13TH.
EXCURSION TO HARTSHILL.

The Hartshill party, numbering about forty, were under the expert leadership of Mr. E. de Hamel, ably assisted by the Rev. H. Norris and Mr. Clarson. As full details respecting the history of the various points visited during the day are given in the presidential address, we shall here only glance at the main features of the route. Starting from Tamworth about ten a.m. on a lovely June morning, the first halt was made at Polesworth, where the party were escorted over the fine church by the vicar, the Rev. J. G. Trotter. From this point a pleasant drive along the famous Watling Street took the party to Merevale Park, where the ruined Abbey and grand church were inspected by the mass of the visitors, while the geological section, under the guidance of Mr. Harrison, plied their hammers in a neighbouring quarry. Following this came a delightful drive through Merevale Park and Bentley Wood, until the old British camp of Oldbury was reached, where the fine Hall was seen to stand in the very centre of the ancient entrenchment. Here C. R. Cox, Esq. most hospitably entertained the party to luncheon, acting as guide, too, in a visit to a large quarry not far off. Tripping pleasantly through another wood, Hartshill Castle and tumulus were next examined. Here a local resident—Mr. Tippetts—exhibited some interesting Roman pottery, and a table at which Henry VII. is said to have dined the day preceding the battle of Bosworth. At Hartshill the geologists, already favoured with the company of Professor A. H. Green, received a strong reinforcement in the persons of Mr. W. H. Hudleston and Professor Morris, who had come down from London to examine the recently discovered Cambrian rocks near Hartshill. Time was all too short for the work that had to be done, and a rapid drive from Hartshill through Mancetter landed the excursionists at Atherstone, where tea was provided at the "Red Lion," and where the leader received his well-earned meed of thanks. Reaching Tamworth at seven o'clock the party separated with mutual congratulations and renewed wishes for an equally pleasant and profitable day at the Union meeting of 1884.

THE LICHFIELD EXCURSION.

The Lichfield detachment numbered about fifty, and left Tamworth to proceed in a diametrically opposite direction to the Hartshill party. Mr. Grayston, F.G.S., the leader for the day, called the first halt at Sir Robert Peel's seat of Drayton Manor, where the fine picture gallery and the American garden were inspected with much interest. Driving thence in a north-westerly direction along the Watling Street, the tumuli at Hints and at Offlow were noted, and the village of Wall—The Roman Station, Etocetum—was examined with care, its chief features being pointed out by the Rev. T. F. Rolfe. Lichfield was the main point of the day, and its centre of attraction was, of course, the Cathedral, whose beauties were discoursed upon by Dean Bickersteth, Canon Lonsdale, and the Rev. H. Dale, whose remarks were listened to with great pleasure and instruction. After lunch at the George Hotel the return route was taken through Hopwas Wood and by Whittington Heath to Tamworth, where the party arrived almost simultaneously with the Hartshill division.

FUNGI OF THE NEIGHBOURHOOD OF BIRMINGHAM.

FIRST LIST, 1881-82.

(Continued from Vol. V., p. 274.)

DISCOMYCETES.

Uncinula bicornis, Lev. Sparkhill. Oct.
Erysiphe Martii, Lk. Sutton, on peas. Oct.
E. communis, Schl. Water Orton, on *Lotus major*. Sept.
Chætomium elatum, Kunze. Water Orton; Great Barr. June—Oct.
Eurotium herbariorum, Lk. Edgbaston, etc. May—Oct.
Geoglossum glabrum, Pers. Sutton Park, *W. H. Wilkinson*. Nov.
Peziza aurantia, Fr. Sutton Park; Sutton. Sept.—Nov.
P. vesiculosa, Bull. Driffold Lane, Sutton. Sept.
P. omphalodes, Bull. Crystal Palace, Sutton, on a heap of burnt wood in the vinery. April.
P. granulata, Bull. Water Orton, Sutton Park, etc. Aug.—Oct.
P. umbrorum, Fuckel. On moist ground, Barnt Green. Aug.
P. scutellata, Linn. Driffold Lane, Sutton, etc. June—Nov.
P. stercorea, Pers. Quinton; Harborne. Feb.
P. theleboloides, A. and S. Sutton; a single specimen, which was growing on a brick, is referred by Mr. Phillips, though rather doubtfully, to this species. Sept.
P. Dalmeniensis, Cooke. Driffold Lane, Sutton, on the ground among coltsfoot plants. This very rare fungus, like most of the other Pezizæ, was named for me by Mr. W. Phillips. Sept.
P. virginea, Batsch. Driffold Lane, Sutton; Edgbaston, etc., on squared timber and logs. Aug.—Feb.
P. nivea, Fr. Driffold Lane, Sutton. Feb.
P. calycina, Schum. Sutton Park, on larch. Sept.—Nov.
P. palearum, Desm. Water Orton, on straw. June.
P. hyalina, Pers. Driffold Lane, Sutton. April—May.
P. stereicola, Cooke. Driffold Lane, Sutton, on the hymenium of a dead Stereum; named by Mr. W. Phillips. Very rare. Sept.
P. chavetiæ, Lib. Driffold Lane, Sutton, on chips. Feb

P. fusca, Pers. Driffold Lane, Sutton. Feb.
P. cyathoidea, Bull. Sutton, on a decayed stump. May.
P. vinosa, A. and S. Driffold Lane, Sutton. Sept.
P. cinerea, Batsch. Driffold Lane, Sutton; Alvechurch. Sept.—May.
P. fusarioides, Berk. Sutton, Harborne, etc. Sept.—May.
Helotium aciculare, Fr. Sutton Park. Sept., Oct.
H. pallescens, Fr. Driffold Lane, Sutton. Oct.—April.
H. claro-flavum, Berk. Driffold Lane, Sutton, on bark. Sept.
H. pruinosum, Jerd. Sutton, on *Hypoxylon* and *Diatrype stigma*. May.
Dermatea dryina, Cooke. Sparkhill, on the bark of a felled sycamore. This unpublished species has been determined for me by Mr. Phillips. Oct.
Ascobolus furfuraceus, Pers. On horse dung, Sutton, etc. Feb.—April.
A. glaber, Pers. On horse dung, Selly Oak. Feb.
A. minutissimus, Boud. On cow dung, Water Orton; Harborne. Determined by Mr. Phillips. As this species has not hitherto been found in Britain, I append the description:—"Omnium minutissimus, sub lente vix conspicuus, semper sparsus; siccus nigricans, fulvus, margine nigro; paraphysibus clavatis, luteo-virentibus." Boudier, Mémoire sur les Ascobolées. About 1-12th mm. broad, flattened, with a distinct dark margin; disc yellowish-brown. Asci broad, decidedly tapering below, $50\mu \times 13\mu$. Spores biseriate, elliptical, hyaline, $9\text{-}10\mu \times 5\text{-}6\mu$. Paraphyses very few. Sept., Oct.
A. pilosus, Fr. On horse dung, Halesowen; Sutton. Feb.—May.
Bulgaria inquinans, Fr. Sutton Park; Sutton. Sept.—Nov.
B. sarcoides, Fr. Sutton Park, on a stump, amongst moss. Oct.
Phacidium ilicis, Fr. Sutton Park. May.
Rhytisma acerinum, Fr. Water Orton, Hampton, etc. Aug.—Oct.
Hysterium pulicare, Pers. Marston Green, on hazel. May.
Stegia ilicis, Fr. Sutton Park, Halesowen, etc. Jan.—Dec.

PYRENOMYCETES.

Torrubia militaris, Fr. Sutton Park, Sutton, Sparkhill, etc. Sept., Oct.
Epichloe typhina, Berk. Hampton-in-Arden; Harborne. July, Aug.
Hypomyces aurantius, Tul. Sutton Park; Sutton. On *Polyporus spumeus* and *Ag. ostreatus*. Oct.—Feb.
Nectria cinnabarina, Fr. Abundant everywhere. Sept.—Mar.
N. coccinea, Fr. Sparkhill, on a felled trunk. Oct.
N. peziza, Fr. Driffold Lane, Sutton. Oct.—Feb.
N. sanguinea, Fr. Sparkhill, on a felled sycamore. Oct.
N. episphæria, Fr. Driffold Lane, Sutton, on *Hypoxylon*. April.
N. mammoidea, Ph. and Pl. Sutton Park, on an old stump. April.
Xylaria hypoxylon, Grev. Abundant everywhere. Sept.—Mar.
Hypoxylon concentricum, Grev. Driffold Lane, Sutton. Nov.
H. coccineum, Bull. Driffold Lane, Sutton; Halesowen. Nov., Dec.
H. multiforme, Fr. Driffold Lane, Sutton, on birch. April.
H. fuscum, Fr. Marston Green, on hazel. May.
Dothidea ulmi, Fr. Solihull; *W. H. Wilkinson*. Oct.
D. trifolii, Fr. Hampton-in-Arden. July.
D. graminis, Fr. Common everywhere. Aug.—Oct.
D. filicina, Fr. Common; Sutton Park, Harborne, etc. May.
Diatrype verrucæformis, Fr. Marston Green, on hazel. May.
D. stigma, Fr. Wylde Green; Sutton Park; Halesowen. July—Feb.
D. disciformis, Fr. Driffold Lane, Sutton. Nov.—April.
D. ferruginea, Fr. Marston Green, on hazel. May.
Melanconis stilbostoma, Tul. Sutton; Edgbaston. July.

Valsa aglæostoma, B. and Br. Driffold Lane, Sutton. This rare species was determined by Mr. C. B. Plowright. Nov.
Cucurbitaria laburni, De Not. Sutton, on laburnum sticks. April.
C. cupularis, Fr. Marston Green, on hazel. May.
Sphæria aquila, Fr. Sutton; Water Orton. Feb.—June.
S. ovina, Pers. Driffold Lane, Sutton. May.
S. pulvis-pyrius, Pers. Sutton; Sutton Park, etc. Nov.—Mar.
S. herbarum, Pers. Common everywhere. Nov.—May.
S. rubella, Pers. Driffold Lane, Sutton; on a nettle stem. May.
S. acuminata, Sow. Solihull; on dead thistle stems. June.
S. acuta, Moug. Sutton; Harborne; Solihull, etc. On nettle stems. Dec.—May.
S. doliolum, Pers. Solihull; on dead stems of Angelica. June.
Sordaria breviseta, Rab. Water Orton; on cow dung. Sept.
S. fimeti, Pers. Quinton, on dog's dung. April.
S. fimiseda, De N. Sutton Park, on cow dung. April.
Sphærella rumicis, Desm. Common; Sutton, Harborne, Barnt Green, etc. May—Aug.

W. B. Grove, B.A.

(To be continued.)

Correspondence.

Curious site for Rook's Nest.—On the Forest Road, Nottingham, a pair of rooks have selected a curious site for their nest. It is placed in the corona to the iron finial of the turret of the Nonconformist College on the Forest Road. There is a small rookery about 200 yards from it.—W. J. Rawson, Nottingham.

Blue Caps (see p. 141).—Although possibly flowering somewhat later than the Scarlet Poppies, the Corn Bluebottle (*Centaurea Cyanus*) is associated with them in the minds of many. I would suggest that this may perhaps be the flower referred to by Clare in the line quoted at p. 141 of the "Midland Naturalist." Certainly nothing in nature can be more aptly termed "divinely blue" than this most beautiful cornflower—the "Bluet" of the French.—O. V. A., Great Bourton, Oxon, 8th June, 1883.

Flora of Derbyshire.—The following letter, addressed to one of the Hon. Secs. of the Midland Union, was read at the Tamworth Meeting on the 12th ultimo:—"For some years past I have been engaged in collecting materials for a Flora of Derbyshire, and I should be very much obliged if you will bring this matter forward at the approaching annual meeting of the Midland Union. I am greatly in want of kind helpers, especially for the part covered by the Derbyshire Coalfield, but shall be thankful for the help of any Botanists in the county or in its neighbourhood. My method of working hitherto has been this:—The friends who take part in this work furnish me with lists of the plants they find and their habitats; of plants not recorded from other parts of the county they furnish me with one or two specimens, in return for which they receive from me such plants as they may desire, which I may have by me. I don't think that any of my correspondents have in this matter been losers by this, as my great wish is to make it as profitable an undertaking to all as may be. If you wish for further information I shall be very glad to give it, and shall be very much obliged if you will accede to this request; still more, if you can secure me efficient helpers.—Rev. W. Hunt Painter, 1, Park Villas, Knowle Road, Bristol."

VIOLA SYLVATICA, *var.* REICHENBACHIANA.—In your report of the meeting of the Birmingham Natural History Society, held on April 24th, Preston Bagot is given as a new locality for *Viola sylvatica*, var. *Reichenbachiana*. I may say that I found it growing there abundantly on my first visit to that neighbourhood six years ago (April 7, 1877), and on each subsequent visit I have found it still just as flourishing.—JAMES TURNER, F.L.S., Moseley. [This was given by me as being new *as a record* for Preston Bagot. Mr. Turner had not recorded it.—J. E. BAGNALL.]

NOTE ON A BEECH LEAF.—Doubtless many persons have been struck by the wonderful beauty of leaves when first unfolded, and in a manner similar to that of which I was forcibly reminded one day in May last, when observing some leaves of a beech tree in my garden, and noticing their delicate silkiness of texture altogether; the soft white hairs of the mid-rib and outer edges; their clear green colouring; the almost exactly paralleled side veins, ending in a slightly projecting blunt point; the fine interlacing network of the ultimate veining; their tenacity, joined to partial elasticity of the entire leaves; the delicate arrangement of stomata seen under the microscope, forming a refined adaptation for breathing, as in leaves generally; all combined to form one of the most interesting among so very many beautiful leaves. —HORACE PEARCE, F.L.S.

NEW METHODS OF MOUNTING FOR THE MICROSCOPE.—At one of the recent meetings of the Birmingham Natural History Society two very interesting and novel methods of mounting objects for the microscope were brought forward, and their concurrence on the same evening was the more remarkable, because they solved the difficulty of preserving vegetable and animal preparations in the fluids best suited for them respectively. One of the best mediums for certain animal preparations is spirits of wine, but the impossibility of preventing its evaporation has always been a bar to its use. Mr. Thomas Clarke, however, exhibited two microscopic slides of objects mounted in spirits of wine, sixty-four over proof, in 1881, which were still perfectly intact. The cement used in closing the cell was manufactured by a friend of Mr. Clarke, who expressed his readiness to supply any of the members with a bottle of it. For vegetable sections glycerine is one of the best preservatives, but as before, the difficulty of confining it within the cell has been deemed insuperable. Mr. J. E. Bagnall mentioned a method invented by Professor Hillhouse, of the Mason College, by which this end is perfectly attained. The Professor himself then kindly and fully explained his mode of operation, which is as follows:—No cell is used, the object is merely placed in a drop of glycerine of just sufficient size to reach the edge of the cover-glass, when it is dropped on. Canada balsam, dissolved in turpentine, is then applied round the edge so as to close the cell, by means of a small glass rod drawn out to a point, but terminating in a little knob. If a little of the glycerine should exude beyond the cover-glass, it need not be removed; it can be covered with the Canada balsam as easily as if it were under the cover-glass, and without interfering with the security of the cell. The Canada balsam is, of course, best if of such a consistence as not easily to become hard and brittle. Professor Hillhouse mentioned, as one of the advantages of this method, that if the section should slip from beneath the cover-glass on the application of pressure, as the thinnest and therefore best sections are apt to do, they would still be visible through the transparent balsam, if its upper surface were made parallel to the slide. It was jocularly suggested that the next step in advance would be to dispense with the cover-glass altogether, and encase the object in a layer of glycerine, protected by a horizontal film of balsam.—W. B. GROVE, B.A.

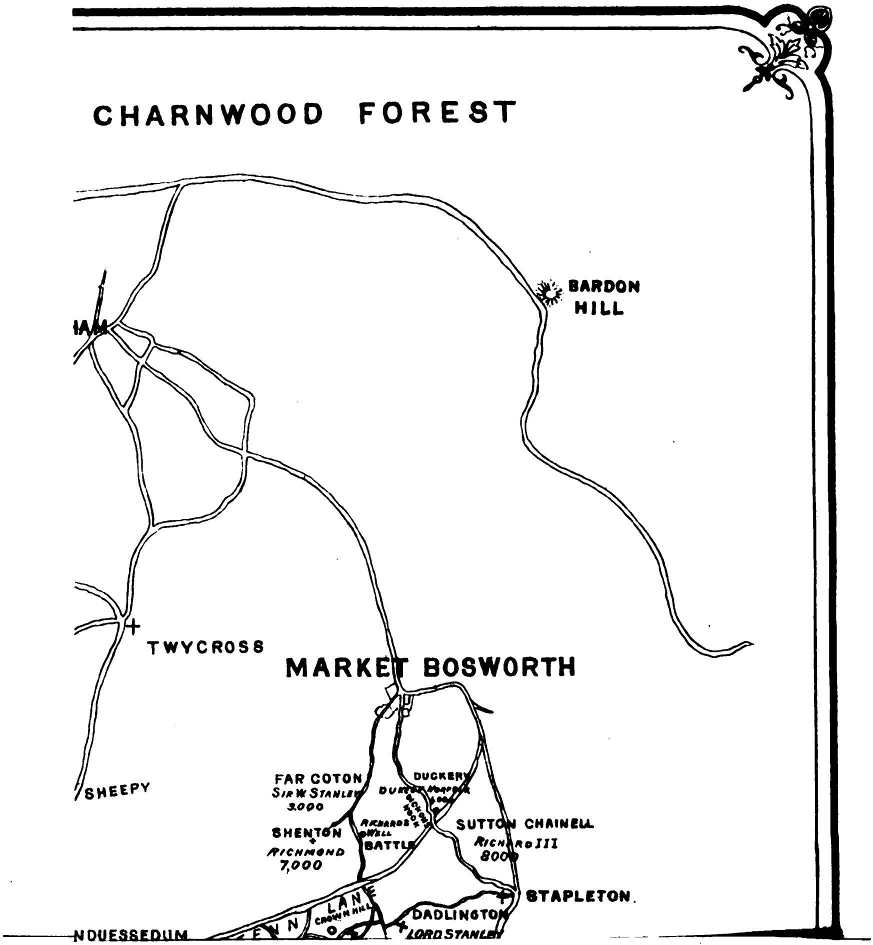
Blue Caps.—In the June number of the "Midland Naturalist" Mr. Rogers asks what plant is meant by the popular name of Blue Caps. In Dr. Prior's work on "The Popular Names of British Plants," page 26, I find, "Blue-Caps, from its tuft of blue flowers (*Knautia arvensis*, Coult)." In Dr. Johnston's "Botany of the Eastern Borders," p. 101, this plant is called Curly-Doddies, and this name is said to be derived from the resemblance of the head of flowers to the curly pate of a boy, and is very ancient.—See "Minstrelsy of the Scottish Border," i., p. cix.

"Where yon Blue-bells and Curly-doddies bloom
On the fair Knowes, amid the waving broom."

—"Scenes of Boyhood" (George Henderson).—The flower affords a horologue of a primitive sort. The head is twisted round a few times, and then left to recover its position. The number of circumvolutions is the true index to the time of day.—J. Hardy. In the Isle of Wight, according to Bromfield's "*Flora Vectensis*," this plant is called "Gipsy, or Egyptian Rose." Withering states "That sheep and goats eat it. Horses and cows are not fond of it. It is slightly astringent, bitter, and saponaceous. (When held over the fumes of tobacco the colour of the blossoms has been observed to give place to a beautiful green)." This peculiarity may also be seen in the purple flowers of the Candy-tuft if tobacco smoke is blown upon it.—J. E. Bagnall.

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—General Meeting, May 29.—Mr. J. E. Bagnall exhibited *Carex præcox* and *Mœnchia erecta*, from Yarningale Common, and *Cratægus oxyacanthoides*, from Lapworth; a moss, *Hypnum filicinum*, in fruit (rare) and an hepatic, *Aneura multifida*, in fruit, both from Rowington; a fungus, *Auricularia mesenterica*, from Upper Eatington, near Stratford-on-Avon; and a lichen, *Parmelia saxatilis*, from Oakley Wood. Mr. W. B. Grove exhibited the following fungi:—*Lenzites betulina*, *Diatrype verrucæformis*, *D. stigma*, *D. ferruginea*, *Cucurbitaria cupularis*, *Uredo potentillarum*, and *Uromyces ficariæ*, from Marston Green; *Pluteus cervinus* (the *Ag. latus* of Withering, who records it from Edgbaston), *Thelephora corrugata*, *Peziza hyalina*, *Helotium pruinosum*, *Helminthosporium folliculatum*, *Helicomyces roseus*, *Helicocoryne viridis*, *Sporidesmium lepraria*, *Lycogala epidendron*, and *Peronospora nivea*, from Sutton; *Œcidium depauperans*, on Viola "Bluebell," from Perry Barr; and on behalf of Mr. R. M. Lloyd, *Coprinus micaceus*, and *Comatricha typhina*, from Handsworth. Mr. F. H. Collins, F.L.S., read a note drawing attention to the necessity of gradually changing the magnifying powers of a microscope while examining any object, and thus observing it under a gradually increasing amplification. He explained the various methods for facilitating these changes, previously in use, and exhibited a microscope arranged with a means for readilyattaching objectives, superior to the mode usuallyadopted. The difference consists in cutting down the ordinary screw worms along three equal and equidistant segments both of the body-tube and the objective screw; then, when the objective is pushed home, a sixth part of a turn engages the screws and fixes the objective in its proper position. The altered screws will fit unaltered body-tubes, and *vice versa*, so that objectives will still be interchangeable as under the ordinary arrangement. A discussion followed, in which the President, Messrs. Levick, Goode, Pumphrey, Hughes, and others took part. General Meeting, June 5.—Mr. W. H. Wilkinson exhibited Lichens from the Highlands of Scotland:—*Cladonia extensa*, *C. endiviæfolia* (rare), *C. gracilis*, *C. macilenta*, *C. pyxidata*, *C. rangiferina*, *C. uncialis*, and *Sphærophoron compressum* (rare). Mr. J. E. Bagnall exhibited *Polytrichum formosum*, *Salix Smithiana*, *Veronica montana*, *Equisetum fluviatile*, and other plants from Arbury Park, collected during the excursion of the Sociological Section on Saturday last. Mr. C. Pumphrey exhibited a number of specimens of Swiss, Italian, and Channel Island plants, at that time in flower in his garden. Mr. W. B. Grove exhibited the following Fungi:—*Lenzites sepiaria*, *Clavaria inæqualis*, *Dacrymyces* *deliquescens, Peronospora Ficariæ, Peziza cyathoidea, P. nivea*, and *P. fusca*, from Sutton; *Torula pulveracea, Uredo bifrons*, and *Peronospora grisea*, from Marston Green. Mr. W. Greatheed then read a paper on "Vertebrate Egg-life," in which he gave an account of the changes which take place in the vertebrate ovum, in its development from a single cell to the organised mass of cells which constitutes the new-born young. After pointing out that in the scientific sense of the word the shell is no essential part of the egg, being absent in those of frogs, snakes, fish, and mammals, he proceeded to define an egg as "a cell amid many cells," which, owing to some peculiarity, is to have a far more glorious destiny than its companion cells: the growth of an egg, however, must not be looked upon as essentially different from that which a bud undergoes, the process of fertilisation being merely a means by which the energy of the cell-division that constitutes growth is much increased. He then detailed the changes which take place in the germinal vesicle, the multiplication of the cells in certain definite directions, the formation of the "primitive groove," of the head and limbs, of the heart and the spinal chord, of the eye and the ear, and of the two coverings by which the embryo is protected from injury. He also referred to some of the more philosophical and general aspects of the deductions which can be drawn from the maxim "That the history of the individual repeats the history of the race," and took occasion, in passing, to refer to the great loss which science had sustained in the early death of Professor Balfour, "the second Darwin." The Chairman (Mr. R. W. Chase) made a few comments upon the paper, which was illustrated by some microscopical sections and diagrams, kindly lent by Professor Haycraft, of the Mason College. SOCIOLOGICAL SECTION, June 7th.—The Second meeting of this Section of the Society was held at the Mason College. The President (Mr. W. R. Hughes, F.L.S.) occupied the chair, and there was a large attendance, including several ladies. Chapter II. of Mr. Herbert Spencer's "Essay on Education" was introduced by Mr. Greatheed. The following members took part in the discussion:—The President, Professor Sonnenschein, Dr. Hill, Messrs. Greatheed, Cullis, Hayes, Major, Williams, Pickering, Pearson, Barratt, and Collins. An Excursion of the Section to "Shakespeare's Country" was fixed for October 6th. The next meeting takes place on Thursday, July 12th, when the last two chapters of the "Essay on Education" will be discussed. GENERAL MEETING, June 19th.—Some of the members who had attended the meeting of the Midland Union of Natural History Societies at Tamworth on the previous Tuesday and Wednesday gave an account of what took place, and a vote of thanks was passed to the Tamworth Society for the excellent measures which they had taken to render the gathering a success. Mr. W. P. Marshall exhibited the apparatus that had been prepared for the forthcoming dredging operations which the Society intends to commence at Oban at the end of June. Mr. W. B. Grove exhibited *Peziza cochleata, Oidium chartarum*; and the following Fungi from Solihull—*Peziza umbrata* (Fries, *not* Cooke), *Sphæria acuminata, S. doliolum, Peronospora effusa, P. grisea*, and *Urocystis pompholygodes*; also, on behalf of Mr. Bolton, *Puccinia Betonicæ* from Yorkshire. Mr. J. E. Bagnall exhibited *Chara fragilis, Nitella flexilis, Carex curta, Bromus commutatus, Littorella lacustris*, and *Equisetum sylvaticum*, all rare, from Earlswood; *Nardus stricta*, from Baxterley Common, *Equisetum maximum*, from Bentley Park, and other plants. Mr. T. Clarke communicated a new method of mounting animal preparations in spirits of wine, sixty-four over proof, and showed some slides which had remained for two years without suffering from evaporation. Professor Hillhouse described a similarly successful mode of mounting vegetable objects in glycerine which he had invented: the cell is closed by Canada balsam, dissolved in turpentine, which effectually prevents the glycerine from oozing out. The Secretary then read a paper by Mr. Thomas Bolton, F.R.M.S., in which he enumerated the "Discoveries in Freshwater and Marine Life" within the last four years, for which he claimed credit. These included the following species of Rhizopoda, Infusoria, Annelida, and Entomostraca:—*Raphidiophrys pallida*, and *R. elegans, Hyalodaphnia Kahlbergensis, Ilyocryptus sordidus, Acineta grandis, Stichotricha remex, Floscularia regalis, F. ambigua, F. coronetta, Haplobranchus æstuarinus, Nais littoralis* (not found before, since its first discovery fifty years ago), *Chilomonas spiralis* and *Hemidinium nasutum* (from Sutton Park), and other rare organisms, most of them new to Great Britain, and some new to science.


CHARNWOOD FOREST
BARDON HILL
TWYCROSS
MARKET BOSWORTH
SHEEPY
FAR COTON
SIR W. STANLEY
3,000
DUCKERY
SHENTON
RICHMOND
7,000
RICHARDS WELL
BATTLE
SUTTON CHAINELL
RICHARD III
8000
STAPLETON.
LANE
CROWN HILL
DADLINGTON
LORD STANLEY

MIDLAND UNION OF NATURAL HISTORY SOCIETIES.

TAMWORTH MEETING, JUNE 12TH, 1883.

ADDRESS BY EGBERT DE HAMEL, ESQ.,

PRESIDENT OF THE UNION.

We have assembled this afternoon to celebrate the Sixth Annual Meeting of the Midland Union of Natural History Societies, an association which, as recorded on the first page and opening lines of the Union archives, derived its initiative, its first idea, developed in 1878, from the fact that early in 1874 the Tamworth Natural History, Geological, and Antiquarian Society held a very successful soirée, in which the Birmingham Natural History and Microscopical Society took a part. That Meeting (as the record further states) was in every way so satisfactory and gave such proofs of the value of co-operation, that many who attended it expressed a desire for more instances of a like kind, and thus we may fairly claim that to the local society (over which I have the honour this year to preside, and in whose name I now most heartily bid you welcome to Tamworth), the Union owes its birth, and it is pleasant to find that this body in its manhood is revisiting the scene of its infancy.

Then, as now, our near neighbour, the Birmingham Microscopical Society, came forward in response to an appeal for scientific assistance and placed a choice collection of their best instruments and most carefully selected objects at the service of those who attended and will attend our conversazione. So gratifying was the result, so agreeable the friendships then formed, that the original idea of co-operation has been followed up from this small nucleus until twenty-two societies, with an aggregate member roll of about 2,500 persons, all more or less bound together by the common tie of scientific pursuits, have joined its banner, and that admirable journal "The Midland Naturalist" (which deserves a higher appreciation and far wider circulation than I fear it enjoys) sprang into existence. Nor are these the only advantages that are to be derived from the Union, for at its Annual Meetings many men of similar scientific tastes are brought together and made acquainted. Dredging Parties under the auspices of the Birmingham Microscopical Society afford excursions on a princely scale, and ransacking the ocean's bed display to the enchanted participants an insight that it is impossible to overpraise into some of Nature's loveliest living objects; whilst smaller expeditions into the various districts over which the Union extends its branches (not the least important amongst which are those connected with our annual gathering), introduce those who are energetic enough to attend to an immense variety of local objects of interest otherwise so difficult of access as to be passed unheeded. Not only so, but members of the various societies who have been at pains in the preparation of lectures, have redelivered their papers before other societies, and have thus been able, with but little extra personal exertion, to assist in extending the sphere of usefulness of the Union, help out the programmes of their neighbours (and all secretaries present will bear me out in saying how invaluable such assistance is), and finding their exertions on behalf of scientific knowledge not cast aside with the one occasion for which they were expended, have discovered in this an additional incentive to more earnest and better work than they might otherwise have deemed it necessary to employ.

Further than this, the Council of the Union, with a view to the encouragement of original research, provides an annual prize open for competition to every member of the affiliated societies, which consists of a medal (of the value of £10), struck in gold or bronze at the option of the successful candidate, and bearing the effigy of the late ever to be admired Mr. Charles Darwin, F.R.S., by whose permission (granted but a short time before he was personally lost to us) it is called the Darwin Prize. Founded in 1880 it was gained in 1881 by Edward Wilson, F.G.S., for Geology; in 1882 by Professor A. M. Marshall, D.Sc., M.A., M.D., of Owens College, Manchester, and W. P. Marshall, M.I.C.E., for a joint paper on Zoology, in which they give to science a vast amount of new and important information respecting the Pennatulida, and to these two last-named gentlemen, at the conclusion of my address, I shall have the honour of presenting the gold medal in the name of the Midland Union.

The subject selected for 1884 is Botany, and as the Union is rich in botanical specialists we may anticipate a keen and more than usually interesting contest.

These few remarks, scanty as I feel them to be, should suffice to indicate the value of the Union, and to induce the societies not yet enrolled and those individuals who have not joined one or other of the local societies, or subscribed to "The Midland Naturalist," at once to do so, not altogether for the mere personal advantages they may actually derive, but for the public good and the encouragement of an important and valuable method of promoting the most useful of all knowledge, that which is based on purely scientific principles.

I shall now, leaving the general objects of the Union, venture to draw your attention to its local aspect, especially as regards our present meeting place, "Tamworth," a spot that though it may be numerically small and insignificant is yet historically mighty and replete with a more than usual interest on account of the time over which its history extends, and the consequent changes and vicissitudes that, like the fleeting shadows of summer clouds, have darkened for a moment its prospects only to enhance the brilliancy of the sunshine which followed in their train. Situated on a point of land overlooking extensive marshes, and placed at the confluence of two of Trent's most important tributaries, the rivers Tame and Anker—of which Drayton in his "Polyolbion" says

> "And likewise toward the north the lively tripping Rhea
> T' attend the lustier Tame is from her fountain sent;
> So little Cole and Blythe go on with him to Trent,
> His Tamworth at the last he in his way doth win,
> There playing him awhile, till Ancor should come in"—

Tamworth occupied the most important defensive position in the Forest of Arden, which anciently covered the whole of the district in which I should like to-day to interest you.

> "Muse, first of Arden tell, whose footsteps yet are found
> In her rough woodlands more than any other ground
> That mighty Arden held, e'en in her height of pride,
> Her one hand touching Trent, the other Severn's side."

And we shall point out to-morrow, on both excursions, venerable giant oaks that doubtless graced the glades of this quondam forest.

Our district is therefore bounded on the south by the Avon, on the west by the Severn, on the north by the Trent, and on the east by an imaginary line from High Cross (Bennones), to Branston (Ad. Trivonam), near Burton-on-Trent, and was the stronghold of the British tribe of the Cornavii which occupied the present counties of Warwickshire, Staffordshire, Worcestershire, Shropshire, and Cheshire.

Although we know but little about the Britons before the Roman invasion, we have good reason to suppose them to have been a powerful and wealthy people, deriving their riches mainly from the cultivation of corn, mining for lead and tin, and trading with the Phœnicians and other foreign nations; they were possessed of an excellent breed of horses, with an abundance of chariots, their country intersected with roads, or trackways, as the earlier writers termed them, the chief characteristic of which was that they followed the hill tops and avoided the marshes, throwing out branch roads at intervals to the adjoining villages or clusters of wattled beehive huts.

Amongst these roads the Gethling Street, or "Way of the Stranger," was one of the most important, and was afterwards taken possession of by the Romans and called "Watling Street," and we have therefore devoted our attention to it as the backbone of the Tamworth meeting.

The ancient British forts consisted of large mounds of earth surrounded with "foss and vallum" (ditch and embankment), the latter surmounted with a strong wooden palisade. Of these we can show a goodly number in the immediate district. First and most important amongst them as occupying the central and strongest position, situated at the confluence of the Tame and Anker, defended on the south by vast and impenetrable morasses, Tamworth stood, surrounded and supported within moderate distance by Seckington, Castle Ring, at Beaudesert, Knave's Castle, Castle Old Fort, at Stonnall, Druid Heath, Barr Beacon near Sutton Coldfield, Castle Bromwich, and Oldbury.

Beyond these important places we find a large number of lows, barrows and tumuli, which in almost every case occupy elevated and commanding positions, as those of you who accompany either of the excursions to-morrow will observe; not only so, but many of them were rendered sacred by use as places of sepulture, and were by this means protected from destruction. There is also no doubt that these spots were beacon stations from whence military signals were conveyed by a pillar of cloud, *i.e.*, smoke by day, and a pillar of fire by night.

Our townsman, Mr. A. A. Clarson, who has distinguished himself among scientific men as a most painstaking archæologist, in an excellent paper on the "Tumuli of the District" draws attention to this fact, and to the different classes of sepulchral pottery found in them when opened. These he divides into four kinds.

Cinerary urns and incense cups in the case of cremation, the urn for the ashes of the dead, the incense cup to carry the fire to the funeral pile.

Drinking cups and food vessels in the case of inhumation supposed to contain sustenance for the departed on the journey to the happy hunting grounds.

The local tumuli are at Hopwas Wood, Wigginton, Elford, Edingale, Croxall, Barrow Cop Hill, Bury Hill, Offlow, Hints, King's Standing, Windmill Hill, Maxtoke (3), Arley, Hartshill (2), and Cloudesley Bush, with doubtful ones at Polesworth, Stipershill, and Bramcote.

Several of these have been opened, that at Elford, in 1680, by Dr. Plot, who found it to contain ashes and burnt bones, whilst one of those at Hartshill was opened in 1773 and disclosed a pavement of brick about 6ft. square, which indicates the Romano-British period, as bricks were not used until after the Roman invasion.

In 1832 Mr. Mathew Bloxam opened the second tumulus near Hartshill Castle, and the dagger, cups, and vases of early pottery found there are now in his possession. Close by Croxall, in 1873, Sir Wilmot Horton found and presented to the Museum at Lichfield two Roman or Romano-British urns, containing bones, and one drinking cup. These were discovered at about 2ft. below the surface of the ground in a field at Oakley Farm.

In the year 55 B.C., Julius Cæsar crossing the Channel with a fleet of eighty ships and 10,000 men, landed in Britain on a flat part of the coast between Walmer and Sandwich, to avenge an attack that had been made on the Roman arms by a British force, he was met in battle by the Princes of Kent, whom he signally defeated, and having accomplished his object retired to Gaul.

But early in the next year, 54 B.C., he invaded Britain a second time and advanced as far as St. Albans, where a treaty was made with the British Chief Cassivelaunus, who, with 4,000 chariots, had stoutly opposed his advance, and Cæsar taking hostages again retired, in all probability leaving behind him representatives, or, as we should call them, consuls, to look after Roman interests, and for whose safety the hostages were doubtless the guarantee.

It was ninety-seven years before the Romans reappeared, and during this period their agents had been diligently furthering Roman interests and developing the great thoroughfares of the country, three of which traverse our immediate district. They are the Watling Street, which runs from Richborough, on the coast of Kent, through High Cross, Manduessedum, Atherstone, Fazeley, and Wall, to Holyhead, in Anglesea, the great port for Ireland, sending a branch from near Chester, northwards to Scotland.

The Icknield Street, or "Road of the Iceni," proceeds from the coast near Great Yarmouth, by Royston, where it intersects the Ermyn Street to Dunstable, when it crosses the Watling Street and thence crossing the Thames passes by Bridport to the Lands End. This I mention in particular as the ordnance map places the Icknield Street between Birmingham and Wall, consequently this road, the Icknield Street, is erroneously connected with Tamworth, whilst it is the Rykenield Street, or road of the Upper Iceni, in which we are directly interested. This road connected Newcastle-on-Tyne, Chesterfield, Derby, Burton, Wall, where it crossed the Watling Street, the exact spot being indicated by three ancient stones, one in either hedge-bank and one in the middle of a field crossed by a footpath between the termination of the Watling Street at Barn End and the point by the Trooper at Wall, when the road recommences, with Sutton Coldfield, Birmingham, King's Norton, Tewkesbury, Gloucester, Chepstow, and Carmarthen, finishing at St. David's.

The Fosseway extended southwards from Lincoln to Leicester (in the museum of which town is a beautifully preserved Roman milestone) by High Cross, where it intersects the Watling Street, continuing past Brinklow, one of the finest earthworks in Warwickshire, and so on to Bath.

The Ermyn Street leads from the coast of Sussex to the south-east part of Scotland.

In A.D. 43, the Emperor Claudius decided on again invading Britain, and sent an army under Plautius for that object, who, after desperate fighting with Caractacus, became dispirited, and called on Claudius for assistance. The Emperor came with armed elephants and much pomp. In the meantime Caractacus had retreated towards the west, and although Claudius only stayed sixteen days, his visit had the desired effect, and reinspired the Roman army with courage. After a few years Caractacus was signally defeated at Caer Caradoc, in Shropshire, by Ostorius Scapula, and being betrayed by his mother-in-law, was handed over a prisoner to the Romans in A.D. 51.

The Romans now divided the country into five provinces, the central one called "Flavia Cæsariensis" extending from the Thames to the Humber, and so including Tamworth.

Nothing further that especially interests us occurred until A.D. 78, when Vespasian confided the Government of Britain to Agricola, a man of great intelligence and determination, able and accomplished both as a warrior and statesman.

Agricola marched straight along the Watling Street to Anglesea, conquering or conciliating as proved necessary, as well as teaching the civilisation enjoyed by Rome. Under his administration the condition of Britain, much as it had improved during the past century, made vast onward strides. He it was who planned the chain of forts on the Watling Street (two of which you will inspect on your excursions to-morrow), established garrisons throughout the country, and built many of the substantial stone houses, the solid foundations and tesselated pavements of which are so often discovered beneath the level of the ground in many parts of the country.

In 180 Christianity was, at the instigation of the British King Lucius, introduced into Britain by Pope Eleutherius.

A century later, in the year 300, Emmenius describes "Britannia as fortunate and happier than all other lands, enriched with the choicest blessings of heaven and earth."

The year 418 saw the last of the Romans in Britain, and we learn a singular fact from the Anglo Saxon Chronicle, which is corroborated by the constant finds of coins and pottery in this neighbourhood and elsewhere. "That this year the Romans collected all the treasures that were in Britain, and some they hid in the earth, so that no one has since been able to find them, and some they carried with them into Gaul."

Before leaving the Romans I would especially call your attention to the bold and skilful manner in which they planted their stations and camps in the very midst of those belonging to the Britons, and how occasionally they invested particularly strong positions such as Seckington, with a camp, at Thorpe Constantine, Oldbury, with one at Park Place, and Tamworth with another at Wigginton.

In 450, Hengist and Horsa, two Saxon chiefs, commenced the invasion of Britain that led to its subjugation by the Saxons; and we pass over another 135 years, until in 585 Creoda led his followers into the district of Arden, overran the Midland Counties, and founded the Kingdom of Mercia, which comprised all the territories south of the Humber, east of the Severn, north of the Thames, and west of a line drawn through the counties Herts, Beds, Cambridge, Hants, and Lincoln.

The next great historical event was the coming of Augustine in 597.

In 627 the terrible heathen Penda began to reign, and conquered in succession two of his Northumbrian rivals; but in 655 was at the age of eighty finally slain in battle by Oswin, of Northumberland, who thus obtaining Mercia converted it to Christianity, and it was at once put under the spiritual charge of a bishop. In 667 Ceadda (St. Chad), fifth Mercian Bishop, fixed his See at Lichfield.

Mercia soon after this regained her military supremacy.

Some of the Saxons settled at Campus Martius of the Romans near to the Watling Street, and called it Arden's Hill, now Hartshill; another Saxon town was formed near the Castra Æstiva or summer camp, Ealdburie, now Oldbury, whilst a little to the north they founded Arden's town, now Atherstone.

During the reign of Ethelbald, which extended from 716 to 756, Mercia obtained great power, the most important events being the constant battles for supremacy with the West Saxons, and this brings us to the great battle of Seckington, near Tamworth, between Ethelbald and Cuthbert, King of the West Saxons, during which Ethelbald was slain by the traitor Beornred, who in turn was put to death by Offa, the succeeding King of Mercia, and he victorious over all enemies within his own island, corresponded on equal terms with the great Charles, the mightiest potentate of the east.

Soon after his accession to the throne Offa came to Tamworth, where he caused a palace to be built of greater dimensions than was usual in those times, which was the admiration and wonder of the age.

He also strongly fortified the town by surrounding it with a vast entrenchment and bank, which we still call Offa's Dyke or the King's Ditch, and the town became one of great celebrity, a favourite resort of Offa and his successors, from which they dated charters to the bishops and religious bodies of the realm.

Tamworth enjoyed with other great places the privilege of coining from the time of Offa until the reign of Henry I.

Offa died on the 18th of August, 794. From this point we find Tamworth mentioned in charters of various Mercian Kings until we reach the year 852, when Burgred the twentieth King of Mercia, and last recorded as being at Tamworth, succeeded and enjoyed a period of profound peace for fourteen years.

After this the Danes invaded the kingdom, two years later having established themselves in the north they descended on Mercia and took Nottingham, where Burgred beset them; but unable to maintain the siege had to allow them to march back to Northumbria. They poured into the country again in 874, and destroyed the Mausoleum of the Mercian Kings at Repton, in Derbyshire. Burgred, worn out, fled, and Mercia, as a kingdom, after 292 years ceased to exist. The Danes spreading through the land destroyed the principal towns and fortresses, amongst them Tamworth, which, completely razed to the ground, lay a mass of blackened ruins for nearly forty years.

In 880 Nemesis (in the person of King Alfred) overtook the marauders, their raven banner was struck down, and after a bloody engagement the survivors were spared only on the condition that they embraced Christianity and helped to repel a further invasion by their countrymen.

King Alfred not only overcame the Danes but legislated wisely for the country, dividing it into counties and hundreds, the Tamworth district being within the counties of Warwick and Stafford, and comprising the hundreds of Hemlingford,—named from the ford at

Kingsbury, five miles south of the town,—and Offlow from the tumulus of that name near to Lichfield.

Alfred died in 901, leaving behind him a daughter "Ethelflæda," who was known as the "Lady of the Marches," and inherited qualities that fitted her to take part either in state councils or in war; she made it her greatest care to restore the principal towns and fortresses which had been destroyed by the Danes, and marched to Tamworth with her whole army in the early part of the summer of 913, caused it to be rebuilt, restored the castle and all the fortifications, and raised a strong keep or dungeon upon a partly artificial mound on which the present edifice has been built in later times, and Tamworth once more regained its former celebrity and importance.

Ethelflæda died in 920, and was succeeded by her daughter Alfwin, who was deposed in about six months by Edward the elder. On this, Tamworth, with Nottingham, Derby, and some other towns, rose in Alfwin's favour, Edward was forced to take arms against the insurrection, and first marching upon Tamworth subjugated it. He died in 924, and was succeeded by Athelstan, who gave his sister Editha to the Danish King Sihtric on the condition that he embraced Christianity, and their marriage was celebrated at Tamworth, on the 30th of January, 925. Sihtric died soon after, and Editha, retiring from the world, became Abbess of a Nunnery which she founded at Tamworth, the Castle of Tamworth in the county of Warwick being given to her by her brother.

In 941 Anlaf, a son of Sihtric, anxious to regain Northumbria conquered York, and advancing rapidly to Tamworth stormed and took it with great slaughter, and carried away much plunder. From this time Tamworth ceased to be a Royal residence and sank into comparative obscurity, and at this point we cannot do better than glance for a moment at the ecclesiastical history of the district. As already stated, St. Chad, fifth Bishop of Mercia, fixed his See in 667 at Lichfield, that field of the dead where unnumbered martyrs had shed their blood for Christ in the Diocletian persecution. Within a hundred years, *i.e.* by 770, Palmer states there must have been a Church at Tamworth.

About 820 Egbert (so the legend recorded of him says) had a son, a leper, who, by advice, was sent to Ireland and cured by a Nun named Modwenna, a daughter of the King of Connaught, and so grateful was the King that he offered to found a religious house for her and her nuns in England. This offer was accepted, and Modwenna established at Trensale, a village opposite Polesworth.

A few years later Egbert, whose daughter Editha had been placed under Modwenna's care for religious instruction, built the nunnery at Polesworth and made Editha the first abbess, Modwenna retiring to the chapel of Andressy, near Burton-on-Trent, in whose abbey she was subsequently buried.

Following on in chronological order we find the church at Tamworth entirely destroyed in 874 by the Danes, and we hear of it again in the reign of Edgar the peaceful, who founded it afresh in or about 963, after the direful sacking of the town by Anlaf, and consecrated it to his beatified aunt Editha.

Between 975 and 1016 we find it recorded that there was a monastery at Tamworth. A Royal Mint existed here from the time of Offa. Ruding describes a penny of Edward the Martyr bearing the name of the town abbreviated to "Tanwo.," and here I may fitly quote Bartlett, who in his Manduessedum Romanorum, page 19, says "In the year 781 Offa issued a charter to the monks of Worcester, dated from his Royal Palace at Tamworth."

At Kingsbury, also a royal seat, Burtwulf held in 851 a grand Baronial Council, at which were present the temporal Barons, the Pope's Legate, one Archbishop, six Bishops, and three Abbots.

And he adds "we may conclude that as Tamworth was at that time the Mercian capital, and as all these Princes coined money, and some in large quantities, that certainly a mint was established in this town."

A discovery of coins which created considerable sensation at the time was made in Tamworth in 1876, on the site of the board school and just within the ancient earthworks, amongst which were thirty-three Tamworth specimens of William I. and II., bearing the minters' names—viz., Brunic and Coline,

BRVNIC ON TAMP,
CVLINE ON TAMP,

whilst in the reign of Canute, who died in 1035, coins were issued by a moneyer of Tamworth, stamped Edric on Tam.

We now pass on to 1066, when William the Conqueror took possession of the country and rewarded his nobles by presenting them with the captured districts, amongst them was Robert le Marmion, Lord of Fontenaye, near Caen, who received for his share lands in Warwick, Leicester, and Lincoln, comprising the Castle of Tamworth, with the lands round about, which included Polesworth and Stipershill, the rising ground adjacent, on which was held the three weeks' court leet of the lords of Tamworth Castle.

Sir Robert Marmion soon after expelled the nuns from Polesworth and forced them to take refuge in a cell close to Oldbury, but, conscience-stricken, dreamt a dream, in which the saintly Edith appeared at his bed side and struck him with her crozier; repenting his haste he rode over to Oldbury and escorted them back with all honour, stipulating only that he should have burial within the chapter house of the Abbey.

Round about the Polesworth side of Tamworth we find a considerable number of localities associated with the ecclesiastics. On the right hand side of the Amington Road, immediately after the first canal bridge is passed, is the only remaining portion, some half mile in length, of a raised and paved monk's walk, or pack-horse road this has been considerably reduced at the Amington end within my knowledge, and bids fair soon to disappear. Some two miles further is Alvecote Priory, an interesting spot with ruined remains of a chapel wall in the garden, curious cellars and ancient stone dovecote. This was a small monastery erected in the reign of Henry II. by a Burdett in expiation of the murder of his wife, and legend states that it was built of the stone ruins of the castle that formerly stood on Seckington Mount about three miles to the north of it. A stone coffin, probably containing the body of an abbot, was discovered opposite the Priory when the Coventry Canal was cut, this was reburied in the garden, but, unfortunately, no record kept of the exact place. Earthen pots containing bronze Roman coins were found here in 1763, 1840, and 1871.

A mile south of Alvecote, on the site of St. Edith's Well, stood the hermitage with its series of fishponds, and near Polesworth, overlooking the River Anker, is an interesting old house, Elizabethan in structure, called Pooley Hall.

A short distance beyond Polesworth is Merivale Abbey, founded during Stephen's reign in 1148 by Robert de Ferrers for a Cistercian Monastery, and the charter was confirmed at Tamworth about the year 1154 by Henry II. in the presence of Theobald, Archbishop of Canterbury.

Returning to Tamworth we find that there was a Hospital of Monks of the Premonstratensian order founded in 1287 by Philip Lord Marmyon, the remains of which (a small chapel and cloister) still exist on the north side of the town.

In 1345 the town was again destroyed by fire, and the church in particular suffered severely, but was immediately rebuilt in all the splendour which characterised the work of the fourteenth century.

About 1466, in the reign of Edward IV., an amusing incident occurred on an unenclosed heath between Sutton Coldfield and Drayton Bassett, when the King, whilst on a hunting expedition, encountered the "Tanner of Tamworth," and after some pleasant banter, exchanged horses with him. The celebrated ballad describing this is preserved amongst the Percy Reliques.

We now reach perhaps the most important local historical event connected with Tamworth, *i.e.*, the great battle which was decided at Bosworth Field, between Richard III. and Henry, Duke of Richmond (afterwards Henry VII.), on the 22nd of August, 1485.

On the 16th, Richard, mounted on "White Surrey," marched with 12,000 men from Nottingham to Leicester, and passed the night at the "White Boar" in Northgate Street. The next day he proceeded towards Atherstone, and took up an admirable position at Stapleton, placing his artillery on the heights now called Dickon's Nook, near Sutton Chainel. The Duke of Norfolk stationed his forces to the north at the Duckery, near Market Bosworth, whilst the traitors—Lord Stanley and Sir William Stanley—encamped, the former south of Richard near Dadlington, and the latter outflanking his chief at Far Coton, west of the Duke of Norfolk.

Richmond landed at Milford Haven on the 6th of August, and marched through Shrewsbury and Stafford (where he had an interview with Sir William Stanley) to Lichfield, he there encamped outside the walls, and next day entered the city in triumph; on the 18th he came down with his army to Tamworth, being reinforced on the way by Sir Walter Hungerford and Sir Thomas Bouchier, who had deserted from Richard. At Coton Turn, close by Hopwas Bridge and about 1½ miles from Tamworth, Richmond missed his way and wandered towards Elford, his absence caused great uneasiness and consternation among his troops, but with the morning light he rode into Tamworth and passing up and down the lines reassured his followers. On the next day, the 19th, he pushed on with twenty men through a forest of Arden byeway, past Merivale Abbey to the outwoods at Atherstone, where in a meadow known as the Hall Close he met the Stanleys by appointment and finally arranged with them the traitorous plan that overthrew Richard. The Duke of Richmond's army followed him from Tamworth and passed along the Watling Street through Atherstone and Manduessedum to the Fenn Lanes up which it proceeded to the White Moors near Shenton Windmill.

You all know how Richard, betrayed on all hands and finding the battle going against him, drank at the well which still bears his name, then battle axe in hand bore down on Richmond in order to settle the conflict by a personal duel; however just as Richmond was in great danger from this sudden onslaught White Surrey stumbled and Richard fell—never to rise again.

On the parapet of the tower of Tamworth Church, which is approached by the curious and unique double winding staircase, are two flat battlements, upon the east side and direction of Bosworth. It is supposed that these carried a mass altar on which Henry VII. had service performed every 22nd of August to commemorate the two incidents I have described—his separation from his army on the 18th, and his subsequent victory.

In 1535 Henry VIII. determined on the dissolution of the monasteries, and among them ordered an inspection of Polesworth Nunnery, which had become the school for all young ladies of position in the Midlands, and bore so excellent a character that it was allowed three years' grace, and was not finally dissolved until January 30, 1539.

The Ghost Chamber in Tamworth Castle owes its origin to this proscription of the Roman Catholics, who, compelled to practice their religious exercises surreptitiously and under heavy penalties, arranged their chapels so that in case of alarm the officiating priest should have ample means of escape, and the vanishing vestments of the ghostly fathers, if anyone approached, naturally constituted an admirable and well conducted spirit.

But we must hasten on to 1643 when Charles I., at war with the Parliament, was engaged in civil strife, in which Tamworth again played an active part, and the Castle was occupied by the King's party, who also under Sir Richard Dyot were defending Lichfield Cathedral, a strong fortification, from the Parliamentarians under Lord Brook, who was killed by a bullet from the tower of the Cathedral while directing the siege, the spot being now marked by a brass plate and inscription; the Lichfield Royalists were, however, defeated, and the Republicans for some time, although in possession of the Close, were much annoyed by the garrison at Tamworth Eventually the Castle was, after two days' siege and a stout resistance, captured by Colonel Purefoy, and the command of it given by the Parliamentarians to Captain Waldive Willington.

Meanwhile the Royalists recovered Lichfield, and the two towns continued in a state of hostility until the Lichfield Royalists had again to capitulate, and Tamworth, having no longer any adversaries to contend with, assumed its usual peaceable condition, and henceforth all interest centred in the town is of a political and commercial character.

During the decade terminating with 1671 several tokens were struck and issued by tradesmen in the town.

Tamworth had been disfranchised by Cromwell, but recovered its political privileges in 1660, sending two members to the Rump Parliament, and this it has continued to do ever since.

From this point the only events worth comment are the introduction of Canals in 1788, of Gas in 1835, and Railways in 1839, together with the Queen's visit to Drayton Manor, the seat of the then Premier, Sir Robert Peel, in 1843.

I must apologise to the lovers of pure Natural History for not dealing with the birds, beasts, and plants, of the locality, and to the students of Geology for neglecting their especial branch; but I may tell the latter that the district is divided by a notable fault running north and south from Dosthill, that the Hartshill excursion will be on the coal measures and Cambrians, whilst the one to Lichfield will be over the Triassics.

Thanking you for the attention you have given to what I am perfectly conscious is a very feeble effort, I shall conclude this perhaps too tedious summary of Tamworth's history in which I have endeavoured chiefly to interest you in those points which will come under your notice during the excursions or at the conversazione, by quoting the poetical prediction, that :—

"When in its banks no longer flows
The Anker's clear and sparkling stream;
And Tame withholds its gentle course,
Thy memory Tamworth, as a dream
Shall, by tradition's voice alone
Then be told—
Thy place forgotten, but as one
Once of old."

Mr. Hamel exhibited a most elaborate map of the localities referred to in his address. A reproduction of this map on a reduced scale is presented with the present number of the "Midland Naturalist."

MARINE ZOOLOGY AT OBAN.

By W. R. Hughes, F.L.S.

The Sixth Marine Excursion of the Birmingham Natural History and Microscopical Society, and the second to Oban, in the Western Highlands of Scotland, extended from 30th June to 10th July last, and proved quite equal to its predecessors both in interest and result. Twenty-three ladies and gentlemen took part in the Excursion, and good quarters were secured at the Great Western Hotel at Oban. The weather was very fine, and the time was devoted to dredging in the quiet lochs and bays in the vicinity, and to land excursions for exploring the botany and geology and the unrivalled scenery of the district. For the dredging party an excellent and commodious screw steam yacht, the "Aërolite," of about sixty tons, was chartered from Messrs. Ross and Marshall, of Greenock. Mr. Ross personally undertook the management of the vessel, and by his obliging and hearty co-operation, and by the willingness of his crew, added much to the success of the Excursion.

Steam gear was for the first time made available for hauling in the dredges, trawls, and other instruments, and proved most valuable. In addition, Mr. W. P. Marshall, M.I.C.E., had devised two special forms of apparatus termed respectively the "Harrow" and the "Plough." These and the other instruments were very ably constructed by Mr. A. W. Wills, of Park Mills, Nechells, Birmingham, a former President of the Society. A little messenger dredge, measuring only ten inches and worked by hand with a thin rope line, was extremely useful in ascertaining the nature of the ground.

The main object of this Excursion was to supplement the captures made during 1881 of the *Pennatulida* (Sea-pens, etc.), and to enable Professor Marshall, D.Sc., and Mr. W. P. Marshall (who, it will be remembered, obtained the Darwin Gold Medal of the Midland Union of Natural History Societies this year for researches on these organisms), to determine several interesting points in their life-history. The results proved equal to the appliances. Dredging and trawling were carried on at various depths from fifteen to one hundred fathoms, but generally at a depth of about thirty fathoms, and many most interesting and beautiful specimens were obtained. The "Harrow" is a very ingenious contrivance, consisting of a series of lines about a yard in length, armed with nearly a hundred fish-hooks (without barbs) and kept in position by short leaden rollers, the whole being attached to an axis and supported by two stout galvanised iron wheels. The "Plough" consists of an axis attached to two stout wheels, and carries a few strong curved iron bars terminating in spatula-shaped ends for digging into the bottom and uprooting certain organisms, the produce being carried into a bag-net dragged from the rear. Both instruments worked admirably. Many examples of *Funiculina* in several stages of growth, and also of *Pennatula*, were entangled by the hooks of the "Harrow." The *Pennatula* were also taken between the rollers—an unexpected piece of good fortune not contemplated. Notwithstanding every effort, however, a disappointment was sustained by the non-capture of *Virgularia*. This of course might be attributed to the "Aërolite" not having got on the right ground; but, on the contrary, the chart used by the Members, and which was enlarged from the Admiralty maps, was carefully studied, and every station marked on the previous occasion where it appeared was diligently searched. A much more likely explanation is suggested, viz.—that in this locality *Virgularia*—a slender and short form—cannot survive in the "struggle for existence" against its more robust and lengthy ally, *Funiculina*, which sometimes measures several feet in length, and from its habit must crowd the bed of the sea in certain parts like rushes in a bog. Local testimony seemed to favour the latter explanation, and to agree in opinion that *Virgularia* had generally become scarce. As a compensation, however, a number and variety of specimens of *Alcyoniidæ*, an allied family, were taken, not met with on the previous occasion. Fine examples of Sponges, Zoophytes, Echinoderms (including, it is believed, two species of *Antedon (Comatula)*, the rosy feather-star), Annelids, Tunicates, Mollusca, etc., were also secured. The last-named were not very numerous, and *Terebratula*, so plentiful on the previous occasion, was comparatively rare.

One of the most interesting specimens taken was an example of an interosculant form of sea-anemone—*Zoanthus Couchii*,* var. *liber* (Gosse). In the normal species, var. *linearis*, this curious Actinoid is attached to stones or old shells, such as *Cardium*, etc., by a narrow creeping band, in which are embedded grains of sand. From this band are sent up at intervals a number of small pale-brown polypes about ⅛th of an inch in diameter and thrice that height, having upwards of twenty long slender tentacles disposed in two rows round a central mouth. The creeping band is highly sensitive, and if touched by a sharp-pointed object the polypes nearest contract in succession. Another var., *diffusus*, has the creeping band spread over the whole surface of a shell—a *Natica*, for instance—as a carpet whence the polypes irregularly spring. In time the shell disappears, "and all that is left is the exact model of it in the sand-clothed membrane, or basal carpet of the polypite." † The variety *liber* has this distinction: it is quite free and unattached, the creeping band has assumed a cylinder shape and is cruciform, the cylinder measuring a little more than ⅛th of an inch in diameter, and the whole mass in length about an inch. From the four points of the cross are presented polypes not differing materially from the normal form. The sensitive character is maintained, and on one of the polypes being irritated the others sympathetically contract. Specimens

* The generic name is founded on ζῶον an animal, and ἄνθος a flower. The specific name is in honour of the distinguished Cornish naturalist, Jonathan Couch.

† "Actinologia Britannica," 1860, by P. H. Gosse, F.R.S., p. 299.

of this Zoophyte were obtained by the late Mr. Barlee, from Shetland, but in no case did the number of polypes in the unattached condition exceed three.

The late Mr. Jonathan Alder remarked on the varying conditions of *Zoanthus* as follows:—"I have come to the conclusion that when the Zoophyte has free space on the stone it runs over it as *Zoanthus*, but when the base is confined to a shell it spreads into a uniform crust as *Palythoa*. The loose branched specimens, I conclude, having affixed themselves to some minute object not affording a proper base of attachment, take a tubular form until they terminate in polypes."* If the foregoing be the explanation of the circumstances under which *Zoanthus* survives it furnishes a very interesting illustration of "the adaptation of the organism to the environment."

A curious case of cannibalism was noticed in *Solaster papposa*, the common sun-star. A specimen was taken measuring about nine inches across. Within its mouth, and partly digested, was one of the same species, measuring about three inches across. Several of the rays which had not been engulphed appeared fresh in colour and healthy.

During the days and in the evenings the living objects taken were exhibited and described to the Members. Phosphorescence was observed not only in *Pennatula*, but for the first time in *Funiculina*, the characteristic light coruscating over the whole series of polypes, and forming a very beautiful sight.

Upwards of sixty hauls of the dredge, trawl, harrow, and plough were made, and accurate observations of the locality, depth, and temperature were recorded, together with lists of the animals captured by Mr. John F. Goode, hon. sec. of the Biological Section, who again rendered good service as "log-keeper." It was noteworthy that most of the hauls came from a muddy bottom, the mud seeming much more abundant than on the previous occasion. Specimens of the bottom were taken by Mr. J. F. Goode in many instances, to be hereafter searched for *Foraminifera*, etc. Miss Osler also rendered good service by taking water-colour drawings, from the life, of several interesting animals brought up by the dredge.

A preliminary report of the dredgings was made at the Microscopical Meeting of the Society held on Tuesday, 17th July last, by Mr. J. F. Goode, by the writer, as Chairman of the Excursion (who exhibited in their native element some of the living specimens captured), and by Mr. Marshall. During the excursion Mr. G. W. Tait, M.R.C.S., tried some important experiments on the various kinds of preserving fluids used for the immersion of the specimens. Fuller general reports will be presented hereafter when time has been allowed for the examination of the collections. An interesting collection of botanical specimens was obtained by Mr. John Morley, the hon. sec., and other members, including fifty species of plants gathered in flower during a walk on Sunday, the 1st of July, and the following is a list of the rarer ones:— *Geum rivale*, *Anthyllis vulneraria*, *Orchis latifolia*, *Gymnadenia Conopsea*,

* "Act. Brit.," p. 300.

G. albida, *Orchis incarnata*, *Habenaria bifolia*, *Cardamine impatiens*, *Glaux maritima*, *Hippuris vulgaris*, *Saxifraga aizoides*, *S. hypnoides*, *Sedum Anglicum*, *Geranium Robertianum* (white), *G. sylvaticum*, *Honckeneya peploides*, *Aster Tripolium*. Mr. Thomas Hooper made a collection of specimens of the rocks of Oban, and the neighbouring places visited, including Staffa, Iona, Mull, Glencoe, Easdale, etc., which will be reported upon by the Geological Section. Altogether the Excursion was most successful, and the best thanks of the members were given to Mr. Morley, the hon. sec., for his untiring exertions, and for the very excellent arrangements which he made for the comfort and convenience of the members.

HOLES IN THE SAND.

BY FREDERICK ENOCK.

During the latter part of May I had the opportunity of observing the strange larva of the Tiger Beetle (*Cicindela campestris*), which abounds on the commons about here, but being a "common thing" it is very often passed over, I think from the fact of its being far sharper than a good many entomologists, who are content with seeing a round hole in the sand, but don't care to examine whether there is an owner or not. I was passing along one of the numerous rough roads, cutting across a common, where there was a slight perpendicular sand-bank on the left side, full of very round holes of about ¼in. diam., when suddenly another lot of holes seemed to appear in a moment. I passed on thinking, then quietly returned in about five minutes, and again holes appeared. I was much puzzled, so stood at a respectful distance round a corner, and, having the holes in view, presently I saw something move in one of the holes, but as it was of the exact colour of the sand I could not make it out; it continued moving until it was just level with the face of the bank; others followed in the other holes, and now I drew out my long trowel, and noting the exact position of one hole, I "sneaked" out from my corner, and making a rapid lunge, I plunged my trowel in some four inches from the hole, at an angle of 45°, endeavouring to cut off the backward movement of the occupant, and on removing the sand I found that I had done so; but only just, for so quickly did the larva shoot back, that it came into collision with the point of my moving trowel, and so lost part of its tail! But now having found one, I soon dug out a number by simply following the bore down, generally about seven inches, though often I had to dig ten inches before I came upon the savage larva, gnashing its jaws at any and every thing.

I took several home to examine, thinking it one of the strangest things I had yet seen, and, on further acquaintance with it, it certainly is a most extraordinary creature, and though so strangely and, at first sight, apparently so awkwardly made, *every* part is so marvellously formed for the purpose intended that we cannot fail to admire it.

When full grown and stretched out it is $\frac{3}{4}$-inch long, with a broad, flat, black head $\frac{5}{32}$in. wide at the back, having very powerful mandibles, curved upwards and inwards; the body is white, tinged with brown on the back of the second, third, and fourth segments, the skin on this part being very hard; the rest of the body is very delicate and easily torn; the back of the ninth segment is swollen up into a hump, bending slightly back, surmounted by two peculiarly curved hooks, about $\frac{3}{64}$in. long, bending towards each other at the middle, and out again at the tips which point towards the head, which is "set on" at a right angle to the body, the mandibles also rising from the head at almost a right angle, but curved over and in, not unlike the horns of some cows. The head is flattened out into a hard plate, the purpose of which is apparent almost directly the larva is placed in a pot of fresh sand. When after surveying the surface, and snapping at imaginary foes, it places its feet firmly in the sand, and commences to excavate with its strong mandibles, first taking a good bite, it turns the sand over on to the flat head, and when loaded, withdraws from the hole, and the mandibles being placed at right angles to the head, prevent the sand from slipping off. On reaching the surface it shoots its load to one side, then proceeds to deepen the hole, generally bringing up a load of sand at every quarter of an inch additional depth. When it has bored to nearly its own length it retains its hold at the top by its anus, but when a greater depth has been reached the wonderful hooks on the back of the ninth segment come into play, and now we see why they point towards the head; for besides being used for holding on to the sides whilst excavating, they enable the creature to lever itself up *backwards* with its load of sand, for we must remember that beetles have but three pairs of legs, a pair on the second, third, and fourth segments, and which are in this case comparatively useless in assisting it in its arduous excavations. When it has bored some two inches deep it turns in its hole and has a rest, but in a strange zigzag position; the broad flat head is brought up just to the top of the hole, and, as might be imagined, begrimed with sand, making it the exact colour of the bank, so that anyone watching quietly would have great difficulty in detecting anything, until by a sudden movement the larva collapses, and falls to the bottom of its hole like a shot. When the head is placed in position the body is bent at the fifth segment, the sixth to ninth segments are drawn up, the ninth with the hooks on resting just below the plate on the head, the remaining four segments bent down again, thus the whole larva when in position resembles the letter N; here it remains perfectly still, until some innocent ant walks upon the sand-begrimed head, and in an instant the head is thrown *back*, just in the same manner as a gymnast about to turn a "flip-back," the powerful mandibles completely enclosing the unfortunate ant, who finds herself suddenly seized from above, and as quickly hurled into darkness below by this terrible "tiger." After a meal the larva generally proceeds to deepen his hole, has another rest, and—if he can get it—another meal, and so he goes on until seven or ten inches is reached, and there, after slaying numberless ants, etc., he changes to a pupa. The beautiful bejewelled Tiger-beetle emerges in June and July provided with terrible jaws and a most pleasant perfume, which exudes when the creature is handled.

I have found four and five holes in a circle of three inches' diameter, the bores running parallel to each other; but should a larva attempt to enter the home of its neighbour, there is a fight immediately. The owner has the best of it, and with a grin (if they do laugh) makes a meal of the intruder. Anyone desirous of studying this most interesting creature will be well repaid the little trouble in the first search, and find that there is a vast amount of knowledge to be obtained by carefully thinking over "the why and the wherefore" of such apparently insignificant things as "holes in the sand."

I might just mention that since I captured *Atypus Sulzeri* (Trap-door Spider) here, I have found another large colony, by observing which I have proved beyond doubt two most important and hitherto unrecorded "links" in the economy of this Spider.

THE FLORA OF WARWICKSHIRE.

AN ACCOUNT OF THE FLOWERING PLANTS AND FERNS OF THE COUNTY OF WARWICK.

BY JAMES E. BAGNALL.

(Continued from page 138.)

COMPOSITÆ (*continued*).

LACTUCA.

L. virosa, *Linn.* *Strong-scented Lettuce.*

Native: On banks. Very rare. July, August.

I. Roadsides, Stonebridge, *Bree*, *Purt.*, ii., 372; Maxtoke, *Blox.*

II. Railway near Willenhall, *Kirk.;* Chesterton! Burton Dassett, *H. B.;* between Dunchurch and Willoughby, *Blox.*, *MS.*, *N. B. G.*

This plant has not been known to occur in any of the abovenamed stations recently.

L. muralis, *Fresen.* (*Prenanthes muralis. Purt.*). *Wall Lettuce.*

Native: In woods, and on banks and walls. Local. July, August.

I. Sutton Park; Middleton; Merivale; Hartshill; Arley; Maxtoke; Stonebridge; Packwood; Solihull, etc.

II. Between Middle-town and Sambourne; between Washford and Mapleborough Green, *Purt.*, ii., 376; Mellos Lane and Vineyard Lane, Warwick, *Perry Fl.*, 65; Allesley! Meriden! *Bree*, *N. B. G.;* Kenilworth; Woodloes; Rowington! *H. B.;* Salford! *Rev. J. C.;* near Frankton Wood! *R. S. R.;* Chadshunt; Edgehill! *Bolton King;* Alveston Pastures; banks near Preston Bagot.

SONCHUS.

S. oleraceus, *Linn.* *Smooth Sow-thistle.*

Native: On banks, by waysides, in cultivated land, &c. Common. May to September. Area general.

S. asper, *Hoffm.* *Rough Sow-thistle.*
Native: On banks, by waysides, and in cultivated lands. Common. May to September. Area general.

S. arvensis, *Linn.* *Corn Sow-thistle.*
Native: In cultivated fields and by waysides. Frequent. July to September. Area general.

CREPIS.

[**C. setosa,** *Hall fil.* *Bristly Hawksbeard.*
Casual: In cultivated land. Rare. August.
II. Clover field, Woodloes, Warwick; corn fields, Myton, Warwick! *H. B.*
A weed of uncertain appearance, brought with corn seeds.]

C. virens, *Linn.* *Smooth Hawksbeard.*
Native: On banks, waysides, in pastures, &c. Common. June to October. Area general.
Both the large and small varieties are abundant, and are possibly merely states of a variable species.

C. biennis, *Linn.* *Large Rough Hawksbeard.*
Colonist: In corn fields and on banks. Very rare. June, July.
II. Hill Wootton, on railway bank, *H. B.;* corn field near Binton Bridges.
The large form of *C. virens* is liable to be mistaken for this plant.

C. paludosa, *Moench.* *Marsh Hawksbeard.*
Native: In marshy woods. Very rare. July.
I. Sutton Park.
Abundant here when I first found it in 1866, but very thinly scattered in 1882.

HIERACIUM.

H. Pilosella, *Linn.* *Mouse-ear Hawkweed.*
Native: On banks, waysides, and heath lands. Common. May to July. Area general.

H. murorum, *Linn.* *Wall Hawkweed. Golden Lungwort.*
Native: On banks and in woods. Very rare. July.
II. "On the bank by the side of the turnpike-road at Marsom's Gate (Dunnington); Oversley Wood," etc., *Purt.*, ii., 369.
I have carefully searched Oversley Wood for three seasons without being able to find a trace of this plant. A form of *H. vulgatum* occurs there which might have been mistaken for this plant. Purton does not mention *H. vulgatum.*

H. vulgatum, *Fries.* *Wood Hawkweed.*
Native: In wood and on banks, and wall tops. Locally common. June to August.
I. Sutton Park; Middleton Heath; Marston Green; lanes about Solihull, Shirley, &c.
II. On walls near the Charter House, near Coventry; on walls and banks at Arbury Hall! sparingly on banks, Berkswell! Keresley, *T. Kirk*, *Phyt.*, ii., 971; walls in Warwick! *Perry*, 1817; on Rugby and Dunchurch Road near the toll gate! *Blox.*, *N.B.G.*
II. *H. sylvaticum, c. pictum;* plantations, etc., near Arbury Hall, *T. K. Phyt.*, ii., 971. "I have received it from Arbury Hall, collected by Mr. Kirk"; *Syme's E. B.*, ed. 3, vol. v.
H. maculatum, Sm.
Hill Wootton railway bank, *H. B.*, *Herb. Brit. Mus.;* near Arbury Hall, *T. Kirk*, *Herb. Brit. Mus.;* old walls, Warwick.
This seems to be the plant recorded by Kirk in "The Phytologist" under the name *H. vulgatum*, var. *pictum.*

H. tridentatum, *Fries.*
Native: In quarries and on ruins. Rare. July.
I. What I take to be this occurred on the Abbey ruins at Nuneaton, and in stone quarries, Hartshill; Warwick, specimen, *Blox.*, *Top. Bot.*

H. umbellatum, *Linn.* *Narrow-leaved Hawkbit.*
Native: On dry banks and heath lands. Local. July to August or later.
I. Coleshill Heath! *Bree, Mag. Nat. Hist.*, iii., 165; bog at Coleshill Pool! *Bree, Purt.*, iii., 375; Hams Hall, *W. B. Grove;* Sutton Park; Middleton Heath; lanes about Walmley; lanes near Solihull.
II. On the walls at Warwick Castle! *Purt.*, ii., 369; St. Mary's churchyard wall, and castle wall in Vineyard Lane, Warwick! *Perry*, 1817; on the Rugby and Dunchurch Road, near the Tollgate! *Blox.*, *N. B. G.*, plentiful here in 1880; Hill Morton Road, Rugby, *Blox.*, *M.S.;* Harbury Heath.

H. boreale, *Fries.* *Broad-leaved Hawkweed.*
Native: In woods, on heaths and banks. Locally common. August to October.
I. Bordesley Green, *Ick. Anal.;* Sutton Park; Middleton; Marston Green; Hartshill; lanes about Knowle and Solihull; Hampton-in-Arden, etc.
II. (*H. sabaudum*, Purt.) Oversley! and Ragley Woods! *Purt.*, ii., 368; Hatton Wood; Beausale, *Perry*, 1817; near Rugby, *L. Cummin;* Stoke Heath; on Stair bridge, *Kirk. Phyt.*, ii.. 970; near Dunchurch Toll Barr, *H. W. T.*

[*H. villosum.* Allesley walls. *T. Kirk. Herb. Perry.*]
[*H. aurantiacum.* Old wall near Coventry station, *H.B.*]. These plants are recorded because they are represented in *Perry's Herbarium*, they are merely stragglers, or possibly misnamed.
[*Xanthium spinosum*, Linn. Occurs year after year in the skin yards at Kenilworth, but is merely a casual incidental to such places.

CAMPANULACEÆ.

JASIONE.

J. montana, *Linn.* *Sheep's-bit.*
Native: On heaths and heathy waysides. Rather rare. June to August, or later.
I. Near Sutton Woods, *Ick Anal.;* near Sutton, *Freeman, Phyt.*, i., 262; railway embankment Sutton Park, 1880; Middleton Heath.
II. On the Hillmorton Road, near Rugby, *Blox. MSS.;* Kenilworth, *Y. and B.;* near Leamington, *Herb. Perry.*

PHYTEUMA.

[*P. spicatum*, Linn. *Spiked Rampion.*
Casual: In woods? Very rare.
II. Hill Wootton, *Herb. Brit. Mus.* "One plant of it found in Warwickshire in 1865;" *Comp. Cyb. Brit.*, page 536.
[*P. nigrum*, Schmidt. "On an old bank between Leek Wootton and Ashow, May, 1863;" *Thomas Cox, Herb. Bab.*]
In both instances mere casuals or escapes from gardens.

CAMPANULA.

C. glomerata, *Linn.* *Clustered Bell-flower.*
Native: In woods and on banks in calcareous soils. Local and rare. July, August.

II. Above Roll's Wood on the side of the road to Grafton, *Purt.*, i., 120; Chesterton; Moreton Morrell, *Y. and B.;* Wellesbourne Hastings; Lighthorne Rough, *Bolton King;* Brandon; Binton, near the church; near Rose Hall, Oversley; plentiful in Drayton Bushes.

C. Trachelium, *Linn.* *Nettle-leaved Bell-flower.*

Native: In woods and thickets, and on banks. Very local. July, August.

I. Between Ansley and Over Whitacre; railway bank near Water Orton; lanes near Minworth; near Hoare Park.

II. Stoneleigh; Pillerton; aqueduct near Leamington, *Perry*, 1817; Chesterton, Ufton, *Y. and B.;* Chesterton Wood! *Bolton King;* Lighthorne Rough; bridle road from Billesley to Wilmcote; Oversley Hill (var. *alba*)*;* banks of the river Alne, near Crab Mill.

C. latifolia, *Linn.* *Broad-leaved Bell-flower.*

Native: In woods, hedges, and banks. Very local. July, August.

I. Near Packington, *Aylesford*, *B. G.*, 634; Old Chester Road, near Tyburn; between Ansley and Over Whitacre; osier plantation near Solihull; banks of the Blythe, Righton End.

II. Banks of the River Arrow, the Alne! &c., *Purt.*, i., 118; var. *flore albo*, Allesley, *Bree*, *Purt.*, iii., 341; plantations at Coton House, by the side of the Lutterworth Road, *Blox* , *N.B.G.S.;* river bank between Honington and Tredington, *F. Townsend;* Combe Woods, 1881.

[*C. rapunculus*, Linn. *Coventry Bells.* *Rampion Bell-flower.*

Denizen: by waysides and in old gardens. Rare. July, August.

II. "Near Guy's Cliff, and near Gaveston's monument on the Blacklow Hill," *Perry*, 1817! "Not very uncommon in old gardens, &c.; abundant in the pleasure grounds, Arbury Hall!" *T. Kirk*, *Phyt.*, ii., 970. "Rare, possibly not indigenous, though perfectly established in Warwickshire," *Syme*, *E. B.*, ed. 3, vi., 15.]

"*Viola marianus.* *Coventry Bells.* They grow in woods, mountains, and dark valleys, and under hedges among the bushes about Coventry, where they are very plentiful abroad in the fields, and are there called Coventry Bells."—*Gerard Em.*, p. 448.

"The Coventry Bells doe not grow wilde in any of the parts about Coventry, as I am credibly informed by a faithful apothecary dwelling there, called Master Brian Bull, but are nursed in the gardens with them as they are in other places."—*Parkinson Paradisus Terrestris*, 357.

C. rotundifolia, *Linn.* *Harebell.*

Native: In woods, on banks, heath lands, &c. Very common. July to October. Area general.

C. patula, *Linn.* *Spreading or Field Bell-flower.*

Native: In woods, on banks, field borders, and hedges. Local. July, August.

I. Near Meriden! and Coleshill! *Aylesford*; on the roadside in a wet lane called Water Orton, *Withering;* in a hedge in a small village called Wells Green, about three miles from Birmingham, on the high road from Coventry! *Cullum*, *B. G.*, 633-4; near Hoare Park; lane near Balsall Street; Slowley Hill; Arley.

II. On the side of Oversley Hill! Spernall Park, *Purt.*, i., 119; Guy's Cliff, *Perry*, 1817; borders of Hatton Wood, *Perry*, *Fl.*, 19; by Lord Craven's Wood! Brinklow Road, *Blox.*, *N. B. G. S.*; near Artley; near Fir Tree Grove, Arbury Hall; Willenhall Lane, *T. Kirk*, *Phyt.*, ii., 970; Ipsley! *J. T. Slatter.*

[*C. rapunculoides.* On roadsides near Ragley, *Herb. Perry*; is merely a straggler from cultivation.]

(To be continued.)

Correspondence.

New Methods of Mounting for the Microscope.—Many of the readers of the "Midland Naturalist" will learn with pleasure that there is such a ready way of mounting vegetable preparations as that mentioned by Mr. Bagnall in the July number, as the invention of Professor Hillhouse of the Mason College. The process is very simple, and the medium excellent; but from practical experience I would suggest the sealing of the cover-glass with pale copal varnish, instead of dilute balsam; it can be obtained of as light a colour, is much tougher, and not likely to get so brittle as that medium. As regards the newness of the invention, I can only say I have preparations by me that have been put up in this way for seven years or more, and several of my friends have used it as long a time, preferring it to glycerine jelly, as it does not show such a disposition to leak. Practical microscopists will, however, be glad to learn that after this space of time the objects show no signs of deterioration, but rather wear an improved appearance.—The process introduced by Mr. Thomas Clarke would doubtless prove useful if he would give us the name of the particular cement used to close the cell.—J. W. Neville, Wellington Road, Handsworth.

Leafing of Oak and Ash.—During the second and third weeks of May last, many hundreds of these trees were observed in S. Beds. and N. Herts. The Oaks, on the whole, were decidedly before the Ash trees. Many of the former were fairly into leaf before any of the latter began to unfold. This season, however, the differences were not so marked as they have been for several years past. In some instances the most backward of the Oak trees were scarcely so advanced as the most forward of the Ash trees. These differences were easily accounted for by constitutional variation and dissimilarity of position. Oak trees growing in places with an unfavourable aspect would compare disadvantageously with Ash trees in favourable situations. But wherever the two grew in company, the oaks were invariably in advance of the Ash. As this is now the fourth season in succession in which these trees have expanded their foliage in the same relation to each other, one begins to surmise that the old adage may be based upon limited observations, and without taking into account constitutional differences and dissimilarity of localities.—J. Saunders.

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—Geological Section, June 26th.—The following exhibits were made:—Mr. J. E. Bagnall: *Avena pratensis*, *Kœhleria cristata*, *Brachypodium* ~~*cristatum*~~, and *Potamogeton flabellatus*, all rare plants from a new district; *Bromus racemosus*, *Galium tricorne*, and other rare plants from Binton and Bardon Hill; *Œnanthe*

× B pinnatum

crocata and *Thalictrum flavum*, from a new locality; and *Matricaria chamomilla*, from Middleton. Also, for Mr. Sylvanus Wilkins: *Glaucium luteum*, *Ophrys apifera*, *Ranunculus parviflorus*, and a fasciated stem of *Asparagus hortensis* from Lyme Regis. Mr. W. J. Harrison: Rock specimens from Sweden, China, and Charnwood Forest. Mr. W. B. Grove, B.A.: *Sanguisorba officinalis*, *Chelidonium majus*, *Chenopodium Bonus-Henricus*, *Stellaria aquatica*, *Sphæria aquila*, *Uredo miniata* and *Xenodochus carbonarius*, *Puccinia compositarum*, *Ræstelia lacerata*, *Dendryphium comosum*, *Septonema elongatispora*, *Phyllosticta vulgaris* var. *Loniceræ*, all from Water Orton; and on behalf of Mr. Oliver: *Acorus calamus* or Sweet Sedge, from the River Blackwater. Mr. C. A. Matley: Quartzite Pebbles, from Castle Bromwich, containing species of *Phacops*, *Lingula*, *Orthis*, and *Riberia*. Professor C. Lapworth, F.G.S., then gave a very interesting and lucid lecture on Scotch Geology, principally with regard to the rocks in the neighbourhood of Oban, which the Society will shortly visit. He first described the igneous rocks of the Island of Mull, which, with Ben More, formed a lofty volcano in the Miocene epoch. He said that probably during that period a vast volcanic range ran from Iceland down to the South Pole, including, among other peaks and districts of eruption, Hecla, Skye, Mull, Staffa, north of Ireland, some ranges in Spain, Teneriffe, Ascension, and St. Helena. He next described the characters of the Old Red Sandstone, which stretches in a homogeneous mass over a great part of Scotland, and showed that the granite bosses which are found projecting from it are probably nuclei of ancient volcanoes. Finally, he referred to the dispute now raging with regard to the rocks in the Highlands, where metamorphic rocks appear to overlie Silurian limestones, which arrangement, however, as he stated, is probably due to an overlap. The lecture was illustrated by numerous diagrams, and was followed by an animated discussion, in which Messrs. W. J. Harrison, T. H. Waller, and W. R. Hughes took part. GENERAL MEETING, July 3rd.—Mr. E. Wagstaff exhibited *Physarum cinereum*, from a poplar tree at Edgbaston, and *Nassula ambigua*, from near Smethwick. Mr. W. B. Grove exhibited (on behalf of Mr. Morley) a twin flower-stem of *Inula glandulosa*, which was a case of simple fasciation, being the result of the equal and parallel growth of two flower-buds where only one is usually produced. Also (on behalf of Mr. T. Bolton) a spirally-twisted stem of Sweet William, which was not a case of fasciation, being apparently produced by the unequal growth of the two sides of the stem, owing to the action of some check, such as frost or insect perforation, on the one side; in this instance the leaves and flower-stalks were arranged in a single, continuous spiral line, the stem being inflated, hollow, and transversely undulated. Also a stem of Bryony (*Tamus*) from Penns, which was a case of combined fasciation and spiral contortion; in this case one of the two adjacent buds had grown faster than the other, and thus produced the twist. Also three fungi from Clent:—*Ag. præcox*, *A. campanulatus*, and *A. radicatus*. Mr. J. E. Bagnall exhibited: *Ceratophyllum submersum*, *Acorus calamus*, *Carex pseudo-cyperus*, *Agrostis canina*, *Salix alba* var. *cærulea*, *S. pentandra*, *Carex acuta*, from Henfield and Temple Balsall, *Nitella opaca*, *Carex elongata*, *Genista tinctoria*, *Helosciadium inundatum*, *Scirpus acicularis*, from Earlswood; *Scirpus Tabernæmontani*, *Carex distans*, *Cortinarius cinnamomeus*, from Itchington; *Rosa gallicoides*, *Bromus erectus* var. *villosus*, from Chesterton; *Prunus cerasus*, from Oakley; and (on behalf of Mr. S. Wilkins) *Orobanche rapum*, and *Orchis pyramidalis*, from Dorset. BIOLOGICAL SECTION, July 10.—Mr. W. B. Grove exhibited a piece of oak branch impregnated with the mycelium of *Helotium æruginosum*, forming the "green oak" used in the Tunbridge ware, from Crackley Wood, Kenilworth. Mr. W. H. Wilkinson exhibited a number of foliaceous roses, where the ordinarily pink petals were of a green colour;* also a Canterbury Bell, in which the sepals were enlarged and of the same blue colour as the corolla; also a fine compound raceme of *Francoa ramosa*, from Chili, the rachis of which was over three feet long. Mr. E. H. Wagstaff exhibited *Triarthra longiseta* from near Quinton. GENERAL MEETING, July 17.—Mr. Bagnall exhibited *Helosciadium inundatum* and *Nardus stricta*, both rather rare; *Carex axillaris*, from the only Warwick-

South

* Exactly the ordinary leaf, i.e. with midrib & serrated margin.

shire locality; *Rosa bibracteata*, rare; *Equisetum maximum*, rare; and other plants from Warwickshire localities; also two local mosses, *Fontinalis antipyretica* and *Bartramia fontana;* and on behalf of Mr. S. Wilkins, *Trifolium striatum* and *T. subterraneum*, from Lyme Regis. Mr. W. B. Grove exhibited a fungus, *Uromyces Dactylidis*, from Harborne, new to this district, the presence of which he had anticipated from theory before it was actually discovered. Mr. J. F. Goode gave an account of the visit of the recent party to Oban, and the progress of the dredging operations there, together with a general account of the animals captured. Mr. W. R. Hughes followed with a particular description of some of the organisms, especially of four which he had preserved with great trouble and then exhibited alive to the meeting. These were *Zoanthus Couchii* var. *liber*, *Sagartia viduata*, *Pennatula phosphorea*, and *Antedon* (*Comatula*) *rosaceus*. He gave a brief *resumé* of the life-history of the last, and showed how the last but one, "the phosphorescent Sea-pen," exhibited in the dark coruscating flashes of pale blue light on gentle irritation. He also exhibited, on behalf of Miss Osler, drawings of these species and of a Sabella, made from the life, at Oban. Mr. W. P. Marshall then described the successful way in which the new apparatus that he had devised for the dredging had acted. These consisted of a "harrow," covered with triplets of hooks, in which the specimens were entangled, and a "plough," which was designed especially for bringing up Virgularia whole and unbroken, which has never yet been done by an ordinary dredge. The latter, however, failed because the party did not chance on any Virgularia, but its efficiency was proved by the multitudes of Funiculina and Pennatula which it brought up in perfect condition, as contrasted with the few which had been obtained at the former visit to Oban, two years ago. Mr. Marshall also described the new method which was adopted for raising the dredge over the side of the vessel by means of a swinging gaff attached to the mast. The expedition was especially successful in its main object—namely, to supplement the specimens previously dredged at Oban by others in a more perfect state of preservation, which was effected by putting them into mixtures of glycerine and spirit immediately after their capture. SOCIOLOGICAL SECTION.—Two meetings were held on July 12th and 19th, at the Mason College—the President, Mr. W. R. Hughes, F.L.S., in the chair. There was a large attendance on both occasions. Chapters iii. and iv. of Mr. Herbert Spencer's "Essay on Education" were discussed.

BIRMINGHAM MICROSCOPISTS' AND NATURALISTS' UNION.—Monday, June 4th.—Mr. Deakin showed Æcidium, on leaves of Pilewort; Mr. Hawkes, Cardinal Beetle and larva of Dytiscus; Mr. Darley, small Copper and Green hair streaked butterflies. June 18th.—Mr. Betteridge, young and nest of Nightingale; Mr. Deakin, *Bythinia Leachii*, from Kent; Mr. J. W. Neville, microscopic section of leaf of *Ranunculus repens*, showing Æcidium *in situ*. Mr. Hawkes read a paper entitled, "Botany of bygone Times." June 25th.—SPECIAL CONCHOLOGY.—Shells, common in the district, were shown by various members. Mr. Boland showed a collection of new-named varieties of *Helix virgata* and *Bulimus acutus;* Mr. Betteridge, a collection of district summer birds. Monday, July 2nd.—Mr. Delicate, eggs of *Helix nemoralis;* Mr. J. W. Neville, a piece of so-called worm-eaten glass, taken from an old Warwickshire Church; Mr. Hawkes, district plants; Mr. Tyler, *Melicerta ringens*. July 9th.—Mr. Hawkes showed a specimen of *Modiola tulipa*; Mr. Tyler, microscopic section of spine of Cidaris; Mr. J. Wykes, Spirogyra in conjugation A geological paper was read by Mr. H. Insley, entitled, "How to work in the field."

Exchange.

THE "CHAIN BRAND," *Xenodochus carbonarius* and *Uredo miniata*, sent to anyone interested on receipt of a stamped envelope. This rare fungus makes a beautiful microscopic object.—W.B. GROVE, 269, St. Vincent Street, Birmingham.

THE RHÆTIC ROCKS OF NOTTINGHAMSHIRE.*

BY E. WILSON, F.G.S.

It is now more than twenty years since the term "Rhætic" was applied in this country by the late Mr. Charles Moore to a peculiar set of black and grey shales, sandstones, and impure limestones (first noticed in Britain by Strickland and Portlock) which occur immediately at the top of the Red Marls of the Keuper series, and at the base of the Lower Lias (zone of *Ammonites planorbis*). The term "Penarth Beds" was assigned to this group by Sir Roderick Murchison, on account of their being so typically developed in the cliffs between Penarth and Lavernock, near Cardiff, and Dr. Wright gave the name "*Avicula contorta*" zone to the same beds from the presence of a peculiar species of Avicula (*Cassianella contorta*). The term Rhætic, however, is the best, as expressive of the great development of these rocks in the Rhætian Alps bordering the northern plain of Lombardy, where, between Como and Lake Garda, they attain a thickness of from 3,000 to 4,000 feet, and occur as and constitute mountain ranges.

Many years previous to their discovery in this country—viz., by Von Buch in 1828, and Alberti in 1834—an extensive and widely spread series of rocks, rich in organic remains, of contemporaneous age with our "Penarth Beds," had been noticed and described on the continent of Europe. In England, as in the Northern latitudes of Europe (*e.g.*, Sweden, South Norway, the Islands of the Baltic, and also in Bohemia and Hungary) the Rhætic series is only known as a thin but representative zone, whereas in the South of Europe (France, Austria, Germany, and especially the Alps of Switzerland, Lombardy, and Savoy) it attains a great development, rich in organic remains, either molluscan or piscine, with occasionally plant remains, but everywhere containing the *Avicula contorta*, a shell which is cosmopolitan in the strictest sense.

The distribution of the Rhætic rocks over much of Europe is a very marked feature, both physically and palæontologically. It marks the close of the Triassic sandstones and marls almost everywhere, and commences and exhibits in Britain new conditions of life through a fauna (according to Etheridge) closely allied to, and perhaps migratory or descendant from the Middle Trias or Muschelkalk of Germany, and the Kossener and St. Cassian beds of Central Europe. The relationship of the British with the Continental deposits is fully established by certain mollusca which ranged through the Rhætic seas, and which, in Britain as in Lombardy, abound in the black shales, bone beds, and impure limestones of the group. In fact, in almost every essential feature the Rhætics of Britain agree with the Continental deposits, enabling us to co-ordinate through its fauna the entire series in this country with those of Europe.

* Read before the Nottingham Naturalists' Society, March 20th, 1883.

We cannot, however, affirm or believe that in England we possess even a *moderate* representative of the Mid-European Rhætic formation, for nowhere in Britain do the Rhætics exceed 100 feet in thickness (including the Tea-green marls at the base). In the Austrian Alps they are between 3,000 and 4,000 feet, and in the Rhætian Alps nearly the same, so that our most typical sections (long as the time may be they have taken to be deposited) are poor representatives of the spoils of that sea which occupied a large European area at a time between the close of the Trias and the commencement of the Jurassic epoch, thus linking together those two great formations.

Though we may justly regard the Triassic epoch over much of what was then Europe as a terrestrial one, and admit with Ramsay that the New Red sandstones and marls were accumulated in inland seas or salt lakes surrounded by masses of land, we must recognise the very marked and general change that commenced with the Rhætic stage, a change brought about by gradual depression of these lakes or lagoons into a sea; for the forms of the Rhætic are all marine; and in connection with this also we note the parallelism and conformity of the Rhætic with the marine Liassic deposits not only through England, but also over nearly all Western Europe.

The peculiar *facies* of the Mollusca of the British Rhætics attests their abnormal marine condition, and comparison with the fossil remains of the Italian and Austrian Rhætian beds shows the shallow, marginal, and brackish nature of the scanty British deposits, and the poverty of the species, besides the dwarfed and stunted aspect of the forms compared with those of the normal deposits of Lombardy. Thus also we can understand the small vertical development of the Rhætic strata in this country.

In Britain the Rhætic series, though so thin, forms a clearly defined and continuous line from Redcar and the bold headlands on the Yorkshire coast to the Cliffs of Dorsetshire, exhibiting to us on the way, those magnificent sections in the valley of the Severn at Watchet, Penarth, Westbury, and Aust Cliff, also at Axmouth on the English Channel, while the coasts of Londonderry and Antrim give unequivocal proofs of these rocks having once occupied an immense area now covered by the waters of the North Atlantic, or buried beneath the ancient lava flows and basaltic columns that form the coast line of the Great Causeway.*

Rhætic rocks were first noticed in the Nottinghamshire district about fifteen years ago by Mr. F. M. Burton, F.G.S., near Gainsborough,† just outside the county boundary, and were subsequently

* "The Rhætic or *Avicula contorta* beds at Garden Cliff, Westbury-on-Severn," by R. Etheridge, F.R.S.—Proc. Cotteswold Naturalists' Field Club, 1864. "On the Physical Structure and Organic Remains of the Penarth Beds of Penarth and Lavernock," by R. Etheridge, F.R.S.—Cardiff Naturalists' Society, 1871.

† "Q. J. G. S.," 1867, p. 315.

observed at Newark by the Rev. A. Irving,* and Mr. Horace Woodward,† and at Elton Station on the Nottingham and Grantham Line by Mr. R. Etheridge, F.R.S. All these sections, however, were more or less imperfect either above or below.

Seven or eight years ago, several new and some complete sections of the Rhætic rocks were exposed on the eastern and southern borders of Nottinghamshire, chiefly by new railway works. These sections, unfortunately, are now all covered up and grass-grown. As, however, they disclosed several interesting facts and some new features, a record of them seems desirable.

The Rhætic formation in this country is usually subdivided into three groups of rocks, viz.: (1) *Lower Rhætic:* grey or green indurated marls ("Tea-green marls" of Etheridge); (2) *Avicula contorta* series (black fissile shales, with thin seams of sandstone and limestone, with or without one or more bone beds); and (3) *Upper Rhætic* or *White Lias* (a variable series of shales and light-coloured limestones). This threefold division has generally been considered to hold good for Nottinghamshire. In this and the adjoining counties we get at the top (3) a series of pretty thickly laminated grey marls with bands, or layers of blue-centred nodules of limestone (containing *Estheria minuta*). Below these we have (2) the characteristic, black, thinly-laminated shales of the *Avicula contorta* series, and beneath these come (1) a series of indurated unfossiliferous light blue marls that weather a yellowish green, and break up into cuboidal fragments—for reasons presently to be given, I would take these "Tea-green marls" from the Rhætic and relegate them to the Keuper formation (see Fig. 1).

I now proceed to briefly describe the chief Rhætic sections that are or have been exposed in this district:—*Gainsborough:* In the cuttings of the Great Northern Railway, at Lea, near Gainsborough, Lincolnshire, the *Avicula contorta* beds represented by at least 25 feet of fossiliferous black shales, with several bands of micaceous sandstone and one or two "bone beds," may be seen resting with conformable stratification on "an eroded surface" of blue marl of the Upper Keuper series. The upper portion of the cutting is occupied by Glacial drift, which appears to cut out the higher beds of the Rhætics at this point. The Gainsborough section is remarkable for the exceptional development of the *Avicula contorta* beds, and for the numerous and thick bands of sandstone they contain. Its preservation as a section is, I understand, due to the benevolence of the Great Northern Railway Company, the cutting being left vertical and bare for some distance where the Rhætics outcrop, a favour for which all local geologists should be grateful. Mr. F. M. Burton, F.G.S., who accurately described this highly interesting section in the year 1867, then thought that the Rhætics were limited to a small area of three or four miles long, by a

* "Proceedings of the Geologists' Association," vol. iv.
† "Geological Magazine," October, 1874.

half to two miles wide. The idea of such a localised extension along the strike was certainly erroneous, and has since been abandoned. The Southerly continuation of these beds in Lincolnshire is indeed indicated by the low escarpment which lies not far from the eastern bank of the River Trent.

*Rhætic of Notts. Generalised Section.**

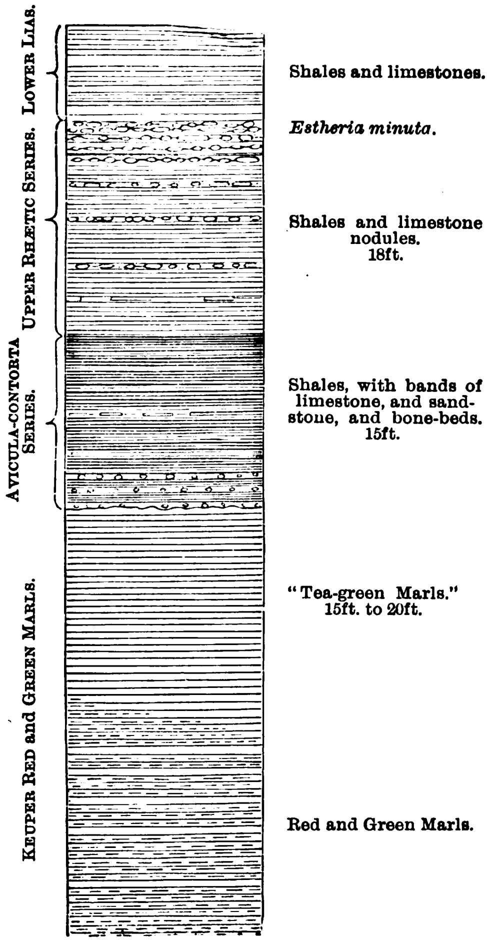


Fig. 1.

* NOTE.—This section is taken from the Quart. Journ. Geol. Soc. for 1882, vol. xxxviii., p. 451, and is printed by special permission of the Council of the Geological Society.

Newark. — Rhætic strata are exposed in the gypsum quarries on Beacon Hill, Newark. This section also is incomplete above. In the quarry face about 10 feet of black paper shales (with casts of *Cassianella contorta* and *Axinus elongatus*) without any bone bed are seen to rest *with a sharp line of demarcation* on fourteen or fifteen feet of light-green marls. These green marls appear to graduate down into the red and green gypsiferous marls of the Upper Keuper. Mr. Woodward, on having an old limepit in the Lias deepened, found the uppermost zone of the Rhætic series—viz., the White Lias—*in situ.*

The cuttings of the new Great Northern line between Newark and Bottesford, which roughly followed the Rhætic outcrop, exposed several interesting sections in these rocks.

Cotham and Kilvington.—In the long cutting at Cotham, four miles south of Newark, a complete section through the Rhætic rocks was exposed, showing at the south end the green marls of the Upper Keuper, succeeded—going north—by the *Avicula contorta* shales (fifteen feet) with *no* sandstone or bone bed, and hardly the trace of a fossil of any kind; and Upper Rhætic marls with limestone nodules (eighteen or nineteen feet); Lower Lias strata represented by 20 feet or so of limestones and shales of the zone of *Ammonites planorbis;** about a mile farther south Upper Rhætic marls were again seen capped by a few feet of Lias.

A little farther south, near Staunton Grange, the Rhætics were absent, being shut out by a fault which brought up Keuper red marls on the south against Lower Lias on the north. Still farther south, at the Kilvington Road crossing, the *Avicula contorta* shales reappeared, succeeded by Upper Rhætic marls and Lower Lias, dipping south-east towards Bottesford at a low angle. From a limestone nodule at the top of the Upper Rhætic marls or "White Lias" I here obtained the characteristic fresh water entomostracon *Estheria minuta* in vast numbers.

Orston Spa, near by, is a ferruginous spring, probably thrown out by a pyritic sandstone or "bone bed" in the paper shales. At *Elton Station* we may still discern Upper Rhætic marls succeeded by Lower Lias shales and limestones.

Barnstone. — At Barnstone, four miles south of Elton, a capital section in these beds was opened out during the construction of the line from Bingham to Stathern. Here Upper Keuper red gypsiferous marls with tea-green marls above were seen overlaid, with the usual sharp line of division, by fossiliferous *Avicula contorta* shales with a few thin bands of yellow sandstone and a hard pyritic "bone bed" near the base, replete with the usual remains, bones, teeth, fin spines, and coprolites of fishes and reptiles, amongst others *Ceratodus altus.* The *Avicula contorta* shales passed up into Upper Rhætic marls containing large limestone nodules, which became more numerous upwards, and these were conformably overlaid by a few feet of Lower Lias shales and limestones of the zone of *Ammonites planorbis.*

* The proportion of limestone to shale in this section was very large, 6 or 7 feet to 13 feet, which would probably make the working of these beds for hydraulic cement at this spot a profitable enterprise.

Between Barnstone, Elton, and Orston, the Lias-capped Rhætics form a low but very clearly-defined escarpment along the outcrop facing west, with a very palpable and regular dip-slope in the contrary direction towards the Vale of Belvoir. At the boring for coal now, or lately, in progress at Owthorpe, near Colston Bassett, beneath 33 feet of blue shale of uncertain geological age, fourteen feet of paper shales, and then nineteen feet of "tea-green marls" were penetrated.

Stanton-on-the-Wolds.—During the construction of the new Midland line from Nottingham to London, the following interesting section was exposed at the north end of the tunnel at Stanton-on-the-Wolds, between Nottingham and Melton Mowbray:—

SECTION AT STANTON-ON-THE-WOLDS.

	Ft.	in.		Ft.	in.
POST-TERTIARY.					
Boulder Clay with local intercalations of Drift sand	50	0	to	60	0
RHÆTIC "AVICULA CONTORTA" SHALES, 13FT.					
Shales, dark coloured, thickly laminated with a few thin seams of sandstone and a band of blue nodular limestone 1·9 from base: *Cassianella contorta*, *Axinus elongatus*, *Protocardium Philippianum*			..	6	0
Pyritic sandstone	0	0¼	to	0	2½
Shales, darker and more thinly laminated than overlying, with streaks of fine white sand: *Cassianella contorta*, *Axinus elongatus*, *Protocardium Philippianum*			..	3	0
Pyritic limestone with *Axinus elongatus*, *Modiola minima*, fish scales, sun cracks	0	0½	,,	0	1
Shales, black fissile, with thin streaks of fine grey sand	0	9	,,	0	10
Bone Bed, or coprolite seam, quartz pebbles and white sand: spines of Nemacanthus *filifer*, sp., and Hybodus, teeth and scales of *Saurichthys acuminatus*, *Hybodus minor*, *Hybodus reticulatus Hybodus* sp., *Acrodus minimus*, *Sargodon tomicus*, *Ceratodus altus*, *Gyrolepis tenuistriata Gyrolepis* sp., various Cestraciont palatal teeth, teeth of *Ichthyosaurus platyodon*, *Ichthyosaurus* sp., other reptilian and piscine teeth, vertebræ and other bones, and coprolites			..	0	1
Shales, black compact fissile, and earthy layers alternating			..	1	4
Coprolite seam, coprolites at wide intervals ..			..	0	1
Shales, black, with a few large reptilian bones			..	1	3
TEA-GREEN MARLS, UPPER KEUPER.					
Light blue marls, weathering yellowish green, and breaking up into cuboidal fragments; base not seen			..	20	0

The Upper Rhætic marls were not seen *in situ*, but limestone nodules with Estheriæ were found in the overlying drift.

Now, as I have already said, I cannot admit that the green marls which in this and the adjoining districts come below the *Avicula contorta* shales belong to the Rhætic series; for whilst there is always a sharp stratigraphical line of division, with, in some cases, evidences of erosion, between the green marls and the paper shales there is every appearance of a passage between these green marls and the underlying red and green marls of the Upper Keuper series. Again, whilst there does not appear to be any essential difference in textural character between the green marls which come at the top of the Keuper and those lower down in that series, there is a very decided textural distinction between the green marls and the overlying Rhætic shales; the Tea-green marls, like the rest of the Keuper rocks, are practically unfossiliferous, whereas, with the very commencement of the *Avicula contorta* beds we get the first clear evidence of the incoming of a decidedly marine fauna, including not only forms of life that characterise the Rhætic formation on the Continent, but also *species* of mollusca and reptiles which range into the overlying Lias. For these reasons, then, I am of opinion that in Nottinghamshire and the adjoining counties at any rate the line between the Rhætics and Trias should be taken at the base not of the tea-green marls, but of the *Avicula contorta* shales. No doubt the Rhætic formation as a whole, forms a stratigraphical as well as a palæontological passage series between the Trias and the Lias. This passage is apparent at some points in this country, *e.g.*, at Watchet, in the estuary of the Severn. There no hard and fast line can be drawn between the Keuper marls and the Lower Rhætics; green and red gypsiferous marls may there be seen alternating with black gypsiferous shales, and all are unquestionably as much Rhætic as Keuper. Beneath these passage-beds are found in a general way twenty feet or so of green marls and calcareous marlstones (with red mottlings), which, under the term "Tea-green marls," Mr. Etheridge, the late Mr. Charles Moore, and others, have proposed to class with the Rhætics. For the reasons I have stated, I am inclined to agree with Dr. T. Wright and others, who take these "Tea-green marls" as more properly belonging to the Keuper. There is, however, no necessary connection between the "Tea-green marls" of the West of England and the green coloured marls which occupy the same relative position beneath the *Avicula contorta* shales in the Midlands. Probably in both districts these green marls were once red in colour, and have since become bleached (and, also perhaps, calcareous in part) by the downward infiltration into them of some deoxidising chemical agent, possibly derived from the decomposition of the abundant organic matters of the overlying paper shales. The very general occurrence of twenty feet or so of greenish marls at the top of the Keuper marls in this country is a coincidental result of discolouration. Neither the stratigraphical relations, the textural characters, nor the organic remains of these beds, justify us in separating them from the rest of the Keuper and classing them as Rhætic rocks.

SOCIOLOGY.*

(Concluded from page 149.)

(2). As regards the Natural History and Microscopical Society, of which our Section is now a unit, I question very much if there are many local Societies like it which have held their own for something like a quarter of a century, and have had their influence, as ours has, in disseminating a taste for Botany, Zoology, Geology, and Microscopy. Here at our meetings, irrespective of class distinction, the professional man, the merchant, the manufacturer, the clerk, and the working-man gather together on common ground—that common ground being the study of Nature. There is no distinction, either of politics or of religion, or even of sex! I well remember the time when, except among the medical profession, a microscope was a rarity in the town, and now at the Annual Conversaziones of this Society alone we can number a hundred!

The growth and development of our Society has been remarkable. Originally consisting of a few enthusiastic naturalists, who met in a small back room in the Midland Institute—by the courtesy of the Council of that body—it now numbers nearly four hundred members, and has acquired a distinction of which we may be justly proud. The annual contribution to its funds is almost nominal, but by united efforts our Library numbers on its shelves the most important works in Natural History and Microscopy. Our Microscopes are of the best that can be acquired. By our exertions the Midland Union of Natural History Societies was established in 1878, comprising nearly thirty local Societies within a radius of sixty miles, and an aggregate of 2,500 members, having a Journal of its own—"The Midland Naturalist." The annual gatherings in neighbouring towns have been highly successful, and the foundation of the "Darwin Medal"—in honour of the distinguished Naturalist who favoured our Society by accepting the office of an Honorary Vice-President, given annually for the best original Essay or Paper in Biology, Geology, or Archæology—is a noteworthy feature. The last medal was awarded to two of our Members, Professor A. Milnes Marshall, D.Sc., and Mr. W. P. Marshall, M.I.C.E., for researches on the *Pennatulida* (Sea Pens, etc.) obtained at Oban during the Dredging Excursion of 1881. And here I should like to remark that we are proud to have reckoned among the early Members of our Society Mr. Grant Allen, who has since risen to fame as an evolutionist. On all these grounds I submit that our Society is a Sociological factor of importance, that its influence acts and interacts, and that the establishment of a Sociological Section as part of its organization is a step in the right direction.

* Abstract of an Address delivered to the Sociological Section of The Birmingham Natural History and Microscopical Society by W. R. Hughes, F.L.S., President of the Section, at its first meeting at the Mason College, Birmingham.—Thursday, 3rd May, 1883.

The highly suggestive and valuable letter with which Mr. Herbert Spencer has favoured us makes it almost presumption in me to offer any suggestion as to the work of the Section, but reverting for a moment to that passage in his letter in which he says:—"As you indicate *Education* as one of the first objects to be dealt with, you might in connection with it take up the alleged relations between ignorance and crime, and education and morality"—I would venture to suggest in connection with this subject that it would be most interesting and valuable to compare the classified results of Criminal Statistics for a given period of years before the working of the School Board in Birmingham and in other towns with the corresponding period since the School Board has been in existence. And with it I would also suggest the taking note of the recent labours of the Health Committee of our town, resulting in a diminished death-rate, as compared with that of other large towns, and concurrently with it a possibly higher standard of general health. The labours of the Baths and Parks Committee in opening additional baths, parks, and recreation grounds would also tell as factors. In one of his works (I forget which, at this time) Mr. Herbert Spencer suggests that it would be most interesting to ascertain among the criminals in a gaol how many of them had been in the habit of taking a bath! The opening of a public park or recreation ground in a district would not only have remote influence in diminishing crime in that district, but immediate influence in adding to the health of that district. Morally and intellectually the opening of a Free Library in a district would be a most important factor of progress. The labours of the Improvement Committee of our town having charge of the Artizans' Dwellings Scheme in removing unfit and unsanitary dwellings, and opening up spaces for oxygenation and freedom of transit, are all interesting factors. Probably, also, the closing of unnecessary houses for the sale of intoxicating drinks, and the opening of coffee houses in a district, act as Sociological factors of progress.

We all remember the famous illustration in the "Origin of Species" (showing the complex relations of all animals and plants to each other in the struggle for existence), of the large and extremely barren heath, part of an estate of a relative of the author, in Staffordshire, of which several hundred acres, of exactly the same nature, had been enclosed twenty-five years previously, and planted with Scotch fir. "The change in the native vegetation of the planted part of the heath was most remarkable, more than is generally seen in passing from one quite different soil to another, not only the proportional numbers of the heath-plants were wholly changed, but twelve species of plants (not counting grasses and carices) flourished in the plantations, which could not be found on the heath. The effect on the insects must have been still greater, for six insectivorous birds were very common in the plantations, which were not to be seen on the heath; and the heath was frequented by two or three distinct insectivorous birds. Here we see how potent has been the effect of the introduction of a single tree, nothing whatever else having been done, with the exception that the land had been enclosed, so that cattle could not enter."*

Another wonderful instance of the relation between cause and effect is mentioned in the "Data of Ethics," and proved by direct experiment. "Making such arrangements that the bile-duct of a dog delivered its product outside the body, Claude Bernard observed that so long as he petted the dog and kept him in good spirits secretion went on at its normal rate; but on speaking angrily, and for a time so treating him as to produce depression, the flow of bile was arrested."† And the talented author, further illustrating the relation between cause and effect, mentions that "In the normal order, pleasures great and small are stimulants to the processes by which life is maintained. Among the sensations may be instanced those produced by bright light. Sunshine is enlivening in comparison with gloom—even a gleam excites a wave of pleasure; and experiments have shown that sunshine raises the rate of respiration: raised respiration being an index of raised vital activities in general."‡

I feel sure you will all agree with me that if instances of the kind adduced—and their number might be increased to an almost illimitable extent—have weight from a Biological point of view, the factors of progress I have previously alluded to must have weight from a Psychological and Sociological point of view in the question under consideration.

Ladies and Gentlemen, I feel that I have exhausted too much of your time and trespassed too much on the ground of my colleagues in this evening's work. Permit me to express the hope that the interest and kindly feeling which has characterised the establishment of our new Section may continue and develop, and that the Section itself may do good work, bearing in mind Mr. Herbert Spencer's precept "that the growth and prosperity of any organization is bound up with the doing of work of some kind or other. Mere receptivity will not suffice, there must be independent activity;" and that it may benefit the parent Society by an increase of new members who may be attracted by the opportunity thus afforded of discussing any object that may arise in connection with the Doctrine of Evolution as illustrated in Mr. Herbert Spencer's writings. I am sure the Society is to be congratulated on having secured the co-operation of our talented and devoted hon. sec., Mr. Alfred Hayes, B.A., and of the friends whom he has introduced. We shall endeavour to make our meetings interesting, and where practicable there will be illustrations. The excursions "to local spots rendered famous by great minds" will be a relief to harder work, as well as a means of bringing together those of us who think alike. In his famous address to the Americans on the

* "The Origin of Species," by Charles Darwin, M.A., F.R.S., etc., 4th ed., 1866, pp. 81, 82.

† "The Data of Ethics," by Herbert Spencer, 1879, p. 89.

‡ "The Data of Ethics," by Herbert Spencer, 1879, p. 89.

occasion of the farewell banquet, Mr. Herbert Spencer wisely says:—"In brief I may say that we have had somewhat too much of the gospel of work. It is time to preach the gospel of relaxation."

I have to express our warmest thanks to those who have taken an interest in the new Section, and especially I would mention the support we have received from distant localities, notably Wolverhampton, a most important town, possessing many of the characteristics belonging to Birmingham, and yet differing from it in some respects.

A few words of caution may be necessary for us in our progress, and here again I must quote from Mr. Herbert Spencer. "It is (he says) always the tendency of discipleship to magnify the effect of the master's teachings; and to credit the master with all the doctrines he teaches."* And further—"The advocates of a cause usually overstate their case." One of the chief teachings of "The Study of Sociology" is to eliminate the various forms of bias that affect accurate Sociological generalizations. To members of this Section, the mere mention of these aphorisms of the Author of the Synthetic Philosophy—on whose rich stores I have drawn so largely—will suffice, for *they*, happily, do not come within the category of those of whom Mr. Herbert Spencer says that "only by varied iteration can alien conception be forced on reluctant minds." †

Of the Doctrine of Evolution as set forth in Mr. Herbert Spencer's writings, and in the works of Darwin, Huxley, Tyndall, Ernst Haeckel, and others, I need say nothing to an assembly of Naturalists. So far back as 1873 the late Sir Wyville Thomson, whose name will ever be associated with the origin and development of the "Challenger" work, wrote, "I do not think that I am speaking too strongly when I say that there is now scarcely a single competent general Naturalist who is not prepared to accept some form of the doctrine of evolution."‡ Able writers, such as the late Mr. Walter Bagehot in his "Physics and Politics," have applied it in other directions, and others are following the example.

Its most bright, encouraging, impressive, hopeful, and even sublime aspect is that the "process of modification upon modification which has brought life to its present height must raise it still higher,"§ and that the most particular ways "in which this moving equilibrium, this further evolution, this higher life, this greater co-ordination of actions, may be expected to show itself, will be in intelligence and morality."

Regarding intelligence, Mr. Herbert Spencer says: "There is ample room for advance in this direction, and ample demand for it. Our lives are universally shortened by our ignorance. In attaining complete knowledge of our own natures and of the natures of surrounding things—in ascertaining the conditions of existence to which we must

* "The Data of Ethics," by Herbert Spencer, 1879, p. 6.
† "Essays," 2nd series, page 60.
‡ "The Depths of the Sea," by C. Wyville Thomson, F.R.S., 1873, p. 9.
§ Herbert Spencer. 'Postscript to American Address.' "Contemporary Review," January, 1883.

conform, and in discovering means of conforming to them under all variations of seasons and circumstances—we have abundant scope for intellectual progress."*

Regarding morality—that is, in greater power of self regulation—Mr. Herbert Spencer says: "Right conduct is usually come short of more from defect of will than defect of knowledge. To the due co-ordination of those complex actions which constitute human life in its civilised form, there goes not only the pre-requisite—recognition of the proper course; but the further pre-requisite—a due impulse to pursue that course. And on calling to mind our daily failures to fulfil often-repeated resolutions, we shall perceive that lack of the needful desire, rather than lack of the needful insight, is the chief cause of faulty action. A further endowment of those feelings which civilisation is developing in us—sentiments responding to the requirements of the social state—emotive faculties that find their gratifications in the duties devolving on us—must be acquired before the crimes, excesses, diseases, improvidences, dishonesties, and cruelties, that now so greatly diminish the duration of life, can cease." †

A gifted poet of our day, who is essentially the Poet of Evolution—the author of the "Light of Asia"—has caught the spirit of the master, and has given in that remarkable and beautiful work a picture of evolution in lines that cannot fail to be appreciated by all who recognise its operations:—

* * * * * *

Marking—behind all modes, above all spheres,
Beyond the burning impulse of each orb—
That fixed decree at silent work which wills
Evolve the dark to light, the dead to life,
To fulness void, to form the yet unformed,
Good unto better, better unto best,
By wordless edict; having none to bid,
None to forbid; for this is past all gods
Immutable, unspeakable, supreme,
A Power which builds, unbuilds, and builds again,
Ruling all things accordant to the rule
Of virtue, which is beauty, truth, and use.
So that all things do well which serve the Power,
And ill which hinder; nay, the worm does well
Obedient to its kind; the hawk does well
Which carries bleeding quarries to its young;
The dew-drop and the star shine sisterly,
Globing together in the common work;
And man who lives to die, dies to live well
So if he guide his ways by blamelessness
And earnest will to hinder not but nelp
All things both great and small which suffer life.‡

* "Principles of Biology," vol. ii., p. 496.
† "Principles of Biology," vol. ii., p. 497.
‡ The "Light of Asia." By Edwin Arnold, C.S.I. 9th ed., 1882, pp. 169, 170.

SUMMER MIGRANTS.

NOTICE OF THE ARRIVAL OF MIGRATORY BIRDS IN NORTH OXON IN THE SPRING OF 1883, WITH NOTES.

BY OLIVER V. APLIN.

It will be unnecessary to remind your readers that the early spring of 1883 was very cold, but for the sake of drawing a comparison between this year and last I may mention that the mean temperature of March, 1882, was 43·9°, of the same month in 1883, 35·2°, of April, 1882, 46·7° as against 45·8° of April last; also that in March and April, 1882, snow fell on one day only, while in the same months of this year it fell on fifteen days, and remained on the ground for several more.

Still more striking was the difference in the state of vegetation, the hawthorn hedges being from three weeks to a month later in assuming their vernal dress of green, and the blackthorn observed last year to be flowering on March 12th was not noticed this season until April 17th. But with all this marked difference in the season it is surprising how little our summer migrants were affected by it. The Chiffchaff (*Phylloscopus collybita*) is perhaps a solitary instance of retarded appearance, but this may possibly be accounted for by the fact that it is generally the welcome note of the bird that first makes its presence known to the observer, and that therefore the bird may well be with us for some days until a genial and sunny day brings forth his song. Some idea of the general lateness of the observations made upon this bird may be gathered from the fact that among all the valuable records which appear annually in the *Field* newspaper I failed to discover a single March note, and the only record of it during that month that I have been able to find this year was in Devonshire on the 25th. Here I did not observe it until April 7th (a fine warm morning), when I noticed two in song. A careful observer in the north-west of Oxfordshire (near Chipping Norton) observed it the day before, but remarked that it was silent. Two days after I found a pair of Redstarts (*Ruticilla phœnicurus*) in some willows beside a small stream, where they remained all the summer; this is, I think, an early arrival; the male was singing gaily. I have recently examined an example of this species in very curious plumage for the time of year at which it was killed—viz., April or May. It was in almost exactly the same plumage as a male bird of the year which has completed the autumnal moult before leaving this country. The white edges to the black feathers on the throat were especially noticeable. It would appear that this individual (as is supposed to be the case with some wagtails coming to Europe in spring) was hatched in the winter quarters of the species. On the 14th I heard a Tree Pipit (*Anthus trivialis*), but it was not till three days after that I saw the bird; the white bar across the wing is very conspicuous, and I think has not been sufficiently noticed by authors as a distinguishing mark. On the 15th the Willow Wren (*Phylloscopus trochilus*) was in song; high time for it, as the larches were decidedly green.* The abundance of this bird in Oxfordshire was remarked by more than one observer, and about the end of the month they were apparently by far the most numerous of our warblers. A soft warm day on the 19th brought us the Whitethroat (*Sylvia rufa*), and the next both the Swallow (*Hirundo rustica*), and Cuckow (*Cuculus canorus*); the latter remained in full song all May, and (though a few changed their note in the first few days) well into June. On the 21st I saw about half a score of Yellow Wagtails (*Motacilla Raii*) on a fallow; as usual they varied much in plumage, possibly from the reason given by Mr. J. H. Gurney, jun., when writing on a nearly allied species—viz., that some were young birds bred beyond the Equator in winter, and coming to Europe with their parents in spring as immature birds.† I scrutinized them carefully with the glasses for a Grey-head, but without success. In a hedge close at hand the Sedge Warbler (*Acrocephalus schœnobænus*) was uttering his hurrying song. On the 22nd my brother observed the Blackcap (*Sylvia atricapilla*) in his garden singing grandly; notwithstanding the snow which fell the next day and the return of severe weather I have no doubt this seemimgly hardy little warbler continued his song, for I remember on the 7th May, 1879, hearing it actually during a snow storm. Walking along the high road on the 28th we saw a Nightingale (*Daulias luscinia*) come out several times on to the ground at the roadside to feed. It is remarkable how nearly this bird resembles the Robin in many of its habits. Just here I have found it rather more numerous than I used to do some five or six miles further south. Another sang beautifully on the 30th as I walked up a lane from the valley, reminding me of the truth of Keble's lines—

"If, the quiet brooklet leaving,
  Up the stony vale I wind,
Haply half in fancy grieving
  For the shades I leave behind,
By the dusty wayside drear,
  Nightingales with joyous cheer,
Sing, my sadness to reprove,
  Gladlier than in cultured grove."

House Martins (*Chelidon urbica*) appeared in some numbers on the 28th. It is wonderful how soon they find out where wet mud can be obtained. Except for a mechanical contrivance which brings the water in pipes, this village would be badly supplied with it, and around one of the taps near our gate I have often seen upwards of half a dozen building birds busily engaged in getting materials for their mud walls, which otherwise would

* *Vide* Professor Newton in "Phenological Instructions."
† *Vide* "Rambles of a Naturalist," p. 114.

have been at a standstill. The following day I saw three Whinchats *(Pratincola rubetra)*, all hen birds. I omitted to mention in my notes last year that this species was unusually abundant. Their numbers with us vary very considerably in different years. Mr. Harting says, "I have generally found that a cold or wet spring has so affected their migration as to cause them apparently to alter their plans and induce them to spend the summer but a short distance to the north or north-west of their winter quarters."* The fine warm spring of last year would thus account for their abundance, and probably the worst of the weather this year was over before the time arrived for them to move, for they have been fairly plentiful. On May 5th the snow lay on the ground at 5 a.m., and there was a high cold wind; nevertheless in the afternoon I observed a Swift *(Cypselus apus)* in the valley, and also on the canal bank three Common Sandpipers *(Totanus hypoleucus)* busily hunting for food in the short grass at the water's edge. These birds must spend but a short time in their breeding quarters, as when they visit us in May they never seem in a hurry, and stay sometimes a few days, and then they are often back again at the end of July. This year, indeed, I saw one at the stuffer's on the 25th which had been shot the day before. It seemed as if all the Martins in the district were collected over Wormleighton Reservoir that afternoon, doubtless for shelter from the wind, and for the sake of the probable abundance of insects over the water as compared with the higher grounds swept by the searching wind. I did not observe the Wryneck *(Jynx torquilla)* until the 11th, when two in Banbury Cemetery were attracting the attention of passers by with their loud cries. A Spotted Flycatcher *(Muscicapa grisola)* appeared on the 14th, and on the same day the Swifts were uttering their welcome screams—nine days after their first arrival. On the 16th I observed the Corncrake (*Crex pratensis*) and the Garden Warbler (*Sylvia hortensis*); and on the 20th, a soft, warm day, Turtle Doves (*Turtur communis*) were numerous. The following day I was surprised to see a hen Wheatear (*Saxicola œnanthe*): this bird visits us rarely in March, but I did not observe it this season, and the above is by far the latest date in the summer that I ever saw it. I do not think it was breeding, and cannot account for its presence. Lesser White-throats (*Sylvia curruca*) are fairly common just here, though I did not come across one until this same day. About 9 p.m. on the 22nd I heard the "reeling" of the Grasshopper Warbler (*Locustella nævia*)—a rather rare bird in North Oxon. My correspondent from Chipping Norton writes the following interesting account of one of these birds which he observed on 30th April:—"I was walking along the sunny side of a wood. . . Here I caught the unmistakable "reel," the *ventriloquism* of which was very obvious, but the bird uses a crescendo in the middle of a long spell at it, which betrays its position. Thinking that I might possibly get a sight of it I crossed the low hedge and got in among the grass and saplings up to the point where

* *Vide* "Our Summer Migrants," p. 10.

I had heard it. . . . I very soon saw the bird about ten yards away, perched on a twig. The feature which most attracted my attention was the long and very flexible olive throat, which was moved about a great deal, thrust forward and again drawn back so as to fold like a double chin. I have no doubt that the ventriloquistic power is connected with this long neck, but when the bird again began to "reel" he turned his tail on me, so that I could not so well see the throat at work. As far as I could see, however, there was no very marked vibration of any part of the body in making the noise, to which I then listened for some minutes, but failed to hear a longer effort than one which lasted 40 seconds by my watch. . . . It moved with a peculiar half-flying, half-creeping, or climbing motion—*e.g.*, it *ran* down a sapling, or looked as if it did so, using its broad tail freely to balance itself. . . . My field-glass enabled me to see the bird almost as well as if it had been in my hands." May 27.—The Wood Wren (*Phylloscopus sibilatrix*) is a rare bird in this part of the county: I only once observed it this season, in the tops of some tall oak trees in a wood just inside Warwickshire. The Nightjar (*Caprimulgus europæus*) is far from common; a female bird was shot on the Northamptonshire side (if not in that county) on the 19th. Later on in the year I knew of a nesting spot in South Oxfordshire, where they are far more common. June 9th.—A Cuckow finished with "cuck-cuck-cuck-coo," after a spell of his typical song.

"In June he changes his tune."

A pair of Red-backed Shrikes (*Lanius collurio*), which reared their young a few fields below this house, escaped observation until July 8th, after which date I watched them closely, and obtained several Bumble Bees, and two large beetles (*Geotrupes vernalis* and another) which they had impaled upon thorns. I think the young flew about the beginning of the fourth week; I saw them on the morning of the 24th, being attracted by their strange cries. I think that it has been a good year for summer birds, and the warblers at all events are plentiful enough just now, and frequent the gardens in numbers to feed on the remains of the currants. But the Willow Wren has begun his autumn song, and the Swallows and Martins congregate in the tops of trees, and they will soon all be leaving us.

Great Bourton, Oxon, 8th August, 1883.

MYCOLOGICAL NOTES.

In the "Midland Naturalist" for 1882, p. 185, I recorded for the first time the occurrence of the rare or unnoticed species *Agaricus udus*, in Warwickshire, at Sutton Park. On a recent visit to the Lickey Hills, August 1st, I had the pleasure of finding it again in a similar locality, amongst Sphagnum, in a little marshy spot where Drosera formerly grew. This, of course, is in Worcestershire. It was accompanied here by the variety *polytrichi* (Fries, "Hym. Eur.,"

p. 298), which was distinguishable at once by its very marked characters:—"Pileus plano-depressed, whitish at the margin; stem smooth, pale fulvous; gills at length decurrent." A suspicion of a greenish colour pervaded the pileus and gills.

In the same volume, p. 274, I have recorded the occurrence of *Œcidium depauperans*, Vize, on cultivated Violas at Perry Barr, where I have been familiar with it for several years; and have since met with it at Moseley and Sutton, under similar circumstances. This year I have been fortunate enough to meet, at Sutton, with the associated Uredo and Puccinia, on the same plant; and, as they differ somewhat from *Puccinia violarum*, I shall describe them under the name of *P. ægra*.

PUCCINIA ÆGRA, *n. sp.*

I. *Œcidium depauperans*, Vize. Cups on all green parts of the plant, scattered, *not collected on swollen patches*, roundish or elliptic, with a torn, white, sometimes recurved margin; spores roundish or oblong, angular, smooth, orange-yellow, 17-21 μ long, 14-16 μ broad.

II. Pustules numerous, amphigenous, on yellow spots, not small, scattered or collected in groups, roundish, flatly convex, *veiled by the silvery shining persistent epidermis;* spores elliptic or obovate, brown, delicately spiny, about 28-30 μ long.

III. Pustules as in II. Teleuto-spores elliptic, oblong or roundish, *very irregular*, rounded or tapering at the base or apex, sometimes truncate, smooth, not constricted (more often widest at the septum), dark-brown, 22-30 μ long, 18-24 u broad. August.

The Œcidium appears at the latter end of May and continues till autumn. Its impoverishing effect is most marked the stems affected by it become flaccid, lanky, and yellow. The same plant which bears the Puccinia may still continue to produce the Œcidium; in fact *all three kinds of spores may be found upon the same leaf.* The uredo pustules affect the leaves and stipules only, rendering them weak and yellow; the epidermis remains for a long time as a dome-shaped covering, and at last splits irregularly, or by a longitudinal fissure. This species must rest, perhaps, for its limitation mainly upon its biological characters.

I have also found, in Crackley Wood, Kenilworth, another fungus, new to Britain—viz., *Botrytis coccotricha*, Sacc., the identification of which I owe to Mr. W. Phillips. It occurred on oak chips, and consists of a minute erect branching colourless stem, each branchlet terminating in a single large obovate clear-brown spore.

Lecythea Baryi is recorded in the "Handbook," p. 532, on Brachypodium. It is now known that this is the early stage of a Puccinia, which is called *Puccinia Baryi*. This (in both stages) I have recently found at California, Harborne, on *Triticum repens*. There is, I think, no published record of the occurrence of the Puccinia-spores of this rare species in Britain. Mr. C. B. Plowright informs me that it is also found on *Lolium perenne*.—W. B. GROVE, B.A.

THE FLORA OF WARWICKSHIRE.

AN ACCOUNT OF THE FLOWERING PLANTS AND FERNS OF THE COUNTY OF WARWICK.

BY JAMES E. BAGNALL.

(Continued from page 190.)

CAMPANULACEÆ (*continued*).

SPECULARIA.

S. hybrida, *A.DC.* *Small-flowered Venus's Looking-glass.*
Colonist: In cultivated fields in Lias soils. Very local. June to September.
II. Alne Hills! *Rufford.* *Purt.* i., 119. In cornfields near the School, Rugby, *Baxter*, *Purt.* iii., 342; Bidford, *J. Leefe, N. B. G.* In a field near the Tower, Hill Morton Road, *R. S. R.*, 1869; Moreton Morrell, Fullbrook, *Y. and B.;* Salford Priors, *Rev. J. C.;* cornfield, Whitnash; *H. B., Herb. Brit. Mus.;* Lighthorne, *Bolton King;* Pea field, bridle road from Wilmcote to Billesley; cornfield, Red Hill; quarry in lane Exhall to Bidford; Brandon.

WAHLENBERGIA.

W. hederacea, *Reich.* *Ivy-leaved Bell-flower.*
Native: In damp turf meadows. Very rare. July.
I. Between Nuneaton Common and the town, *J. Power*.
II. "On spongy turf near Arbury Hall! *possibly* planted, but I think it truly indigenous to this locality," *T. Kirk, Phyt.*, ii., 970.
Abundant in this station in 1872, probably planted.

ERICACEÆ.

VACCINIUM.

V. Oxycoccus, *Linn.* *Cranberries, Moorberries.*
Native: In peaty bogs. Very rare. June to August.
I. On marshy ground and quagmires as in Sutton Park! *Ray. Syn.*, 267; near Packington! *Aylesford, B. G.*, 635; Coleshill Bog! *Purt.* i., 195; pool in Chelmsley Wood, *Bree, Mag. Nat. Hist.*, iii., 164; Middleton Heath.

V. Vitis-Idæa, *Linn.* *Whortleberry.*
Native: On elevated peaty mounds, near bogs and marshes. Very rare. June to August.
I. Middleton by the New Park palings, *Ray. Cat.*, 1672; on black boggy ground between Middleton and Sutton, *Gough's Cambden*, ii., 350; by Mr. Worrall's farm near Coleshill Heath, *Perry, Fl.*, 34; Sutton, *Freeman, Phyt.*, i., 262; Sutton Park in several places, 1866—82.
I have not been able to find this anywhere except in Sutton Park.

V. Myrtillus, *Linn.* *Billberries, Blackworts.*
Native: In woods and on heathy lands. Very local. April, May.
I. Sutton, *Freeman, Phyt.*, i., 262; Sutton Park; New Park; Chelmsley Wood; woods about Maxtoke; Arley Wood; woods near Solihull; Forshaw Park.
II. Studley Woods! *Purt.*, i., 195; Haywoods! *Y. and B.;* Corley Wood; Seas Wood, Arbury.
Var. *flore et fructu albo*, Corley Wood! *Bree, Purt.*, iii., 356.

ERICA.

E. Tetralix, *Linn.* *Cross-leaved Heath.*
Native: In boggy or marshy places, on heathlands. Local. July to September.
I. Coleshill Bog! Sutton Coldfield! *Ick., Anal.*, 1837; Coleshill Heath; Middleton Heath; Trickley Coppice; Cornels End, near Berkswell; Forshaw Heath.
II. Studley Common, *Purt.*, i., 193; Wroxhall Heath, *Perry, Fl.*, 35.

E. cinerea, *Linn.* *Fine-leaved Heath.*
Native: On heaths and heathy waysides. Locally common. July to September.
I. Sutton Park; Coleshill Heath; Trickley Coppice; Middleton Heath; Gravelly Hill; Cornels End; Balsall Street; Marston Green; Baxterley Common; Forshaw Heath.
Var. *flore albo*, Coleshill Heath! *Bree, Purt.*, i., 192; Sutton Park occasionally.
II. Yarningale Common; Stoke Heath.

CALLUNA.

C. vulgaris, *Salisb.* *Common Ling. Heather.*
Native: On heaths, heathy waysides, banks, etc. Locally common. July to September.
I. Sutton Park; Middleton Heath; Gravelly Hill; Coleshill Heath; Baxterley Common; Bentley Heath; Forshaw Heath; Earl's Wood, etc.
II. Gaydon Gorses, *Bolton King*; Yarningale Common, etc.
Var. *b. incana*, abundant on Sutton Common; *forma, flore albo*, Sutton Park; Coleshill Heath.

PYROLA.

P. media, *Swartz.* *Intermediate Winter Green.*
Native? in woods. Very rare. July.
I. Wood at Meriden, *Bree, Purt.*, i., 206.
No one appears to have found this plant in the county since Bree's time. I have searched several of the Meriden woods but have not been able to find it.

P. minor, *Linn.* *Lesser Winter Green.*
"38 Warwick, Kirk. Sp.," *Top. Bot.*, page 262.
This is the only record I find of this plant. I have no doubt that both records refer to the same plant.

MONOTROPA.

M. Hypopitys, *Linn.* *Yellow Bird's-Nest.*
Native: In woods. Very rare. June, July.
I. Oldbury, near Atherstone, *J. Power, MS. note in Bot. Guide.*
II. Compton Verney, *W. Satchell, Herb. Perry!* 1848.

JASMINACEÆ.

FRAXINUS.

F. excelsior, *Linn.* *Common Ash.*
Native: In woods, copses, and hedges. Common. March, April. Area general.

LIGUSTRUM.

L. vulgare, *Linn.* *Common Privet.*
Native? In woods, copses, and hedges. Local. June, July.
I. Lanes about Witton; Trickley Coppice; hedges near Atherstone; lanes about Solihull; Earl's Wood, etc.

II. Coventry Wood, Arbury, *Kirk. Herb. Perry;* Warwick, common, *Perry*, 1817; Chesterton! *Y. and B.;* Lambcote, Honington, Tredington, *Newb.;* Alveston pastures; Drayton bushes; Henley-in-Arden; Combe fields; canal bank, near Newbold-on-Avon; Bilton, near Rugby; Birdingbury; Shuckburgh; Willoughby, etc.

In which of these districts this plant may be considered native I am unable to decide. It is so frequently planted in our hedges and borders of woods that I have great doubts as to its being either native or of spontaneous growth in the majority of the stations here given.

APOCYNACEÆ.

VINCA.

V. major, *Linn. Greater Periwinkle.*

Alien: On banks and in woods. Rare. April.

II. King's Coughton, Oversley, *Purt.*, i., 135; Claverdon; Haseley Common; Corley Wood, *Herb. Perry;* "between Stratford and Warwick, in two or three places near Warwick," *J. Wood, MS. in B. G.;* Salford, *Rev. J. C.;* Lapworth; banks near Stratford, on the Alcester Road, abundant 1880; near Brinklow.

Evidently a mere escape where I have seen it, probably so in the other stations above given.

V. minor, *Linn. Lesser Periwinkle.*

Denizen: On marly banks, rarely in woods. Local. March, April.

I. In a lane leading to Alum Rock, Upper Saltley! *Ick. Anal.;* Fillongley! *Bree, Purt.*, i., 133; in several of the lanes near Solihull; Shirley Heath; Bentley Heath; Hay Lane, near Box Trees, Hockley; Olton; Wylde Green.

II. Allesley! *Bree, Purt.*, 133; Salford! *Rev. J. C.;* Honington Park.

In many places a mere straggler from cultivation.

In both these plants the flowers are remarkably adapted for warding off the visits of "unbidden guests."

(To be continued.)

Reviews.

Nat the Naturalist. By G. M. Fenn. 320 pp., 8 plates. Price, 5s. Blackie and Son.

This is an excellent book for boys; full of travel and adventure, natural history, and humour. Nat and his two uncles, one so quiet and stay-at-home, the other so bold and venturous; their faithful black, *Ebo-nee*, and the disagreeable aunt with her parrots and dogs; these make up a group whose history holds young minds spell-bound. How Nat is taught to shoot and to skin birds, how he goes with his uncle to the Eastern Archipelago, and there accumulates great stores of natural history treasures, but also undergoes many great perils, to return triumphantly at last; all this is so well told by Mr. Fenn that we do not hesitate to class "Nat the Naturalist" among the best works of its class of the season.

Contributions to the Physical History of the British Isles. By Prof. E. Hull, F.R.S. Pp. xvi. and 143, 2 woodcuts, and 14 coloured plates. Price, 12s. 6d. E. Stanford.

In this valuable book Professor Hull attempts to restore the physical geography of the British Isles as it existed during each of the great geological periods. A double map is given for each geological formation, showing (1) the part of the surface now occupied by the strata, and (2) the area and coast-line of the sea in which these were originally deposited. Professor Hull's high position as the head of the Irish Geological Survey entitles his opinions to great respect, and we believe that the main facts relating to the changes of distribution of land and sea are better and more clearly laid down in this book than in any which has hitherto been published. On every point the author appears to have consulted the latest available authorities, while on many points his own original researches have thrown much light. An interesting feature in the maps of the Carboniferous, Permian, and Triassic periods is the indication of the ancient Land Barrier which then stretched across Central England, and from which we believe the pebbles of the Triassic Conglomerates to have been mainly derived.

Common British Insects (Beetles, Moths, and Butterflies). By the Rev. J. G. Wood. 284 pp., 130 figures. Price 3s. 6d. Longmans, Green, & Co.

This is a capital book for a beginner in entomology. The technical terms used are but few, and the exact meaning of each is carefully explained. The author devotes fourteen chapters to the Coleoptera, and seven chapters to the Lepidoptera; he describes the structure, appearance, and habits of all our common species, and adds, from his personal experience, many interesting anecdotes concerning them. The figures are good and clear.

The Young Collector's Handbook of Flowering Plants. By James Britten, F.L.S., *of the Department of Botany, British Museum.* 12mo., pp. 32, 11 woodcuts. One Penny.—W. Swan Sonnenschein and Co.

This is a marvellously cheap book, and both the author and publishers deserve our thanks for giving us so good a work in so cheap a form. The author, who is one of our leading British Botanists, and who has had great experience both in the field and study, has in this little pamphlet presented us with an accumulation of knowledge well digested, and given in a pleasantly readable form. It will be found a valuable guide to all young botanists, and many of even riper years. The illustrations are good, marvellously so when the price is taken into consideration, and sufficiently characteristic to enable a young student at once to recognise such plants as the Shepherd's Purse or the Harebell. The book deserves every success, and merits more praise than has here been given. J. E. B.

Correspondence.

A Bird's Nest in a Letter Box.—During this summer a linnet built a nest in a private letter box, belonging to Mr. J. M. Downing Dowles, Salop, and laid seven eggs. She appeared not to be disturbed by the dropping in of the letters, but the postman having discovered the nest took them to the house for a time. The bird hatched her eggs in July, and several did well, leaving the nest when able to fly.—A. H. A.

In the "Midland Naturalist" for August, page 190, under the head of "Reports of Societies," I am reported as having exhibited *Brachypodium cristatum;* this should have been *Brachypodium pinnatum.* And on page 191, last line, *Carex axillaris*, from the only Warwickshire locality, should read from the only *South* Warwickshire locality. I find this plant in three North Warwickshire stations. With regard to Mr. W. H. Wilkinson's exhibit reported on page 191, I may explain that the specimens were even more interesting than they seem in the report, as in these the ordinary petals were not merely replaced by petals of a green colour, but were replaced by the ordinary green leaflets, having the well-developed midrib and serrated margins of these organs.—J. E. Bagnall.

Pond Life.—We occasionally hear of the paucity of Natural History objects round the neighbourhood of Birmingham. Now I think that as regards the study of "Pond Life," as it is generally denominated, that character is not deserved, for in my opinion the fault lies in not looking quite close enough. I have been engaged in this fascinating study only about three years or so, yet I may venture to say that my list of finds would be a tolerably long one for a "beginner," consisting of nearly all the Polyzoa and the Hydrozoa; also Rotifera, Algæ, Infusoria, etc., not excepting the much-sought-for Amœba. Only the other day I found in enormous quantity *Melicerta ringens.* Although we know it is common it is but rarely, I should think, as in this case, found so plentifully. Close by was found that comparatively new Floscule, *Floscularia regalis*, mentioned by Dr. Hudson in the "Midland Naturalist" for 1882, page 252; also on the same weed were *F. ornata* and *F. proboscidea*, and in the same pool *F. ambigua*, Œcistes, Amœba, Brachionus, and many other less rare forms. I may say the pool was a dirty one, and also very unpromising to look at. I mention this just to show that what is required is more perseverance, such as the late President of the Birmingham Natural History and Microscopical Society says in his address "knows no obstacles and heeds no rebuffs."—E. H. Wagstaff, 1, Waterworks Road, Edgbaston.

Limnæa glabra (Muller).—Some eighteen years ago I found this local species very common in a ditch at Sparkhill; two years after I found it moderately common at Acocks Green in a small grassy pond. Mr. James Hopkins later on found a single specimen in a pond at Harborne. Since that time Conchologists have become more numerous in Birmingham. Can any of these supply fresh localities for this local species, also furnish a list of the species associated with it?—Wm. Nelson.

Tree-frogs in England.—I think it may interest some of your readers to know that my little brothers, when out for a walk near Hampton-on-the-Hill last Saturday, caught and brought home alive a small tree-frog, which seems to answer to the description of the green one (*Hyla viridis*) which is common on the Continent, but which I have never heard of as an inhabitant of Great Britain. The creature was about 1½ inch long, the body of a beautiful bright pea-green colour above, and white beneath; a dirty yellowish line ran down the side from head to tail. Its legs were green above, and of a dark reddish colour below; each of the toes was furnished near the tip with a flat round sucker similar to those on the foot of a fly. The throat was very capacious and hung down like a pouch. When placed in the conservatory it exhibited great activity, climbing and leaping from plant to plant almost like a small squirrel. Fearing it might escape, and until I could ascertain something as to its habits and food, I placed the frog in a large box with some plant, where it remained till Monday, but then died, whether from want of food or water I do not know. I have now had it preserved in spirits, and shall be pleased to show it to anyone who may feel interested in the capture. All the books I have seen on the zoology of England say that no species of tree-frog is known here, but if so, the finding of this one is difficult to account for, especially as it was caught quite out in the country, at a long distance from any place from which it is at all likely to have escaped.—Lloyd Chadwick, 27, High Street, Warwick, August 23, 1883.

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—Geological Section, July 24th.—The following exhibits were made: —Mr. E. H. Wagstaff: a fish parasite, *Argulus foliaceus;* fine specimens of *Lophopus crystallinus*, and an infusorian *Dendrosoma radians*. Mr. W. B. Grove the following Fungi:—*Pistillaria micans* (rare), from Solihull; *Cyphella Curreyi*, from Erdington; *Trichobasis oblongata*, from Harborne; *T. violarum*, from Clent. Also on behalf of Mr. Plowright, *Uromyces Poæ*, newly discovered in Britain; and on behalf of Mr. W. Phillips, *Puccinia mixta*, on chives, also probably new. Mr. C. A. Matley, Fossiliferous quartzite pebbles, from the Drift at Northfield. General Meeting, July 31st.—Mr. J. E. Bagnall exhibited *Campanula Trachelium, Agrostis nigra, Tilia parvifolia, Juncus Gerardi, Centaurea nigra* var. *radians*, and *Arundo Epigejos*, from Ragley; *Hieracium maculatum*, from Hampton; *Lemna polyrrhiza, Anthemis arvensis* (rare), *Polygonum arenastrum, Silaus pratensis, Arctium minus*, from Escoles Green; *Paris quadrifolia* (in fruit), from Oldbury; *Selaginella selaginoides*, from Southland; a moss, *Sphagnum fimbriatum* (in fruit), from Bentley Park; Fungi, *Amanita rubescens, Pluteus chrysophæus*, from Ragley Park; *Boletus flavus, Lactarias pyrogalus, Hygrophorus conicus*, from Hampton; also, from Mr. F. Enock, *Drosera intermedia* and *Epipactis palustris*, from near Basingstoke. Mr. W. B. Grove exhibited Fungi:—*Puccinia Luzulæ* (rare) and *Peziza cinerea*, from the Hagley Road; *Macrosporium cheiranthi*, from Harborne; and the spores of *Xenodochus carbonarius*, from Water Orton, beneath the microscope. Mr. W. H. Wilkinson exhibited Lichens from the Highlands of Scotland:—*Usnea barbata, Ramalina farinacca, R. fraxinea* vars. *ampliata, fastigiata*, and *canaliculata, R. calycalis, Sticta pulmonaria, Peltigera canina, Physcia furfuracea*, and *P. prunastri*. Mr. W. Greatheed exhibited a specimen of *Tænia solium*, human tapeworm, 20ft. long. Mr. J. Morley exhibited the rare white variety of *Lamium purpureum*, from a garden. Biological Section, August 14th.—Mr. J. E. Bagnall exhibited *Orchis pyramidalis* (rare), from near Stratford-on-Avon; *Scabiosa columbaria*, from Bardon Hill; *Epipactis latifolia*, from near Stoneleigh; *Arundo Calamagrostis* (very rare), from near Solihull; *Narthecium ossifragum* (very rare), from Marston Green, a new locality; Fungi:—*Lactarius pergamenus*, from Oversley and Stoneleigh, named by Dr. Cooke; *Boletus piperatus*, from Middleton; *Phyllosticta violæ*, from Drayton, named by Mr. C. B. Plowright, all new to Warwickshire; *Flammula flavida* and *Cantharellus cibarius*, from Ragley Woods; *Collybia platyphylla* (rare) and *Boletus scaber*, from Middleton; *Lactarias rufus* and *Gomphidius glutinosus* (rare), from Marston Green. Mr. W. B. Grove exhibited Fungi:—*Amanita vaginata*, *Lepiota granulosa*, *Paxillus involutus*, *Boletus badius*, *Russula cyanoxantha*, *R. fragilis*, *R. integra*, from Coleshill Pool; *Phragmidium mucronatum*, *Melampsora betulina*, from Stonebridge; *Puccinia pulverulenta*, *P. violarum*, *Stigmatea Robertiani*, from Hampton; *Puccinia galiorum*, *Phragmidium obtusum*, *Ag. udus* and var. *polytrichi*, from the Lickey Hills; *Ag. sericeus*, from Rubery Hill; *Diatrype stigma*, with its two customary parasites, *Nectria episphæria* and *Helotium pruinosum*, *Boletus flavus*, *Cystopus candidus*, *Melampsora salicina*, *Polythrincium trifolii*, from Earlswood; *Ag. fibula*, *Corticium incarnatum*, *C. quercinum*, *C. cinereum*, from Warley Woods; *Polyporus fomentarius*, *Polythrincium trifolii*, from Salford Priors; *Peronospora grisea*, from Bidford; *P. arborescens* and *Lycoperdon giganteum*, from Wixford; *Ag. rimosus*, from Cleeve Hill Wood; *Ag. campanulatus* and *Cyphella villosa*, from near the Hagley Road; *Dacluca filum* (rare), and *Puccinia Baryi* (very rare), from California, Harborne; and a lichen, *Lecanora pyracea*, from Kenilworth Castle; also (for Mr. W. H. Wilkinson), *Polyporus rufescens*, from Solihull; (for Mr. R. M. Lloyd) *Arcyria punicea*, from Spring Hill; and (for Mr. J. W. Bodger) *Clavaria fragilis*, from near Peterborough. Mr. W. H. Wilkinson exhibited a collection of plants and lichens from Earlswood; also (for Mr. S. Walliker) a piece of conglomerate from North of Ireland, on which were growing the following Lichens:—*Ramalina scopulorum*, *Physcia parietina*, *Lecanora subfusca*, and *Verrucaria maura* (Leighton). Mr. J. F. Goode exhibited a slide of marine Entomostraca, taken in the tow-net near Oban. MICROSCOPICAL GENERAL MEETING, August 21st.—Mr. J. E. Bagnall exhibited *Drosera rotundifolia*, *Empetrum nigrum*, and other plants from Milford, near Stafford; *Pimpinella magna*, *Comarum palustre*, *Potamogeton rufescens*, *P. polygonifolius*, *Menyanthes trifoliata*, *Malachium aquaticum* (all rare or local in South Warwick), from near Tile Hill; *Russula lutea*, from Middleton; *R. fœtens*, *Lectarius pergamenus*, *L. cilicioides*, *L. camphoratus*, *Collybia platyphylla*, and *Cantharellus cibarius*, from Hurley, near Warwick. Mr. J. Levick exhibited *Mimulus luteus*, from the banks of the Rother, near Midhurst, Sussex. Mr. W. B. Grove exhibited Fungi:—*Ag. geophyllus*, *Lactarius glyciosmus*, *Cortinarius castaneus*, *Marasmius ramealis*, *Boletus subtomentosus*, *Polyporus annosus*, *Æthalium septicum*, and *Monotospora megalospora*, from Coleshill Pool; *Polyporus dryadeus*, from Stonebridge; *Triphragmium ulmariæ*, and a substipitate form of *Polyporus versicolor*, from Hampton; *Ag. appendiculatus*, *Polyporus sanguinolentus*, *Phlebia merismoides* var. *albo-marginata* (Phillips), *Peziza cochleata*, *Hypomyces aurantius* and *Cribraria aurantiaca* from Sutton; *Ag. variabilis*, *Ag. tener*, *Lactarius quietus*, *Russula emetica*, *R. alutacea*, *Boletus flavus*, *B. edulis*, *Polyporus annosus*, *Isaria umbrina*, and *Hypoxylon coccineum*, from Sutton Park; *Penicillium candidum*, *Peziza palearum*, and *Dinemasporium graminum*, from the Hagley Road, Edgbaston; *Marasmius oreades*, from Kenilworth Castle, and a Fungus new to Britain, *Botrytis coccotricha*, Saccardo, from Crackley Wood, Kenilworth; also (for Mr. Greatheed), *Phragmidium mucronatum*, from Essex; (for Mr. H. T. Soppitt) *Puccinia chondrillæ*, *P. chrysosplenii*, *Œcidium prenanthis*, *Ustilago Kühniana*, and *U. bromivora*, from Yorkshire; and (on behalf of Mrs. Dalton, of Peterborough) a series of exquisite drawings of Fungi, which were much admired. Mr. T. Bolton exhibited *Caligus Stromii*, from Christchurch, Hants, a parasite on salmon, which lives on the fish in salt-water, and is killed by the fresh-water, when it enters a river.

THE FELSPARS.*

BY T. H. WALLER, B.A., B.SC. LOND., PRESIDENT OF THE SOCIETY.

Among the minerals of which the so-called igneous or crystalline rocks are made up there appear certain which are distinguished from the others by their hardness, colour, and specific gravity, and which go by the general name of the Felspars. I have, however, found it impossible to formulate a definition which would include them all without giving it such wide limits as to destroy its value. Thus there are silicates of alumina and potash, or of alumina and lime, or of alumina and soda, or of alumina with any two of the other oxides. The ratios of the silica to the bases vary greatly, and the crystalline form is either monoclinic or triclinic, and the specific gravity varies between 2·57 and 2·75.

I have, therefore, ventured to risk the charge of unsystematic procedure, hoping that even if we cannot exactly express in words the definition of the whole group, the differences between the various members of it, and some of the more striking characteristics, may profitably employ half-an-hour this evening, especially as there is, so far as I know, nothing in the case of minerals which answers to the natural system in Botany, and we have therefore to fall back on what we may call a Linnæan system of description.

Beginning, then, with a *concrete* example, and taking a coarse granite,† such as there is on the table before you, we pass over the black mica scales and the transparent glassy quartz grains, and fix our attention upon the opaque white crystalline constituent of which there is so much in the specimen. We observe first of all that some of the fractures are smooth and shining, evidently such as are familiar to us as cleavage planes, and examining them a little more closely we find in any one crystal two sets of them meeting in an edge, so that the crystal can easily be broken up into prisms. The goniometer tells us that the angles of these fragments are right angles, and from this circumstance the mineral has received the name of Orthoclase, as cleaving at right angles. If now we can obtain a crystal separate from the rock and examine its shape more accurately, it becomes evident that the crystallographic system to which we must refer it is the monoclinic; that is, there is only one plane along which we could divide it and have the two parts similar—*i.e.*, only *one* plane of symmetry. If we take a rectangular block of wood and place it on a looking-glass, the reflected image will appear simply a continuation of the block, and the same would be the case whichever of the faces of the block was placed on the glass. There are, therefore, three planes

* Read before the Birmingham Natural History and Microscopical Society.

† From Lamorna, near Penzance. The granite contains very large white crystals of Felspar.

of symmetry parallel to the three pairs of faces. But supposing that in preparing our block one pair of sides had, while still at right angles to the second pair, been inclined at some other angle to the third pair, a little consideration will show that placing the block on the glass again we shall have the reflection as a continuation of the object in only two of the six possible positions—that, therefore, there is only *one* plane of symmetry, and with the block worked to a proper angle this would be a model of our Felspar crystal.

If now we cut slices thin enough to see through, parallel to the two cleavage planes, we shall find some differences between them as to their relation to polarised light. In both cases we find double refraction—that is, if the polarising and analysing prisms are so placed that the field of the microscope is dark (if the prisms are *crossed*, as it is called), the film of crystal will, in both cases, enable light to pass through the second prism. But, now, keeping the prisms crossed, rotate the specimens on the stage. Four positions will be found in which they no longer do this, but become dark like the rest of the field of view. If now these four "extinction" positions are accurately compared with the positions of the Nicols prisms, it will be found that the edge formed by the two cleavages is parallel to the principal planes, as they are called, of these (that is, to the shorter diagonal of the face of the prism) in one case, and inclined to them at an angle in the other. The first of these will be found to correspond with the most perfect cleavage, the other with that in the plane of symmetry. Some of the larger crystals, when examined on the best (or basal) cleavage, will be found to be divided into two parts, shown by the fact that the cleavage on the one side makes a considerable angle with that on the other; and where detached specimens can be observed it will be seen that the appearance is that of two thin individuals, one of them turned round half way with respect to the other, and partly penetrating each other. This is called twinning, and this particular form is the most usual in Orthoclase, and is termed the Carlsbad twin, from a locality where good examples are found. It will be seen that the rotation is not round an axis perpendicular to the faces in contact, but round one lying in it. The laws governing the twinning of crystals show that that plane, being the plane of symmetry, could not be the twinning plane, as it is called, in contradistinction to the plane of composition. It will be seen at once that merely turning these two rough models round on that plane produces no difference in shape, and neither can there be any in physical properties, seeing that these also are the same on both sides of the plane in question.

In thin slices this twinning shows very strikingly by the different appearance of the two halves in polarised light, produced by the different distribution of the optical properties in them. If the section is accurately perpendicular to the plane of composition, although there will be differences of colour in most positions, still both halves will become dark at the same time. This, however, will happen but rarely, but it is important, in view of what we shall find afterwards, to observe that when they do not become dark at the same time the two parts do not extinguish when the dividing line makes equal angles on each side with the principal sections of the Nicols.

We shall often find in these sections a very indefinite extinction—*i.e.*, the whole surface does not become equally dark all over at any possible position of the section, but takes a curious mottled look. The cause of this is not certainly known, but it has been suggested that it is owing to the crystal being compound instead of simple, built up of an extremely large number of very minute ones of another of the group, a potash felspar, but differing from Orthoclase in some important particulars.

Now we shall probably soon find among the colourless, but often rather cloudy grains, which we are inclined, at the first glance, to take for the mineral we have been studying, some which, under the searching test of polarised light, show themselves to be made up of a very large number of fine bands alternately light and dark, or if the section is thick enough, alternately differently coloured. On rotating this section between crossed prisms alternate bands will be found to *extinguish* together and at a considerable angle at times from the position of extinction of the other ones, and this, even when the lines of junction make at the extinctions *equal angles* with the principal planes of the prisms. This shows that we have to do with a mineral which is not symmetrical (physically) with regard to the plane of composition of the twinning; in fact it will be found that we have here a crystal of what is called the *Triclinic* system, in which, that is, the three axes are *all* inclined to each other, in which, therefore, no plane can be found which will divide the form into two exactly similar parts—no plane of symmetry, in fact. If the block of which I spoke earlier had not had any of its edges rectangular, it would be seen that it was impossible to find any position in which there was not an apparent break between the object and its reflected image when it was placed on the looking glass.

The mineral which we have thus detected is one of the Triclinic or Plagioclase felspars, so called because if we examine the cleavages in a crystal of one of them we shall find that these are no longer at right angles to each other, but inclose an angle, measured over the edge in which they meet, of about 86½°, varying slightly with the different sorts.

The rough models before you are attempts to give visible proof of some of the exterior properties of these minerals, especially in regard to that by which we have detected them in the rock, the multiple twinning. In the first place, we find that, seeing that no face of the crystal is a plane of symmetry, we may, by simply turning one component through half a circle, keeping the corresponding planes together, produce a twinning possible according to the laws of crystals; and, indeed, this is the commonest of all among the Triclinic felspars, and from its prevalence in Albite is called the *Albite* twinning. In most cases this is repeated very many times, and the models show that the result is the production on the surface (it is no longer truly a plane) of easy cleavage of a number of ridges and furrows. These are the cause of the striations visible even to the naked eye on broken surfaces of these felspars which make them frequently easy to distinguish from Orthoclase. In the large crystal in Granite on the table an included grain of slightly different lustre is visible, and a little further observation shows the striæ on it, proving that it is an inclusion of one of the Plagioclases. It is, however, to the more Basic rocks, such as Basalts, Dolerites, and Gabbros, that we must go for the most extended presence of these minerals, in contradistinction to the presence of Orthoclase in the acid rocks, such as Granite, Obsidian, and Porphyry. It must not, however, be for one instant supposed that the separation between what we may call Orthoclase and Plagioclase rocks is a sharp one. Almost all rocks which contain felspar contain a triclinic one to a greater or less extent—even Granite, as mentioned above; and on the other hand, Orthoclase is by no means unknown, even in those rocks in which the prevailing felspar is triclinic.

As to the composition of the different species which make up this group, they are naturally divided into three sections: the pure Soda felspar *Albite*, the pure Lime felspar *Anorthite*, and the mixed felspars *Oligoclase*, *Andesin*, and *Labradorite*. It is still a disputed point whether these last three are really definite minerals, or only mixtures in various proportions of the other two. Szabo is convinced, by the examination of many thousands of specimens, by means of their flame reactions, that the series from Albite to Anorthite is a perfectly continous one. On the other hand, other observers consider that the compounds named are definite and invariable, and that differences of composition are at any rate, to a considerable extent, due to the interlamination of felspars of different species. Dana adduces in favour of the latter view, the fact that different felspars are frequently found intercrystallised; that in these cases there is no appearance of indefinite shading of one into the other, but that both keep perfectly and sharply distinct. I exhibit a specimen, showing this in a striking manner. On the other hand, it is quite certain that some of them—*e.g.*, Oligoclase—have definite optical properties, and a tolerably definite composition. But we must confess that variations are decidedly more common and larger than can be very easily accounted for. I may perhaps give an instance—Professor Heddle, in his analysis of Scotch felspars, gives one of an Oligoclase from Lairg in Sutherland. I have made one of a specimen collected by Professor Lapworth, in Sutherland, and find a very complete accordance, except that the potash is a trifle higher and the lime correspondingly lower. On cutting a thin slice parallel to the basal cleavage, the reason becomes pretty certain. The greater part of the mass is Oligoclase, extinguishing at the low angle from the twinning plane which is characteristic of it but interlaminated with it is another felspar, which by its angle of extinction is shown to be Microline. Now this latter is a potash felspar, so that its presence would necessarily tend to increase the percentage of that alkali, and correspondingly diminish the lime. It is much to be regretted that Professor Heddle has not made (or published, if he has made) observations on the microscopical and optical properties of the grand series of felspars analysed by him. They would almost certainly have afforded an immensely improved point of departure for argument as to the actual chemistry of the group.

To determine what felspar we have in a rock is, unfortunately, a very difficult task, at any rate where it occurs in but small-sized crystals. Chemical analysis is very difficult in the case of such small quantities of material as are usually available, and is frequently but uncertain on account of the almost unavoidable admixture of other minerals. But two or three methods have been proposed, and of them I propose to speak, though only very briefly, seeing that to properly elucidate the subject I should have to make more experiments before you than there is time and opportunity for to-night. I the less regret this, as some time ago I read a paper, and showed experiments, on one of the methods mentioned.

This, which is the one elaborated by Dr. Szabo, professor in the Univerisity of Buda-Pesth, is, in essence, a carefully arranged determination of the fusibility in different parts of a Bunsen burner flame of particular (or at least invariable) dimensions, the same operations also serving for the estimation of the percentage of the alkalis by the intensity of the flame-colouration. This method, which can be completely carried out in about a quarter of an hour, if all goes fortunately, enables us to decide at once and easily between Orthoclase, Albite, Oligoclase, Labradorite, and Anorthite, but requires more practice and more careful observation to determine accurately the varying proportions of soda in Orthoclase (in eighteen analyses of Scotch felspar, by Dr. Heddle, this varies between 0·53 and 5·5%), the division of Andesine between Oligoclase and Labradorite, and the occurrences between this last and Anorthite, which have been called Bytownite. The best way is to compare the specimen with fragments of known composition, one on one side of the flame, the other on the other.

Another plan is that of Dr. E. Boricky, depending on the facts that a dilute solution of fluosilicic acid decomposes silicates, and that the fluosilicates of several of the bases which occur most frequently in minerals crystallise in characteristic forms, and so can be detected, after the drying up of the drop of reagent, by means of the microscope. Thus Orthoclase leaves beautiful cubic and octohedral crystals of the Potash salt, and a few hexagonal prisms of the soda one. In the case of Albite the proportion of the two sorts of crystals is reversed.

For the purpose of separating portions of felspar for trial by either of these methods it is very convenient to use the heavy solution of iodide of Hg. in iodide of K. which Sonstedt proposed, and which is now being much used, especially in Germany, to get out the various constituents of a rock for purposes of analysis. The solution can be got of a sp. gr. of just over three, so that felspars and quartz float while augite sinks. By careful dilution quartz and felspars can be then separated, and even Orthoclase, from the Triclinic ones. This is also proposed by Goldschmidt* as a very convenient and very accurate means of obtaining the sp. gr. of the constituent minerals of a rock even when only one or two grains can be detached, for if the dilution be carried so far that the fragment remains suspended anywhere indifferently in the fluid the sp. gr. of the solid and that of fluid must be equal, and may be easily determined in the case of the latter by means of the sp. gr. bottle.

The optical method of determining what is the particular felspar in a rock is founded on the fact that the position of the optic axes with respect to those of form varies in the different species. Of course Orthoclase is distinguished from the Plagioclases by its monoclinic symmetry—*i.e.*, in a section of a rock some crystal sections will probably be found in which "extinction" happens when the composition line of the twin structure is parallel to the principal plane of one of the Nicols. It is, however, the discrimination of the Triclinic specifics which is so difficult, and in many cases quite impossible. We have to pick out in the section those crystal sections which extinguish at equal angles on both sides the Nicol plane, and then measure this angle in as many cases as we can find. Now symmetrical extinctions only show that the plane of section has accidentally passed through the crystal perpendicular to the twinning plane, and therefore the extinction angle may vary within wide limits, and it is only by noticing the *maximum* angle that we can form any conclusion whatever; † *e.g.*, in trying to determine a felspar a short time ago I found an extinction of 16° on one side and 17½° on the other—*i.e.*, 33½° from one to the other. Now if I had only been able to find this one tolerably symmetrical extinction I could not have told which felspar it was. It would probably not have been Albite, seeing that the angle in that case should not have exceeded 31½°, but I could have gone no further. When, however, I found further angles of 44°, 48°, 53½°, 54°, 56°, 58°, 66°, 71°, 73°, there was enough to assure me of the presence of a very basic *Lime felspar*, and the observation of one grain showing the zonal structure to be presently mentioned with an extinction angle of 48° in some parts and of 82° in others, made the presence of both Labradorite and Anorthite almost a certainty. In this case a large number of observations could be made, and therefore such a degree of probability produced that I was not at all surprised to find the observations quite confirmed by Szabo's flame reactions, some of the grains which I was able to detach being much more fusible than others, and all

* Neues Jahrbuch I., 1881. Beilage Band, p. 179.

† The following table of the angle between the extinction positions of two Twin Lamellæ in the various Felspars may be of service. The section is supposed perpendicular to the plane of twin composition, and the angle given is the maximum observable for each species:—Orthoclase, 0°; Microcline, 36°; Albite, 31½°; Oligoclase, 37°; Labradorite, 62½°; Anorthite, 74½° and upwards. In sections parallel to the Basal cleavage:—Microcline, 30°—32°; Albite, 7°—8° Oligoclase, 2°—3°; Labradorite, 10°—14½°; Anorthite, 57°—74°.

showing a low alkali percentage—*i.e.*, the presence of the two most basic Lime felspars. But the essential condition of obtaining any satisfactory result is the possibility of finding *many* symmetrical extinctions, and even then Dr. Becke, who has studied this a good deal, says that the division and discrimination leaves much to be desired, and should only be relied on in default of more certain methods.

The optical method, however, is quite trustworthy and accurate when it can be applied to fragments obtained by cleavage and placed in definite directions in the field of the microscope. But this naturally demands a certain size in the crystals, so that manageable pieces may be detached. As an example, I may mention that in a north country dyke large clear glassy felspar crystals occur, which my friend Mr. Teall determined optically as Anorthite, the determination being fully borne out by a subsequent chemical analysis.

Passing now to the general features, common to all the different species of Felspar, there is not much that is characteristic, at any rate microscopically. According to the rock in which they occur, they are found to enclose the various minerals associated with them, and, in addition, portions of the ground mass or glassy base, where this occurs, and sometimes, though rarely, the so-called water cavities—*i.e.*, little drops of water shut in by the growing crystal. These inclusions are very frequently arranged in bands round the outline of the section of the crystal, showing that during the time it was forming changes of condition took place, and this is also strikingly shown by the Zonal structure, as it is called, even when there are no inclosures to accentuate it and make it visible without polarised light. A crystal showing this typically does not extinguish all over its extent in any one position between crossed prisms, but bands, more or less nearly following the outline of the grain, become dark, and on continuing the rotation, the extinction passes to other bands, showing, according to the optical method mentioned just now, a difference of composition from band to band.

Some felspars are particularly beautiful minerals, on account of the play of colours they exhibit. In addition to the beautiful green amazon stone from various localities, which is remarkable as being a pure Potash felspar, and yet *Triclinic*, we have the Aventurine or Sun Stone of Norway; Oligoclase, with extraordinarily delicate flakes of a mineral which is probably Hematite, and the well-known Labradorite from Paul Island, Labrador, with its exquisite play of blues and greens, which is also due to inclusions in its substance, though the nature of them is at present quite a matter of dispute. Those who went to Oxford the other day saw in the new schools a beautiful piece set in amongst the marbles of the staircase, and in the Museum is a fine slab of considerably larger dimensions. I am sorry that I can show you to-night only small specimens, but there is a case of beautiful polished specimens in the Corporation Art Gallery which will well repay a visit and examination.

The course of the decomposition of these minerals is most generally by the washing out of the alkaline silicates, and the consequent formation of Kaolin when pure, or of Clay when less so. The China Clay industry of Devon and Cornwall is, as you are well aware, an extremely important one, and the processes of washing, settling, and drying are very interesting to witness, not least perhaps as proving the great length of time that fine particles may remain suspended in water, and the beautiful green colour which is produced by the multitudinous reflections from them while so suspended. In some other cases the decomposition of felspar seems to have resulted in its complete removal—*e.g.*, in the so-called Serpentine of Clicker Tor, by Menheniot, near Liskeard, the original presence of felspar is proved by its still existing where it was completely inclosed by the Augite, which is very little, if at all, changed, and by the forms of the spaces where it indented this mineral, but in the Serpentine of the rock there is no trace of it at all. In the change of the Olivine to Serpentine the felspar has utterly disappeared.

In other cases Zeolites and Potash Mica, with the Tridymite form of Silica, result from the decomposition of Orthoclase, while in the case of the Lime felspars, as Labradorite and Anorthite, the curious aggregate called Saussurite, or False Jade, is perhaps as common as any form of alteration product. The analyses show that there is very often a percentage of ferrous oxide or magnesia, which can only be accounted for by supposing a simultaneous alteration of the Pyroxene or Horneblende associated with it, and a mixture of the products.

I have omitted a good many points which would have been of interest if they could have been properly exhibited to you. In particular, I should have liked to have spoken rather more of the different twinning systems prevalent, and of the compound twinnings which produce such curious appearances of gratings in polarised light. The minute crystals, too, in some Obsidians, which have some claim to be thought incipient Orthoclase, and the curious structural peculiarities of some of the massive forms, but this paper, although but superficial and cursory in the treatment of the subject, has already extended to quite as great a length as I can reasonably ask you to listen to, so I will conclude by referring those who wish to inquire further into the subject to—

Geikie's Text-book of Geology.

Green's Physical Geology, where there is a good résumé of the optical properties of the various felspars.

Rutley's Study of Rocks.

Bauerman's Systematic Mineralogy, for some information on the crystallography and twinning.

Zirkel's Die Mikroskopische Beschaffenheit der Mineralien und Gesteine.

Rosenbusch's Mikroskopische Physiographie der petrographisch wichtigen Mineralien.

Szábo's Eine neue Methode die Felspathe auch in Gesteinen zu bestimmen.

Boricky's Pamphlet on the method of discrimination by the use of Hydrofluosilicic Acid.

(The last four in German.)

Fouqué and Levy's grand book on Microscopic Petrology "Les Roches Eruptives de la France."

DR. BUCKLAND AND THE GLACIAL THEORY.

The following notes of a discussion that took place at a meeting of the Geological Society of London, on November 18th, 1840, were made by my father, the late Dr. S. P. Woodward, at that time sub-curator to the Society. The discussion followed the reading of the first part of a "Memoir on the Evidences of Glaciers in Scotland and the North of England," by the Rev. Professor Buckland, D.D., Pres. G.S., commenced on the 4th of November, resumed and concluded on the 18th of the same month.* At the previous meeting Professor Agassiz, then of Neuchâtel, had communicated his celebrated paper on Glaciers, and the evidence of their having once existed in Scotland, Ireland, and England; and in explanation of the subject it may be best to quote the following paragraphs from "The Proceedings of the Geological Society" (vol. iii., pp. 332, 333), in which abstracts of these Memoirs appeared. H. B. W.

"Dr. Buckland's attention was first directed by Professor Agassiz, in October, 1838, to the phænomena of polished, striated, and furrowed surfaces on the south-east slope of the Jura, near Neuchâtel, as well as to the transport of the erratic boulders on the Jura, as the effects of ice; but it was not until he had devoted some days to the examination of actual glaciers in the Alps, that he acquiesced in the correctness of Professor Agassiz's theory relative to Switzerland. On his return to Neuchâtel from the glaciers of Rosenlaui and Grindelwald he informed M. Agassiz that he had noticed in Scotland and England phænomena similar to those he had just examined, but which he had attributed to diluvial action; thus in 1811 he had observed on the head rocks on the left side of the gorge of the Tay, near Dunkeld, rounded and polished surfaces; and in 1824, in company with Mr. Lyell, grooves and striæ on granite rocks near the east base of Ben Nevis. About the same time Sir George Mackenzie pointed out to the author in a valley near the base of Ben Wyvis, a high ridge of gravel, laid obliquely across, in a manner inexplicable by any action of water, but in which, after his examination of the effects of glaciers in Switzerland, he recognizes the form and condition of a moraine.

*The reading of a paper on "The Geological Evidence of the Former Existence of Glaciers in Forfarshire," by Charles Lyell, jun., Esq., F.R.S., etc., was commenced at this meeting.

"After these general remarks, Dr. Buckland proceeds to describe the evidence of glaciers observed by him in Scotland last autumn, partly before and partly after an excursion, in company with Professor Agassiz; but he forbears to dwell on the phænomena of parallel terraces, though he is convinced that they are the effects of lakes produced by glaciers."

The following discussion then took place* :—

Mr. Murchison called upon the mathematicians and physical geographers present to speak of the objections to Dr. Buckland's glacial hypothesis—himself should attend only to the facts of the case. Of the scratches and polish on the surface of certain rocks there is no doubt, and "Are glaciers the cause?" is the question. Could they be done by ice alone? If we apply it to any as the necessary cause, the day will come when we shall apply it to all. Highgate Hill will be regarded as the seat of a glacier, and Hyde Park and Belgrave Square will be the scene of its influence. Dr. Buckland has in his paper *assumed* that all these heaps of diluvium are moraines; but I would rather examine the subject under the old name Diluvium, and with our old ideas of diluvial action, than by using the term moraines assume the question proved. On Schiehallion there are . . . . rocks. If Schiehallion had been covered with glaciers there ought to be some. . . . If the height be great the result should be proportionate. There ought to be a co-ordinate relation in the phenomena. But in the Highland mountains, not one-third the elevation of the Alps, we have moraines two or three times the magnitude of any known in Switzerland. Formerly, when we found traces of fragmented rocks disposed around a mountain, we attributed them to the successive periods of elevation in that mountain. The parallel roads of Glen Roy were compared to sea-beaches; now all are attributed to the action of ice. And not only these, but Edinburgh and Stirling, and other places equally out of the reach of such actions, did glaciers ever exist in the higher chains, are to be covered with a mass of ice! These grooved and striated surfaces and heaps of boulders are also to be found in Scandinavia, on the east of the Gulf of Bothnia, all proceeding from the north and north-west. Have these crossed the gulf on ice? In Russia, too, we shall find them where there are no mountains. And if we look to the remains of marine shells found in beds elevated, differing in no respect from those in our present seas, except that they are called "Pleistocene" (by James Smith and Lyell), we have proof of a lower elevation at the very time (the period following upon the more tropical epochs), when these glaciers should be introduced. On these accounts I am still contented to retain our old ideas, that when a mountain was elevated,

* I insert one or two remarks in square brackets to complete the sense of the observations; otherwise the discussion is an exact copy of my father's notes.—H. B. W.

or a body of water passed over a series of elevations, the diluvium would descend with the strike and be disposed in mounds and terraces according to the direction of currents, etc.

Professor AGASSIZ.—Mr. Murchison has objected to the glacial theory in the only way in which it could be objected to. He allows that the whole is granted as soon as you grant a little bit. For here, as in other cases, we argue from what is proved, to what is to be proved. In Switzerland the action of glaciers is yearly seen by thousands of foreigners, and of these facts there can be no doubt, [nor as to the former] extent of glaciers. In the glacier de l'Aar, grooves, etc., are to be found in the valley 7 leagues (22 miles) from the end of the present glaciers. Did we find these surfaces only on the hard rocks, we might suppose they were merely uncovered by the action of the glaciers; but on the soft limestone rocks these grooves are only to be seen on the surfaces from which the glacier has just retreated. Many glaciers traverse such rocks only (equivalents of our Lias), and there the grooves are annually renewed in winter, and removed by the atmospheric action in summer. I have been many hundred feet under the glacier of Monte Rosa, and found the quartzose sand forming a bed beneath, and acting like emery upon the rocks. A moraine may be distinguished by certain characters from other any accumulation of fragmented rocks. From the sides of the glaciers moving faster than the middle, there is a continual tendency to throw the fragments into lines at the sides (lateral moraines), and when two glaciers descending from different gorges unite, a medial moraine is formed. The lateral [moraines] are exposed to constant friction with the rocks with which they are brought in contact, and their terminations are passed over by the whole mass of the glacier, so that they become rounded and striated; whilst the medial moraines, remaining on the surface, continue angular. When the glacier retreats in the summer, the medial moraine, composed of angular fragments, is spread out over the surface of the lateral and terminal moraines, composed of rounded fragments; and it is by these characters that we have proved the existence of moraines in Scotland, Ireland, and the north of England. There are moraines in the Alps 200 feet wide, composed of boulders several feet in diameter.

Mr. LYELL spoke of the size of moraines, and the way in which they might, under certain circumstances, attain any magnitude. A glacier has been known to retire half a mile in a single summer; [a number of] moraines have been in succession left, and in severe winters all these might be driven successively into one by the downward motion of a glacier.

Mr. GREENOUGH spoke of the arguments derivable from analogy, etc., and objected to the mode in which the Geological Society was in the habit of accounting for phenomena. Instances of accumulations of travelled rocks [occur in] North Germany; from a careful comparison some of these must have crossed the Baltic. In the valleys of

Switzerland some deposits must have crossed Lake Geneva, and ascended very high mountains. Does Professor Agassiz suppose that the Lake of Geneva was occupied by a glacier 3,000 feet thick? (AGASSIZ.—"At least!") [Mr. Greenough then referred to the] Changes of climate necessary to account for these phenomena [and to the] objection from the tropical nature of remains in recent deposits. [He considered it to be the] climax of absurdity in geological opinions. In one period, the Crag, we have three opposite conditions blended: Corals, Tropical; Peat, Temperate; Shells, pronounced by Dr. Beck, Arctic!

Mr. LYELL.—Mr. Greenough confuses four distinct epochs under the name of Crag. The first comparatively tropical (Coralline Crag), the others temperate (Red and Norwich Crag), and the period of the peat bogs (Lacustrine deposits) more recent than any.

Mr. JOHN EDWARD GRAY.—The corals of the Crag appear to me as Arctic as the shells. I know no reason for making them tropical.

Mr. GREENOUGH [remarked] on the size of the blocks on mountains, the agency of floating ice, and on mountains as the physical boundaries of different kinds of diluvium.

Dr. MITCHELL enquired if Dr. Buckland confined the glaciers to the Highlands or whether he made them descend to the Lowlands.

Dr. BUCKLAND expressed himself ready to answer any question on the subject under discussion, or any involved in his paper, but considered the present question irrelevant.

Dr. MITCHELL considered his question relevant to the subject.

Dr. BUCKLAND rose to reply, but Mr. WHEWELL rose (cheers and "Mr. Whewell!")

Mr. WHEWELL.—At this late hour it is impossible to go into the question of the physical changes necessary to allow of the existence of glaciers in this country. I shall, therefore, confine my remarks to the subject as discussed this evening, and it does appear to me that the way in which Mr. Lyell has treated it is not the most fair and legitimate. He says, "If we do not allow the action of glaciers, how shall we account for these appearances?" This is not the way in which we should be called upon to receive a theory. Now it is not within our reach at present to refer each set of phenomena in geology to its adequate cause, but that is no reason why we should receive any theory that is offered to account for it. This glacial theory is brought forward to explain what has hitherto, to a great extent, been found inexplicable — the nature and position of diluvial detritus over considerable areas and in widely different climates. So far as it is founded on strict comparison and analogy, it is to be received; but we must not overrate its influence; and it appears to me *incomplete* in three important particulars:—*Firstly*, in accounting for such an extent of diluvium over such wide areas, in countries of such opposite physical structure, surface, climate, etc. *Secondly* [from the] marine remains of the glacial period, showing the continents to be submerged. Mr. Darwin has described an island capped with snow in the equivalent latitude of Yorkshire, and by supposing an equal extent of water in our Polar regions, we might induce a degree of cold sufficient for that; but these glacial phenomena are found over too wide an extent to allow of that. (Mr. LYELL—"I have attempted to account for that in my paper"—here interrupted. Mr. BUCKLAND—"So have I in a paper which is not yet written!") Mr. WHEWELL, continuing—Our attention to-night is limited to Dr. Buckland's paper. *Thirdly*, the physical conditions under which glaciers now exist. We find them universally stretching out from lofty mountain-chains, which take their rise in *warm* climates, so as to allow of the downward motion and the retiring in summer. Mr. Lyell speaks of the prodigiously *rapid* retreat of a glacier which amounted to half a mile in a single summer. But where shall we obtain mountains as *fulcra* for glaciers, stretching many leagues into the plains, producing such results as are ascribed to their action in Scotland?

Dr. BUCKLAND resigned the chair to Mr. Greenough, and argued the *à priori* credit to be attached to his "narrative," from the circumstance of his having been a "sturdy" opponent of Professor Agassiz when he first broached the glacial theory, and having set out from Neuchâtel with the determination of confounding and ridiculing the Professor. But he went and saw all these things, and returned converted. And he considered the testimony of four such competent observers as himself, and Agassiz, and Renouard, and . . . who, next to Saussure, had spent more time in the Alps than any other geologist, sufficient to prove to all the truth of their observations, and the correctness of their inferences. He referred to Professor Agassiz's book, and condemned the tone in which Mr. Murchison had spoken of the "beautiful" terms employed by the Professor to designate the glacial phenomena. That highly expressive phrase "roches moutonnés," which he had done so well to revive, and that other "beautiful designation," the glacier remanié! remanié! remanié! continued the Doctor most impressively, amidst the cheers of the delighted assembly, who were by this time elevated by the hopes of soon getting some tea (it was a quarter to twelve P.M.), and excited by the critical acumen and antiquarian allusions and philological lore poured forth by the learned Doctor, who, after a lengthened and fearful exposition of the doctrines and discipline of the glacial theory, concluded—not as we expected, by lowering his voice to a well-bred whisper, "Now to," etc.,—but with a look and tone of triumph he pronounced upon his opponents who dared to question the orthodoxy of the scratches, and grooves, and polished surfaces of the glacial mountains (when they should come to be d——d) the pains of *eternal itch*, without the privilege of scratching!

GLACIAL MARKINGS IN THE RED MARL.*

By A. H. Atkins, B.Sc.

For some time past the attention of local geologists has been directed to the marks of Glacial action in the Midland Counties. Their efforts tend to prove that the traces of the Glacial epoch extend as far south as Birmingham at least, and that either a sheet of ice covered this neighbourhood, or else a number of ice-covered islands lay in the midst of an extensive Glacial sea. As is well known, the most common traces of ice action consist of *roches moutounées*, scratches on the rocks, and boulder clay containing striated and polished pebbles and boulders. The former evidences are scarcely possible near Birmingham, where all the rocks are too soft to receive or retain such markings. At the Rowley Hills, however, Dr. Crosskey has discovered large blocks of basalt striated in a manner which points to the action of ice.

Of the latter traces—viz., Boulder Clay, etc.—the best section in this locality is to be seen at California, near Harborne, where there is a thick bed of tenacious clay, containing fragments of all sizes most perfectly scratched and polished, which also show in which direction they have travelled, for among them may be found fragments of basalt, limestone coal-shale, limestone, slate, and in fact almost all the rocks which occur *in situ* between here and North Wales. Patches of a similar clay may be met with in other localities, as, for instance, Washwood Heath and Tysull. In almost every case it is accompanied and interbedded with masses of Drift, and there seems no doubt that these latter beds were deposited at about the same period.

This paper, however, as the title intimates, bears more especially on the traces found in the Red Marl, the uppermost division of the Trias formation.

This bed extends southward from Birmingham to Warwick and Stratford, and consists of marl interstratified with characteristic layers of brown sandstone and white or grey shale. These bands contain in abundance ripple markings, rain-drop impressions, and pseudomorphs of salt crystals, which, together with the beds of rock salt and gypsum which occur in this formation, show that it was deposited in a great continental salt lake, like the Dead Sea of the present era.

The Boulder Clay is not, at first sight, easily distinguishable from the Red Marl, but a close investigation will show that there is often a top layer of clay of very much better quality, commercially speaking, than the Red Marl below; a fact of which the brickmakers of the district are well aware. Mr. W. J. Harrison, F.G.S., first called attention to a section at Small Heath, where the white bands of the Red Marl were

* Abstract of Paper read before the Birmingham Natural History and Microscopical Society, 23rd January, 1883.

contorted in a remarkable manner, as if they had been subjected to an intense grinding action, and this peculiarity I have noticed to be very common in the neighbourhood.

The section, however, to which I especially wish to call attention occurs near Small Heath, at Mr. Sames's brickworks, situated at the junction of Garrison Lane and Cattell Road. When I first saw the pit I put it down as merely a section of red marl, but a closer inspection revealed many points of interest, and that the lower part only is red marl, with the usual bands of white shale. Above this is a layer about three feet in thickness of an unusually hard shale or sandstone, called by the brickmakers *roche*, and surmounting all a bed of very tenacious clay which varies in thickness according to the surface, but in its deepest part is about thirty feet, including about four or five feet of soil and gravel. The dip of the beds is about 5° S.S.E., and they are faulted shortly afterwards against the waterstones, the next lower division of the Trias formation. The fault runs right through the town, extending in fact from Barnt Green to Sutton Coldfield. The hard band is not found elsewhere in the neighbourhood, which is probably owing to the slight dip and the fact that this clay pit is situated on the highest point in the immediate locality. The height is in fact 430ft. above mean sea-level, while the next elevation near is only 420ft., the hard band indeed determining the escarpment which runs for some distance as a steep hill overlooking the whole town of Birmingham. The clay above the hard band contains some of the grey bands, but much twisted and broken. It is of a very different quality from the red marl, and bricks made from it fetch twice the price of those made from the latter.

Dr. A. Hill has very kindly made for me a chemical analysis of the different beds, which I reproduce here :—

	Red Marl.	Hard Band.	Boulder Clay
Silica	63·07	37·55	54·38
Peroxide of Iron	8·30	4·82	15·65
Alumina	10·54	8·16	16·58
Calcium Carbonate	4·53	25·80	1·02
Magnesium Carbonate	9·05	13·29	7·27
Potash	1·26	3·05	4·47
Soda	0·48	0·04	0·15
Water	3·43	6·99	0·94
	100·66	99·70	100·46

This analysis shows a considerable difference in the percentages of silica, and alumina in the Red Marl and Boulder Clay, when we take into consideration the fact that the samples were taken from the same section, but it is uncertain whether the discrepancy can be attributed to the results of Glacial action. There is a remarkable difference in the proportions of the soluble constituents, which might possibly be caused by the dissolving out of these substances during the rearrangement of the strata. We cannot learn much, however, from a single analysis, but I think if more analyses of the rocks in the district were made, and the results compared, considerable light would be thrown on the mode of their formation and the alterations they have undergone. The most remarkable fact connected with the section, however, is found at the top of the hard band. In removing the top layer of clay the workmen made a sort of platform, which Mr. Harper, the manager, pointed out to me, and kindly had left for my inspection. When the clay is removed the surface of the rock is found to be beautifully smoothed and polished, which appears to me to point very strongly to glacier action. The only other probable cause is the slipping of the clay above, but the very slight angle of dip seems to preclude this. On the whole the difference in the composition of the layers, the contorted strata, and the polishing of the rock surface, indicate the action of ice, and I think a more rigid investigation of the whole district would tend to confirm this theory.

I have brought the subject forward thus early, and in a rather crude form, in the hope that some of the readers of the "Midland Naturalist" may give the results of their researches, or be induced to pay a little attention to the matter. The field is a wide one, and it is probable that many more data may be obtained not only on the Red Marl, but throughout the district, which will help us to complete the history of the Great Ice Age, especially as it affects the Midland Counties.

In conclusion, I may mention that in another neighbouring clay pit, at the Adderley Park Brick Works, the clay above the marl is very tenacious and of good quality, but it contains numerous pockets of sand and pebbles. At this pit also is a curious little fracture in the Red Marl which has raised the grey bands in a sort of pucker about six inches high.

THE FLORA OF WARWICKSHIRE.

AN ACCOUNT OF THE FLOWERING PLANTS AND FERNS OF THE COUNTY OF WARWICK.

BY JAMES E. BAGNALL.

(Continued from page 212.)

GENTIANACEÆ.

ERYTHRÆA.

E. Centaurium, *Pers.* *Common Centaury.*
Native: On banks, waysides, pastures, and woods. Locally common. June to August.
I. Middleton; Shustoke; Maxtoke; Solihull; Knowle; Marston Green; Dukesbridge, etc.
II. Wellesbourn, *Herb. Perry;* Salford! *Rev. J. C.;* Harbury Heath; Alveston pastures; Marl Cliff; Billesley; Austey Wood, near Wootton Wawen; Lapworth; Meriden.

E. pulchella, *Fries.* *Slender Centaury.*
Native: In pastures in calcareous soils. Very rare. July.
II. Moreton Morrell, *H.B.!*

CHLORA.

C. perfoliata, *Linn.* *Yellow Centaury.*
Native: In wood and on waysides in calcareous or marly soils. July, August.
I. Plentiful on Galley Common near Nuneaton, *J. P. in B. G.*
II. Great Alne! Grafton! near Rolls Wood! *Purt.*, i., 194; Whitnash pastures, *Herb. Perry;* Billesley! near Alcester, *Blox.*, *N.B.G.S.*; Bidford! *Bree, N.B.G.*; Chesterton! *Y. and B.;* Lodge Woods, Salford, *Rev. J. C.;* Compton Verney! *Bolton King;* near Fullbrook, near Stratford-on-Avon, *Herb. Perry;* near Admington, *F. Townsend;* Marl Cliff; Drayton bushes; Bearley Canal bank; Austey Wood, Wootton Wawen.

GENTIANA.

G. Amarella, *Linn.* *Autumnal Gentian.*
Native: In dry pastures in calcareous districts. Rare. July.
II. Alne Hills, *Purt.*, i., 138; Moreton Morrell, *W. Satchell;* Alcester Road, from Stratford; hill between Billesley and Wilmcote; Banbury Road, 2½ miles from Stratford-on-Avon, *W. Cheshire, Herb. Perry;* Myton! near Norton Lindsay, *H. B.;* Gaydon, *Bolton King;* Red Hill, *Y. and B.*

MENYANTHES.

M. trifoliata, *Linn.* *Buckbean.*
Native: In bogs and marshes. Rare. May to July.
I. Coleshill Bog! *Bree, Purt.*, i., 122; Sutton, *Freeman, Phyt.*, i., 262; near Atherstone, *Harris;* Sutton Park, abundant; Coleshill Pool.
II. In a pit on the Alne Hills; Shelfield, *Rufford, Purt.*, i., 122; Westwood Heath; in the Windmill Field, near Haseley, *Perry, Fl.*, 17; *Herb. Perry;* Allesley, *Bree, Purt.*, iii., 340; Fern Hill! Kenilworth, *Y. and B.;* Snitterfield bushes, *Cheshire;* near Tile Hill Wood, in abundance.

LIMNANTHEMUM.

[*L. nymphæoides,* Linn. *Fringed Buckbean.*
Denizen: In pools. Rare. July, August.
I. Packington Park, abundantly, *Freem., Phyt.*, i., 262; Packington, in still waters, *T. Kirk., Herb. Perry*, 1848.
II. Ornamental waters, Newbold House, *Blox.*, 1871.
This is an introduced plant in all these stations.]
[*Polemonium cæruleum,* Linn., has been found occasionally by Mr. Bromwich in South Warwickshire, and by myself near Shirley, but cannot be regarded as more than an escape from cultivation.]

CONVOLVULACEÆ.

CONVOLVULUS.

C. arvensis, *Linn.* *Small Bindweed.*
Native: On banks, waysides, and in fields. Common. June to August. Area general.
C. sepium, *Linn.* *Great Bindweed, English Scammony.*
Native: In hedges and copses. Locally common. July to September or later.
I. Hedge, near Tyburn; Middleton; Hartshill; Shustoke; Meriden; Solihull; Monkspath, etc.
II. Bidford; Alcester; Stratford-on-Avon; Kenilworth; Coventry; Newbold-on-Avon; Shotwell, etc.

CUSCUTA.

C. Epilinum, *Weihe.* *Flax Dodder.*
Casual: On flax. Rare. July.
II. On flax, near Stratford-on-Avon, *Cheshire, Herb. Perry;* Bidford, *Dr Lloyd, Herb. Perry.*

C. europæa, *Linn.* *Great Dodder.*
Native: In cultivated fields. Rare. July.
I. Flax-fields about Packington, *Aylesford, B. G.,* ii., 634.
II. At Shipton-on-Stour, *Dr. Jones,* 1833; *Baxter,* i.; observed one season on clover at Allesley, *Bree, N. B. G.;* river banks; Honington Hall Gardens, seen one year only, *F. Townsend;* near the Windmill on the Tachbrook Road, 1848, *Herb. Perry.*

C. Epithymum, *Murr.* *Lesser Dodder.*
Native: On banks and waysides. Rare. July, August.
II. On waysides near Dunchurch, 1881! *H. W. T.;* abundant on a bank near Bidford.

C. Trifolii, *Bab.* *Clover Dodder.*
Alien: In cultivated fields. Rather rare. July, August.
I. Clover fields at Springfield, Temple Balsall. Very abundant.
II. Clover fields near Rugby, 1871, *Rev. A. Blox.;* on the Warwick Road from Stratford-on-Avon, *Cheshire, Herb. Perry;* Myton, Moreton Morrell, *Y. and B.;* clover field and gardens at Combe Abbey, *L. Cummin;* Kineton, 1876, *Bolton King;* Red Hill.
[*C. hassiaca,* Pfeiff., occurred as an introduced plant in a field near Rugby, *R. S. R.,* 1869].

SOLANACEÆ.

SOLANUM.

S. Dulcamara, *Linn.* *Woody Nightshade.*
Native: In hedges, woods, thickets, and on waysides. Common. June to September. Area general.

S. nigrum, *Linn.* *Black Nightshade.*
Native: In gardens and fields. Rare and local. July to September.
II. In many places near Warwick! *H. B.;* garden weed, Alveston Heath.
I have never seen this in any of the Tame Basin districts, and believe it to be very rare in this portion of the county. The variety with green fruit occurs abundantly in a shrubbery at Warwick.

ATROPA.

A. Belladonna, *Linn.* *Deadly Nightshade.*
Denizen: In stone quarries. Very rare. July.
I. Sutton Coldfield, Warwick, *Ray. Syn.,* ii., 266; "Near Solihull Garden, where it was introduced from Beausale," *Herb. Perry;* Stone Quarry, Oldbury, near Atherstone! *G. Harris,* 1880.

HYOSCYAMUS.

H. niger, *Linn.* *Common Henbane.*
Native? Road sides, amongst rubbish. Rare. July.
II. Great Alne, Wixford, *Purt.,* i., 128; at the Scar, Hampton Lucy, *Cheshire, Herb. Perry;* near Stratford, on the Warwick road, *Perry, Fl.;* Salford, New Inn Road, *Rev. J. C.*

DATURA.

[*D. Stramonium,* Linn. *Thorn Apple.*
Casual: On rubbish heaps. Rare. July.

II. Salford, Alcester, *Purt.*, i., 127; on a bank at Saltisford, Warwick, *Perry, Fl.;* Hatton, on the road to Grove Park, *Herb. Perry.*]

[*Physalis Alkekengi*, Linn., is recorded as naturalised on waste ground at Foleshill, *T. Kirk. Phyt.*, ii., 971; garden weed near Warwick Priory, *Herb. Perry.*]

SCROPHULARIACEÆ.

VERBASCUM.

V. Thapsus. *Linn.* *Great Mullein. High Taper.*

Native: On hedge banks and waste places. Very local. July to September.

I. Railway banks near Wylde Green; lane from Forge Mills to Water Orton; road from Coleshill to Stonebridge; near Curdworth Bridge; near Arley Wood.

II. Salford Priors! *Rev. J. C.;* clay pits, Dunchurch Road, near Rugby, *R. S. R.*, 1877; Honington! Tredington, *Newb.*, Lapworth Street.

V. nigrum, *Linn.* *Black Mullein.*

Native: On hedge banks and roadsides. Rare. July, August.

II. Between Ashow and Stoneleigh, *Perry*, 1817; Hampton Lucy, 1828; near Leamington, 1835; Wasperton, 1835; Ashow, *Herb. Perry;* Stoneleigh, *Bree, Mag. Nat. Hist.*, iii., 163; Bagington, *T. Kirk, Phyt.*, ii., 971; Hatton Rock; Milverton, *Y. and B;* between Stratford-on-Avon and Eatington.

[*V. virgatum*, With. *Large-flowered Mullein.*

Casual in waste places. Rare. July, August. Near the old bridge, Warwick Castle, probably extinct now, *H. B.*]

[*V. Blattaria*, Linn. *Moth Mullein.*

Casual: On hedge banks. Very rare. July.

II. Near Little Kineton, *Herb. Perry;* near Ipsley, *J. T. Slater;* Friz Hill, near Wellesbourn Hastings, *H. B.*]

A plant frequent in cottage gardens, and as it only occurs in single individuals cannot be considered as more than an escape in this county.

V. Thapso-virgatum, *Hybrid.*

Casual: In quarries. Very rare. July, August.

II. Stone quarries near Warwick, *H. B.!*

SCROPHULARIA.

S. Balbisii, *Hornem.* *Common Water Betony.*

Native: In ditches, by streams and damp waste places. Locally common. June to August or September.

I. Sutton Park; Middleton; Hartshill; Meriden Marsh; Olton; Packington, etc.

II. Salford Priors! *Rev. J. C.;* Honington, *Newb.;* near Stratford-on-Avon; Wixford; Marl Cliff; Alveston pastures; Itchington; Binton; Brandon; Ansty; Willoughby, etc.

S. nodosa, *Linn.* *Knotty-rooted Figwort.*

Native: On hedge banks and waste places. Common. May to September. Area general.

S. Ehrharti, *Stev.* *Water Betony.*

Native: In ditches and streams. Very rare. July, August.

II. Ditch near Chesterton; Tachbrook brook, near Tachbrook! *H. B.;* abundant this year (1881) near Compton Verney.

DIGITALIS.

D. purpurea, *Linn.* *Foxglove.*

Native: On hedge banks, roadsides, ruins, heath lands, railway banks, and in woods. Common and local. June, July.

"It is plentiful about Rugby," *Baxter* ii., 1834.

Frequent in the sandy soils of the Tame basin, but very local in the calcareous soils of the Avon basin.

ANTIRRHINUM.

A. majus, *Linn.* *Common Snapdragon or Calfsnout.*

Alien or casual: On old ruins, walls, and railway banks. Rare. July to September.

I. On rocky banks of railway near Arley Station, possibly planted. Railway bank between Hampton and Berkswell.

II. Salford, *Purt.*, i., 288; "On an old wall at the bottom of the garden, Lawford Hall, near Rugby," *Baxter*, iii.; old town wall, Coventry, *Kirk.*, *Herb. Perry;* Stoneleigh Abbey, *Kirk*, *Herb. Perry;* Westgate, Warwick! *Y. and B.;* Railway banks, near Coventry.

A. Orontium, *Linn.* *Corn Snapdragon.*

Colonist: In cultivated land. Very rare. July, August.

II. Railway cutting, Myton, *Herb. Perry;* a weed in the Rectory garden, Shipston-on-Stour, *Newb.*

(To be continued.)

Correspondence.

Fungi from near Birmingham.—I have lately had the pleasure of adding the following rare species to the Flora of this district:—*Agaricus nitidus*, Fr., remarkable for the dense angular warts on the pileus, and its beautifully white and shining stem; *Ag. inopus*, Fr.; *Ag. pullatus*, agreeing exactly with plate 237 of Cooke's "Illustrations," noticeable for the strong contrast between the pure white gills and the almost black pileus; all from Coleshill Pool. *Boletus alutarius*, Fr., from Hints Wood, a species belonging to that section of the Boleti in which the spores have a rosy hue; and *Hypomyces Baryanus*, Tul., from Solihull, parasitic on the gills of *Nyctalis parasitica*, which is itself parasitic on *Russula adusta*.—W. B. Grove, B.A.

Macropis labiata.—This rare and beautiful bee has not been exterminated from this locality (as some rushers into print imagined it would be when I recorded my captures last year). I have seen both males and females—some at rest upon flowers, principally those of thistles, whilst others were flying around enjoying the gloriously hot weather of last month. I have not yet discovered their home, as it is a difficult matter following these bees on the wing, especially when they fly over the canal. On August 7th I had the good fortune to capture a magnificent hermaphrodite, every part—mandible, antennæ, wings, legs, and half the sexual organ—on the right side being those of the male, whilst the corresponding parts on the left were those of the female—the beautiful yellow face of the male contrasting with the black half of the female. I had the pleasure of exhibiting this unique specimen at the Entomological Society of London. Instances of hermaphroditism among the Hymenoptera are very rare; in fact, so far as I have been able to ascertain, there is but one on record—that of *Anthophora acervorum*, figured in Smith's "Bees of Great Britain," plate 5, figs. 2 and 2a. In this specimen the left side is male, the right female.—Fred. Enock, Woking Station.

VIOLA SYLVATICA, *var.* REICHENBACHIANA.—In your issue for July I notice appended to my remarks on *Viola sylvatica*, var. *Reichenbachiana*, a note by my old friend Mr. Bagnall, to the effect that the finding of that plant had not been recorded by me. I have before me a copy of the "King Edward's School Chronicle," dated Saturday, June 9, 1877. In page 33, vol. ii., and in an account of an excursion of the School Natural History Society on May 2, 1877, from Claverdon to Preston Bagot, Henley, and Knowle, among the rare plants recorded is *Viola sylvatica*, var. *Reichenbachiana*, the plant in question. I had found it a few weeks previous, and now pointed out its peculiarities to the members. Again, before me is the annual report of the Birmingham School Natural History Society for 1877, printed at the "Herald" Office, and here I find a similar record on page 10. If you would kindly set this right by a line in your next issue I should be glad. Unfortunately there was no "Midland Naturalist" in 1877.—JAMES TURNER.

BOTANICAL NOTES FROM SOUTH BEDS.—EARLIEST OBSERVED DATE OF FLOWERING FOR 1882 AND 1883, WITH VOUCHER SPECIMENS:—

NAME.	Date. 1882.	Date. 1883.	Aspect.	Habitat.
Mercurialis perennis (male)	—	Jan. 1	W.	Wood.
" " (female)	—	" 28	W.	Hedge bank.
Tussilago Farfara	Jan. 25	" 22	S.W.	Railway bank.
Helleborus viridis	" 7	Feb. 4	W.	Hedge bank.
Potentilla Fragariastrum*	" 15	" 24	W.	Hedge bank.
Salix Caprea	Mar. 5	" 25	Open	Hedge row.
Adoxa Moschatellina	—	Mar. 11	S.W.	Coppice.
Draba verna	Feb. 19	" 11	Open	Gravel walk.
Anemone nemorosa	Mar. 3	" 24	W.	Coppice.
Nepeta glechoma	" 18	" 26	S.W.	Hedge bank.
Anemone Pulsatilla	" 22	April 4	S.E.	Chalk hills.
Primula veris	" 18	" 1	S.	Hedgebank.
Luzula pilosa	—	" 7	W.	Moist wood.
" campestris	Mar. 25	—	Open	Moist meadow.
Prunus spinosa	" 16	April 8	"	Hedge row.
Ranunculus auricomus	" 26	" 8	W.	Under trees.
" bulbosus	April 8	—	W.	Meadow.
Scilla nutans	Mar. 29	April 13	W.	Coppice.
Stellaria Holostea	" 20	" 21	W.	Hedge bank.
Cardamine pratensis	April 8	" 21	Open	Moist meadow.
Sisymbrium Alliaria	" 10	" 21	W.	Hedge bank.
Veronica Chamædrys	" 22	—	W.	Hedge bank.
Cratægus monogyna	" 30	May 16	Open	Hedge row.
Geranium Robertianum	—	" 17	W.	Hedge bank.

* Gathered in Bricket Wood, Herts, April 11, 1883.

Besides the above, a single blossom of *Caltha palustris* was gathered on February 14, 1883, but the subsequent frosts prevented others from appearing in any quantity till the middle of March.—J. SAUNDERS, Luton.

THE DIORITE OF CHARNWOOD FOREST.—Near Brazil Wood, Charnwood Forest, is a knoll of diorite, "distinctly crystalline, and remarkably tough and refractory." Occurring alone, as it does, in the middle of a field, there is nothing to show its relationship either to the granite or the micaceous schist (gneiss) exposed in the wood. While hammering at this diorite a short time since I obtained some specimens showing a junction between granite and diorite. The junction in the specimens is sharp and clear. The thick growth of lichens on the rock had hidden the characteristic weathering of the granite, making it appear all diorite. The granite of the junction specimens cannot be distinguished from that of the exposure in the wood. This favours the supposition that the diorite is a dyke in the granite, which, by its superior hardness, has withstood the denudation that has worn away the granite. From appearances—the sloping downwards towards the plain of the granite in the wood, the circular and knoll-like character of the diorite—the denuding force, I should think, was land ice, probably during the later Glacial period, when Charnwood was an independent centre, sending glaciers into the valleys below.—H. E. QUILTER, Leicester.

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—GEOLOGICAL SECTION, August 28th.—The following exhibits were made:— Mr. W. H. Wilkinson, sen.: Lichens from the Highlands of Scotland, including *Cladonia rangiferina*, *Parmelia physodes* var. *platyphylla*, in fruit (very rare in fruit), *P. saxatilis* varieties *sulcata* (rare in fruit) and *omphalodes*; *P. olivacea*; *Physcia pulverulenta*, *P. parietina*; *Lecanora tartarea*, *L. parella* var. *pallescens*, and *Pertusaria communis*. Mr. J. E. Bagnall, the following fungi: *Boletus edulis*, *Lactarius pyrogalus*, *L. camphoratus*, *Russula integra*, *Rhytisma acerinum*, all from Baddesley Clinton; *Boletus scaber*, from Middleton; and a Moss *Gymnostomum tenue* (very rare), from Shrewley Common; also, for Mr. W. R. Hughes, F.L.S., a number of interesting plants from South Devon, including *Scilla autumnalis*; *Erica cinerea*, *flore albo*; *Spiranthes autumnalis*; *Cuscuta epithymum*, etc. Mr. W. B. Grove, B.A., the following fungi: *Agaricus platyphyllus*, *Ag. maculatus*, and *Rhizina lævigata*, from Sutton Park; *Ag. humilis*, from Sutton; *Ag. rutilans*, *Lactarius quietus*, *Polyporus dryadeus*, *Nectria peziza*, *Phragmidium*, *violaceum*, *Puccinia striola*, *Coleosporium rhinanthacearum*, *Stigmatea Robertiani*, *Uncinula bicornis*, *Erysiphe tortilis*, *E. Martii*, and *Sphærotheca Castagnei*, from Barton Green; also for Mr. C. B. Caswell, *Thelephora puteana*; and for Mr. R. M. Lloyd, *Tubulina cylindrica*. Mr. W. J. Harrison: Agate nodules, from North Wales. Mr. W. J. Harrison, jun.: Rocks from Criccieth, and Quartz Crystals from Beddgelert, North Wales. GENERAL MEETING, Sept. 4th.—Mr. S. Walliker exhibited (through the Secretary) a species of Lepisma "found in cotton-wool from Cyprus," about three or four times as large as the ordinary species. Mr. J. E. Bagnall exhibited *Epilobium tetragonum* (local), *Chara vulgaris* var. *longibracteata*, *Potamogeton natans*, *Lotus tenuis*, *Carduus eriophorus*, *Linaria Elatine*, *L. spuria*, *Rhamnus catharticus*, *Chenopodium polyspermum*, *Galeopsis Ladanum*, *Rosa stylosa* (new as a record for Warwickshire), *Odontites rubra* var. *flore albo*, *Urtica urens*, *Serratula tinctoria*, *Lithospermum officinale*, *Clematis Vitalba*, *Colchicum autumnale*, all from Drayton; *Iris fœtidissima*, *Rumex Hydrolapathum*, *Chlora perfoliata*, from Wilmcote; *Scirpus acicularis*, from Bishopton; *Rubus calvatus*, from Marston Green, showing sepals passing into true ternate leaves, etc.; also (for Mr. W. R. Hughes) a series of plants from South Devon, including *Solidago virgaurea*, *Sedum dasyphyllum*, *Asplenium trichomanes*, *Usnea hirta*, etc.; and on behalf of Mr. J. Saunders, of Luton, *Sphagnum cuspidatum* var. *plumosum*, and *Tolypella intricata*, both rare. Mr. W. B. Grove exhibited the following fungi: *Russula nigricans*, *R. fragilis*, *Nyctalis parasitica*, *Hypoxylon fuscum*, *Phragmidium violaceum*, *Triphragmium ulmariæ*, *Puccinia straminis*, *P. galiorum*, *P. pulverulenta*, *Coleosporium rhinanthacearum*, *Erysiphe communis* (on Trifolium) and *Peronospora obliqua*, from Solihull; *Puccinia coronata*, *Dothidea graminis*, *Hysterium curvatum*, from near Berkswell; *Arcyria incarnata*, from Barton Green; *Dacrymyces deliquescens*, from Sutton; *Corticium evolvens*, from Warley Woods; also (for Mr. H. T. Soppitt) *Bactrodesmium abruptum*, from Yorkshire; (for Mr. W. H. Wilkinson) *Coleosporium petasitis*, from Arley; and (for Mr. Thos. Birks) *Œcidium Thalictri* and *Puccinia Magnusiana*, from Goole. Miss Jermyn exhibited a gall on a lime leaf from Kew. BIOLOGICAL SECTION, September 11th.—Mr. W. B. Grove exhibited *Ag. maculatus*, *Ag. dryophilus*, *Ag. pascuus*, *Ag. campanulatus*, *Ag. spectabilis*, *Ag. sublateritius*, *Amanita aspera*, *Hygrophorus pratensis*, *Cortinarius armillatus*, *C. cinnamomeus*, *Russula adusta*, *Boletus flavus*, *Polyporus betulinus*, *P. molluscus*, *Calocera viscosa*, *Rhizina lævigata*, and *Melampsora tremulæ*, from Coleshill Pool; *Ag. atro-albus*, *Ag. asterophorus*, *Russula fellea*, *Cantharellus aurantiacus*, *Marasmius androsaceus*, and *Boletus edulis*, from the Wrekin, Shropshire; and a number of other Fungi, on behalf of Mr C. F. W. T. Williams, of Bath. Mr. David Hooper exhibited *Arbutus Unedo*, *Narthecium ossifragum*, *Myrica Gale*, from Killarney, and *Crithmum maritimum*, from co. Cork, Ireland; Mr. E. H. Wagstaff exhibited a fungus, *Erysiphe communis*, from the banks of the Stratford Canal. MICROSCOPICAL GENERAL MEETING, September 18th.—Mr. Cullis, of Mason College, exhibited some specimens sent by Miss Helen von Mickwitz, of Helsingfors, Finland. One was *Linnæa borealis*, and the other *Rubus arcticus*. Mr. Bagnall said the former flower was interesting, as being named after the great Linnæus, and the other was especially so, as from the berries of the plant was made a rather fine preserve, which in Norway was very much esteemed. It is recorded that the berries once saved the life of a noted traveller who, when ill, was maintained for many days by them when no other palatable food was obtainable. The President (Mr. W. R. Hughes) expressed himself particularly pleased not only at the exhibition of the specimens themselves, but as showing that the Natural History Society was not forgotten by a Russian lady who some time was associated in their meetings, but who had now returned to her own country. Mr. J. E. Bagnall exhibited a number of Fungi:—*Ag. asterosporus*, *Ag. pascuus*, *Ag. cervinus*, *Ag. fusipes*, *Ag. conopilus*, *Cortinarius ochroleucus*, *C. decumbens*, *C. sanguineus*, *Russula fellea*, *R. rubra*, *Lactarius pallidus*, and *Boletus striæpes*, etc., from Middleton; and for Dr. M. C. Cooke, *Cortinarius tophaceus*, *Lentinus lapideus*, and *Boletus parasiticus*; also for Mr. W. R. Hughes, *Dianthus Armeria*, *Linum angustifolium*, *Centranthus ruber*, and other plants, from near Plymouth. Mr. W. B. Grove exhibited a number of Fungi, including *Lactarius pallidus*, *L. uvidus*, and *L. turpis*, *Ag. pascuus*, *Ag. tenerrimus*, *Ag. laccatus* var. *amethystinus*, *Ag. sanguinolentus*, *Russula emetica*, *R. ochroleuca*, *Helotium aciculare*, and *Ascobolus pilosus* from Four Oaks Park; *Ag. virgatus*, *Lactarius turpis*, *L. uvidus*, *Sporodinia grandis* from Coleshill Pool; *Tremella lutescens*, *Corticium evolvens*, *Diatrype disciformis* from the Wrekin; *Ag. applicatus*, *Stemonitis fusca*, and *Helotium lutescens* from Sutton; *Corticium giganteum* from Sutton Park; *Peziza nivea* rom Berkswell; (for Mr. C. R. Robinson) *Amanita aspera* and *Peziza aurantia* from Bewdley Forest; and (for Mr. J. A. Wheldon) *Peziza atrata* from Cambridge, and *Sphæria lirella* from Scarborough.

BIRMINGHAM MICROSCOPISTS' AND NATURALISTS' UNION.—August 11th.—Mr. Hawkes showed an abnormal inflorescence of Ribwort Plantain, in which the spikes were reduced in size but produced on short stalks, forming a simple umbel with a conspicuous leafy involucre. Mr. Buttress, living Blindwom. Mr. J. W. Neville, microscopical preparation of larva of *Piniperda*, showing the pine leaves upon which the creature fed enclosed in the alimentary canal. Aug. 18.—Mr. Hawkes: *Parnassia palustris*, from Sutton Park; also transverse section of stem of water lily. Aug. 25.—Mr. J. W. Neville: *Oidium monilioides*, on leaves of grass; *Phragmidium obtusum* and *Lecythea* on leaves of barren strawberry; and microscopical preparations of lancet and gizzard of the common flea. Mr. Hawkes: Eggs of Aphis. Mr. J. Wykes: Fredericella. Sept. 3.—Mr. Deakin: Spores of Trichobasis. Mr. H. Insley: *Porphyra laciniata* in fruit. The following micro-fungi were laid on the table by Mr. Deakin:—Sallow Rust, *Peronospora infestans*, and *Uromyces apiculosa*, on leaves of white clover. Sept. 20.—Paper, "Natural History of a Holiday Ramble," by Mr. C. P. Neville.

PRACTICAL NATURALISTS' SOCIETY.—On Saturday, September 15th, a meeting of the Scotch members of the Practical Naturalists' Society was held in Edinburgh. The earlier part of the day was spent in rambling over the Pentland Hills for the purpose of investigating the entomology of the district. In spite of the foggy weather which prevailed during the day a fair list of captures was made up. In the evening the members assembled in their temporary meeting room, when several excellent papers were read, and a large number of specimens in all departments of Natural History was exhibited.

NOTTINGHAM NATURALISTS' SOCIETY.—Three excursions have been made under the auspices of this Society during the past summer, all well-attended and much enjoyed. The first was on June 28th, to Stamford, under the guidance of Prof. Blake, M.A., F.G.S., and Dr. Seaton (President). After visiting the ancient parish church, under the courteous guidance of the vicar, Rev. A. C. Abdy, the excursionists divided, one party accompanying Prof. Blake to a quarry in the Lincolnshire Oolite, and thence to a clay-pit in the Estuarine series, both just on the outskirts of the town, and later in the day the Collyweston slates; while the other devoted attention to the antiquities of the town. The Oolite proved fairly rich in fossils, while rootlets were common in the Estuarine clays. After luncheon at the George Hotel, the united parties visited Burghley House, the seat of the Marquis of Exeter, which was erected by William Cecil, the first Lord Burghley, and the famous Lord High Treasurer to Queen Elizabeth. Here some time was pleasantly spent in looking through the various rooms, with their painted ceilings and walls, their magnificent carvings by Gibbons, and the pictures, old tapestries, miniatures, and other art objects with which the mansion abounds. Tea at the "George" brought the day's proceedings to a very agreeable close. The second excursion was a half-day visit to Lincoln, on July 28th. Again the excursionists resolved themselves into two parties, one visiting the spots of antiquarian interest, of course including the Cathedral and the Castle, the other devoting their attention to the geology, under the guidance of Mr. W. H. Dalton, F.G.S., and Mr. W. D. Carr, of Lincoln. The latter party first made for the cutting of the M.S. and L. Railway, on the west side of the city, passing over the Middle and Upper Lias, Northampton Sand, the Upper Estuarine Clay, Lincolnshire Oolite, and the Great Oolite, full of fossils, and returning along the top of the ridge known as the "Cliff," where the Northampton Sand was seen well exposed in some ironstone quarries, capped with Oolite. After tea, this party paid a visit to the clay pit in the Upper Lias of Messrs. Swan Bros. and Bourne, on the West Cliff, where in a cutting, over sixty feet deep, the three zones, characterised respectively by *Ammonites bifrons*, *A. communis*, and *A. serpentinus*, could be traced, and where many fossils, including the rare *Trigonia pulchella*, were found. The third and last excursion of the season was to Ilam and Dovedale. Leaving the train at Norbury, near Ashbourne, and first visiting the old church, the party drove northward, through Wootton, to the Weaver Hills. Dismounting about half a mile south-east of Three Knowles, the excursionists walked on to Beacon Stoop, about 1200 feet above the sea, from which a magnificent view of the Churnet and Dove Valleys was obtained. Returning to the carriages, the drive was continued to Blore, stopping to visit the church, under the kind auspices of the vicar, Rev. J. Young, and thence to Ilam, a charmingly secluded and beautiful valley, where the River Hamps and the Manifold well up out of the limestone rocks, after a subterranean course of nearly four miles. The hall and other objects of interest, and the pretty little church, containing a fine piece of sculpture by the famous Chantry, having been visited, the drive was resumed to Dovedale, after which the party, or as many as could get it, took tea at the "Peveril," the arrangements of the proprietor being far from satisfactory. The winter session of the Society was opened on September 4th, by a microscopical gathering, at which objects were exhibited by Dr. Seaton, Mr. Dodd (hon. sec.), Mr. Jennison, Mr. Cave, Mr. Bush, Mr. Blandy, Dr. Marriott, and others.

CREMATION.*

BY W. H. FRANCE.

We have it on very old authority that "there is nothing new under the sun;" and though from his ability to rearrange the forms and combinations of matter, presumptuous man is frequently tempted to exclaim, "Here is something new," all he can do is to transpose substances into new forms, as by the transposition of the alphabet, words of endless variety are produced. Though he use the earth as a ball on which to wind his telegraphs and railways, he works with nothing new, or which did not exist before his own form was evolved from pre-existent matter. He can facilitate, and in some ways he can also retard, that which Nature is constantly doing, namely, changing the forms of matter by decomposition, *not destruction.*

What is decomposition? What is the agency which commences the operation and completes the process?

The popular meaning attached to the word is an erroneous one, or at best is very remote from that of the word *burning* or *combustion* as applied to the consumption of fuel in our dwellings and manufactories; yet decomposition and combustion are one and the same thing, varying only in degree, or rapidity, or both. It is the result of heat, without which nothing can live; nothing which, when dead, can again become food for the living; without which those arteries of the earth —the rivers, circulating the blood of the earth, would cease to flow. But for it everything containing moisture would be locked in the rigidity of ice; perfect cold being the normal condition of matter not subject to active heat.

This is well illustrated in the Arctic regions, where, owing to the equatorial fulness of the earth's form, the sun's rays are intercepted; and in proportion to such interception is the increase of cold, and a consequent decrease in the rapidity of decomposition or combustion of organic substances, so as almost to cease at times, as in the case of Arctic animals, which are occasionally found on thawing to be good food, though possibly they have been dead for many years. An artificial application of this law of nature is now in regular use in the Paris Morgue, or temporary receptacle of the unknown dead, by which means there is a valuable suspension of natural decay or dissociation of the substances of the body.

Where a perpetual state of ice does not exist, there decomposition fills up the intervals, the increase of the one being accompanied by the decrease of the other, until, as in the Tropics, decomposition reigns supreme, and there, as a consequence, life is more abundant.

* Read before the Birmingham Natural History and Microscopical Society October 16, 1883.

Those elements no longer required by the dead are quickly set at liberty in gaseous form, ascending, like aërial springs into the sea of the atmosphere, thence to be absorbed by animal and vegetable life, just as the ocean receives the polluted waters of rivers, only to purify and send them back, to run again in ceaseless circles, a never-ending journey.

Decomposition of the dead must surely be one of the most merciful of the Creator's provisions for the living. But for it, it would only be a question of time as to how long life could be sustained; for, supposing life to have commenced and continued its course by drawing upon a fixed and unrenewable quantity of matter, it would long since have shown signs of local, if not general, exhaustion, resulting in a final extinction of living forms.

In all countries plants and animals have in vast numbers, and endless variety, become extinct, whilst of those still surviving many show indisputable signs of an extinction more or less remote.

Side by side with these, other forms have arisen in apparently undiminished numbers and variety, destined, like those which have gone before, to make room for others, which posterity must be left to study. However this may be, the human race does not yet excite a widespread interest on the score of extinction.

Man's extraordinary and unique power of adaptability to his environment, in nearly every climate which his insatiable curiosity leads him to explore, appears to ensure for him an endless succession of descendants, each possessing some modification of that which gave him birth, a constant modification being associated with the greatest vitality.

Go to the mountain stream, and, where it issues forth in all its sparkling freshness, ask it whence it cometh and whither it goeth? What will it say, and truly say, to the student of Nature? "I come from the avalanche; an iceberg I have been; I flooded the Ganges with its freight of dead and dying; I come from the swamp, and the ocean spray; I moistened the grape, bedewed the grass, rode here on the storm. I go to wait on life; to search out the haunts of man, whose pollution I will bear in my bosom to the sea of forgiveness, burying myself in its fulness, only to rise again pure and free to visit every clime!"

In like manner question the human body.

Listen, student of Nature; and, like the river, it says, "I know no rest. No rest is mine till the sun has ceased to work, I come from the inland grave, and the salt sea wave. In the countless forms in which I have borne a part, I have long since lost all trace of my origin. The form of man is not new to me. I have shared in all his glories, all his crimes. The Mastodon, and greater than he have used my substance, sharing it with all other forms of life, animal and vegetable. Fire is not new to me. Heat is at once my jailer and my liberator. When by its action I am freed from the bonds of one, I go to wait on other forms of life."

If, then, heat is the instrument ordained for the reproduction of living from dead forms, by natural or artificial, combustion, advocates of the latter should doubtless be expected to prove its superiority to the former. It may be suggested that as Nature, when artificial aids are absent, is determined to burn the dead in her own silent mode of slow, so-called spontaneous combustion, why trouble ourselves about such work? Why not leave it to Nature? Certainly her patience is wonderful. She is still at work on the ancient mummies. The cunning of the embalmer only retards, it does not absolutely suspend disintegration. If our sense of smell did not inform us of the fact, the gradual loss of weight is clear proof.

Sanitary science, the pages of which book we are constantly cutting, is teaching us, lesson by lesson, that the production of diseases, of the Zymotic class at any rate, is as dependent upon seeds of "their kind" as is the husbandman for his harvest upon seeds previously buried. Following the simile a little further, we know that if grain be subjected to but a moderately high temperature, its germinating power is permanently destroyed.

We are but slowly realising or appreciating the fact that Nature has selected a code of laws, which, with a glorious impartiality, are as much in favour of one form of life as another. We are learning that the world was not made for us alone, or indeed more for us than other forms of life. That struggle for existence which is so universal seems most severe for man. However that may be, Nature does not hesitate to use and sacrifice its noblest and loveliest forms, as hot-beds for the production of life, in forms so minute, and, so far as we can at present perceive, so utterly valueless and superfluous to Natural Economy, as to excite our bewilderment, and wound our self-esteem.

Self-preservation, the first law of nature, a constant incentive to animal and vegetable action, is exercised most by man. His superior intelligence best enables him to destroy or circumvent antagonistic forces. Slaying his fellow-men often calls forth his utmost energy, and secures his most anxious consideration. He fosters the lives of many animals only to destroy them for food.

The advent of a little beetle from America has more than once sent a thrill of alarm through the country, involving considerable exercise of thought and means in order to secure its living absence. Whilst thus exercising our intelligence, we are fairly chargeable with being inconsistent to an extraordinary degree. The man who could be guilty of purposely introducing a plague of such insects would certainly deserve the worst possible fate; and yet in a perfectly legal, and publicly approved method we are perpetuating forms infinitely more destructive to human life.

Germatologists, if I may, so far as I know, coin a word whereby to distinguish the Tyndalls and Pasteurs of science, have clearly proved that those diseases which are classed as preventable are due to the presence in the body of the patient, of organic forms of extraordinary minuteness, and in numbers beyond computation. The death of the patient is favourable to the further development of such bacterial life. In some virulent cases of infectious and contagious diseases certain articles which have been used by the patient are burnt with a view to render them harmless. In those cases where the patients recover there is a lamentable want of efficient and sufficient isolation. Where death ensues matters are much worse. The body is in most cases treated as if it had lost its power to injure the living. Much unnecessary and purely conventional treatment ensues. I pass by the hideous proceedings conducted by the undertaker, as also the "correct thing" in black garments. Both are in a state of transition, the result of which may be left to the influence of universal education.

If in the country, the corpse will in most cases be carried to the highest point of the hamlet, where stands the village church. The building itself has in most cases been used as a receptacle for the deceased members of influential families. Over the tombs of these decomposing bodies the living assemble more or less frequently. Many of the vaults are during wet seasons partly filled with water. There is no mistaking the odours often perceived in such charnel houses. It is of course impossible to hazard a guess as to how many lives have been sacrificed as a result of such association with the dead on the part of the living. That they have been numerous cannot reasonably be doubted. Outside the building matters are worse. Here the rainfall has full play to percolate through and distribute the contents of the graves into the neighbouring wells, whence is drawn the drinking water for the living, who, in numberless cases, literally drink the dead in solution.

The normal increase of our population may be taken to be about a quarter of a million a year. With such a rapid increase of our resident population, the difficulty of obtaining water free from organic impurities is increasing to a serious extent, involving the outlay of vast sums of money. If, as we know it to be the case, water flowing from limestone ranges is, as a rule, highly charged with carbonate of lime, whilst that obtained from soils containing but small quantities of iron is found to be a solution of iron, how much more easily must the decomposing substance of the dead body be borne through the pores of the earth by the circulation of water? Just as surely as poison, when injected into the blood, is rapidly distributed through the whole system, so do the poisons of disease circulate in water round the dwellings of the living.

At the base of a hill within a few miles of this building flows a spring of ordinarily clear water, prized for drinking purposes. Some time ago a heap of farm yard manure was placed on high ground, a considerable distance from the spring. The hill is mainly composed of sand and sandstone. Shortly after the manure was so placed the water assumed the colour of pale tea, with an odour not to be mistaken, and obviously due to the manure heap.

In the case of suburban cemeteries the results are such as must ere long necessitate a radical change in the disposal of the dead. To economise area, graves are dug 15 to 20 feet deep. These are filled by piling the dead to within a few inches of the surface. Were an inquiry held, such as would be instituted by a royal, or a parliamentary commission, into the internal economy of our public cemeteries, the result would probably startle the public into demanding an immediate change.

A local paper recently stated that—"Some terrible discoveries as to the causes of the rapid spread and lengthened stay of epidemic diseases in places where the principles of sanitary sepulture are imperfectly understood or not acted upon, have just been made by Dr. Freor, an eminent physician of Rio de Janeiro. That city is just recovering from the ravages of a very deadly visitation of yellow fever, and Dr. Freor, in his inquiries into the causes of the epidemic, came upon a dreadful fact that the soil of the cemeteries in which the victims of the outbreak were buried was positively alive with microbian organisms, exactly identical with those found in the vomitings and blood of those who had died in the hospitals of yellow fever. From a foot under the ground he gathered a sample of the earth overlying the remains of a person who had died of the fever and had been buried about a year before, and though it showed nothing remarkable at first appearance he found to his horror, when he placed it under the microscope, that it was thickly charged with these disease germs. Many of the organisms were making spontaneous movements; in effect, therefore, the cemeteries were so many nurseries of yellow fever. Every shower of rain washes the soil and the fever seed which is so thickly sown in it into the water- courses, and distributes the poisonous germs all over the town and neighbourhood. 'Each corpse,' says the doctor, 'is the bearer of millions of millions of organisms that are specifics of ill. Imagine what a cemetery must be in which the new foci are forming around each body.' How terribly fatal these germs are is proved by the fact that the blood of a patient injected into a rabbit killed the animal in less than an hour, and the rabbit's blood injected into a guinea-pig killed it in about the same time, and the guinea-pig's blood injected into another rabbit was also fatal, so that the chain of destruction is apparently endless."

Round these spaces devoted to the dead, the living accumulate, until only the greater area distinguishes them from the surcharged burial-grounds of town churches. By submitting the dead body to a much higher temperature than that which Nature finds sufficient for her purposes, it is rendered perfectly harmless to the living, presenting hygienic advantages which must make its adoption only a question of time.

Burning the dead formed a part of that wonderful civilisation of ancient Greece, to which we owe so much, and which will long hence be viewed with undiminished admiration. Excepting in the case of overheated haystacks and such artificial conditions, natural decomposition rarely occurs at a temperature high enough to destroy animal or vegetable life-germs. Hence the necessity for artificial treatment. There are so many methods by which the process could be successfully conducted that I will not enter on that branch of the subject. There would certainly be little difficulty in framing such regulations as should be a distinct improvement upon those which are at present in use for the disposal of the dead.

The only objection to Cremation which is really of such a character as to call for serious consideration, and to remove which, special precautions must undoubtedly be taken, is the fact that the operation would entirely destroy all trace of foul means as the cause of death. It occasionally happens that after burial circumstances arise which render it desirable to exhume bodies for purposes of examination. Although exhumation seldom results in anything very definite or valuable, public opinion is not likely to be in favour of abandoning it until it is satisfied that a good substitute is ready.

All regulations are more or less liable to abuse. People have been hung for offences they have had no part in. Society is occasionally shocked to find that an innocent person has undergone imprisonment or penal servitude (which by the bye are now synonymous terms), and endeavours to make such amends as are suggested by the circumstances. But it would not for a moment be contended that such unfortunate exceptions offer any inducement to abolish such punishments. It must also be admitted that under present conditions there are probably many persons buried whose deaths have been hastened by foul means, never suspected or questioned before or after burial, and with such precautions as are possible, I think it could be made much more difficult to dispose of such bodies than is now the case. Certainly it would not be difficult to improve upon the coroner's inquiry as at present conducted. One cannot repress astonishment that such a cumbersome and unqualified piece of administration has not succumbed to the want of confidence its decisions excite in the minds of those intimately acquainted with such courts. Since the public mind has ceased to be satisfied with verdicts attributing deaths to the "Act of God" it is manifestly unfair to expect juries, as at present constituted, to elucidate mysteries too deep for the coroner or themselves.

The legal profession never fails to supply the Judicial Bench with occupants who deservedly possess the fullest confidence of the public. Is it too much to say that the medical profession is equally well able to supply any required number of trained experts, in every sense qualified to give the public absolute facts respecting deaths calling for inquiry?

With such safeguards as medical men are well able to furnish, I will remind my hearers that the difficulty already referred to as presenting the most serious practical obstacle to cremation, does not apply to cases in which cremation is most necessary, *i.e.* where deaths have arisen from diseases of an infectious nature, and which are those indeed which especially require to be dealt with in the manner proposed. Perhaps it will be desirable, at first at any rate, to limit cremation to such cases. Much would certainly be gained to the public health. The permanent extinction of any one of such diseases as are admitted to be preventable, would alone confer inestimable advantages on the human race.

Of course many will exclaim, "Oh! the idea of being burnt after death is horrible!" Is not a dead body a horrible mystery, and the disposal of it by any method a horrible duty?

Suppose for a moment that burial in the earth were a new custom, previous to which the dead were collected and deposited in the sea—which would have much to recommend it from a sanitary point of view—how horrified would many be at the proposal to dig a hole in the ground, in which to place their friends, with the knowledge that those first buried would in time be disturbed by the sexton's spade, and mixed up in inextricable confusion to make room for later comers. And though the proposal would be opposed to the teachings of true science, that would not be the cause of the opposition it would meet with, any more than the approval of cremation by science convinces those guided by sentiment rather than knowledge.

It is only a question of time. As the pages of the book of knowledge are unfolded, our stupendous ignorance is reduced, in spite of sentiment; sentiment which is unfortunately so rarely allied to truth.

Far be it from me, however, to despise sentiment. Life would indeed be dull without it. It may indeed be said that fact and fiction, truth and falsehood, are necessary to each other's existence. Truth shines brightest in a setting of fiction. But whilst disclaiming any inclination to repress sentiment or the healthy exercise of that imaginative power with which mankind is blessed, and by the aid of which so many of the burdens and toils of life are lessened, I make a clear distinction between it and prejudice, the child of ignorance and superstition, prolific parents, from whom it behoves us, to the best of our ability, to free ourselves and our children.

Civilisation is ever calling for and initiating measures intended to prolong human life. Mòre, a nation's desire to extend the average life of its subjects is undoubtedly a measure of its civilisation, and is one of the first duties of statesmanship. The increasing density of our population is prompting us to adopt measures of a sanitary nature which have been too long delayed. The results so far, are such as ought to encourage us to the adoption of more general and consistent fulfilment of recognised sanitary principles. Hitherto legislation in sanitary, as in other matters, has been the result of a desire to cure rather than to prevent. Only when a nuisance has become so great as to be no longer bearable, are steps taken to alleviate if not remove it altogether.

Universal education will doubtless develop a more logical public opinion, which must insist upon a policy of prevention, as superior to cure, not alone in matters of bodily health, but of crime also. It is solely as a preventive measure of a sanitary nature that burning the dead, in the opinion of so many, already calls for serious consideration; and in the hope that the subject will be received by this influential Society as one worthy of debate, I have ventured to bring it before you, that your thoughts may, as Matthew Arnold says, "play freely round it," untrammelled by prejudices unworthy of philosophers.

THE FLORA OF HAMPSHIRE.*

Perhaps no local flora was ever more anxiously awaited than the Flora of Hampshire, which was known to be in preparation by Mr. Frederick Townsend. The extent of the county itself, containing as it does not only the sylvan recesses of the New Forest, with the extensive Sphagnum swamps and dry heathy uplands covered with bracken, almost concealing the splendid Gladiolus and handsome Club Moss, the extensive littoral tract, and the woods of Selborne, but also the chalk downs of the north and the Isle of Wight in the south—all these made it probable that the flora of this county would contain almost the largest number of species of any in Britain, and the high reputation of the author as a critical botanist, caused, as has been stated, a considerable amount of expectation. Nor on receiving it has there come any feeling of disappointment; on the contrary, one feels how much more has been given than even the most sanguine imagination expected, as will be to some extent shown when its contents are glanced at. In a book of over 500 pages, without superfluous matter, 1,114 species of plants found in Hampshire are enumerated, with 202 varieties, 28 species not sufficiently vouched, and 153 excluded species, so that the flora is unmistakably the largest in Britain.

Mr. Townsend has divided the county into twelve districts, founded on the river basins, as follows:—1. The Trent and Stour district; 2. The Avon; 3. The New Forest; 4. North Wight; 5. South Wight; 6. The Teste; 7. Itchen; 8. East Solent; 9. The Arun; 10. The Wey; 11. The Lodden; and 12. The Kennet. With respect to these divisions 4 and 5 (North and South Wight) would possibly have been clearer if put as 1 and 2, or 11 and 12, instead of in the midst of the mainland districts; and again, the south portion of 6 district is quite typical of the New Forest from which, however, the drainage rather artificially separates it.

Districts 3, 4, 5, 6, and 7 are subdivided into two, and No. 8 into three portions, so some idea may be formed as to the amount of work necessary to trace the extensive list of plants enumerated through all these divisions. Perhaps it may be suggested that the districts under each plant would have been more clearly shown if the river from

* The Flora of Hampshire, by Fred. Townsend, M.A., F.L.S. London: L. Reeve and Co., Henrietta Street, Covent Garden. Price 16/-

which it took its name had been printed instead of the number. Numbers 4 and 5 N. and S. Wight are thus distinguished. The old authors from Turner downwards, have been thoroughly searched, and Mr. Townsend has followed the example set in the admirable Flora of Middlesex in putting the name of the first recorder to each plant. But the special feature in the Flora is the attention given to critical species and varieties.

Of these we may specify *Lepidium Smithii* var. *alatostyla*, a variety without the notched fruits of typical *Smithii*. *Silene anglica* is made a species, as is also *S. gallica*, the latter divided into *eugallica* and *quinquevulnera*.

Mr. Townsend remarks under *Cerastium tetrandrum* that, contrary to the opinion of Dr. Bromfield and other botanists who had characterised it as a seaside form of *C. semidecandrum*, he has always found the plants, even when growing together, retain their individual characters perfectly. The writer this year noticed on the sands of Barrie some specimens which it was difficult to confidently assign to *semidecandrum*, bearing as they did such a resemblance to the former plant.

Arenaria serpyllifolia is divided into four varieties—*sphærocarpa*, *glutinosa*, *stricta*, and *leptoclados*.

Herniaria hirsuta, first recorded for Hants by Mr. Townsend, is, the author states, a possible native.

Trifolium arvense has a maritime variety described.

Prunus spinosa is divided into *P. spinosa* (Linn.) and *P. fruticans* (Weihe), the latter perhaps the *coœtana* of Syme. *P. fruticans* is between *spinosa* and *insititia*. Under the latter name it doubtless exists in many herbaria.

Poterium muricatum seems pretty generally distributed. The writer noticed it this year on the railway banks between Lyndhurst and Brockenhurst, in the New Forest district.

Alchemilla vulgaris is singularly absent from the New Forest, as is also *Parnassia palustris*.

Of the Rubi thirty-seven species are enumerated.

There is no notice of a new (?) species of *Lythrum*, said to have been found in St. Crossfields, Winchester, by Father Reader.

Isnardia palustris, first recorded in "Merrett's Pinax," 1667, afterwards lost, has been restored to Hampshire by the pertinacious search of Mr. Bolton King, whose name frequently occurs in the Flora.

The small densely-tufted maritime form of *Jasione* is identified with *J. littoralis*, Fries.

The Erythræa are most fully treated, descriptions being given of *E. capitala* (Koch), *E. tenuiflora* (Link.) *E., capitata* (Wild), var. *sphærocephala* (Towns.), with plate.

The spring flowering form of *Gentiana Amarella* is also noticed.

Under *Linaria repens* is noticed that Dr. Bromfield found a pure white unstriped variety. The writer has noticed not only that, but a coral pink-coloured form, as well as more or less striped ones and some of as dark a purple as *purpurea* on the downs of Oxon and Berks. Mr. Townsend says that Mr. Bentham, judging apparently from dried specimens only, is disposed to write *L. italica* (Trev.) with *vulgaris*, but besides other marked and apparently constant characters he finds that the seeds of the two plants are dissimilar; this the writer can fully corroborate.

Veronica arvensis (var. *eximia*—Townsend) is a prostrate form branching from the base of the stem, which has also been found in cultivated fields in Northamptonshire; in habit it comes nearer *agrestis*.

The subglabrous form of *Cynoglossum officinale* is recorded from the Isle of Wight.

The Muddiford habitat for *Polygonum maritimum* was verified by Mr. B. King in 1879.

A hybrid between *Orchis latifolia* and *maculata* is recorded, as is also a hybrid dock, and two thistle hybrids. *Epipactis violacea* is properly separated from *E. media*, from which it abundantly differs.

It is a great misfortune that Mr. R. Pryor did not live to set straight the synonymy of the broad-leaved Epipactis, which seems now almost hopelessly confused. Boreau's description of Durand's plant is very vivid.

Scirpus parvulus is another of Mr. King's interesting discoveries, as is also *Eriophorum gracile*.

The Glyceriæ have, in addition to *G. fluitans; plicata*, *pedicellata* (Towns.), and *declinata* (Brev.), separated as species, although the author considers them only worthy of subspecific rank.

There is little doubt that *Lycopodium complanatum* will yet be found either in the New Forest or Bramshot.

Not only is the flora rich in these critical plants, but such rare plants as *Gladiolus*, *Isnardia*, *Arum italicum*, *Matthiola incana*, *Spiranthes æstivalis*, *Calamintha sylvatica*, *Chara alopecuriodes*, *Scirpus parvulus*, and *Eriophorum gracile* are included in the list.

Mr. Townsend gives a comparative table of plant occurrences in Wilts, Dorset, Isle of Wight, Sussex, Surrey, and Berks, with mainland of Hants, which shows that Hants possesses 187 plants not found in Wilts, 176 not found in Berks, 149 not found in Isle of Wight, 123 not found in Surrey, 69 not found in Dorset, and 64 not found in Sussex.

At the end of the book, the botanical districts are described, and their characteristics and rare species enumerated. Plants which might not be expected to occur are also given ; in fact the author seems to have left nothing undone, but has produced a county flora which amply refutes the statements of some so-called botanists—*i.e.*, that the British Flora is worked out, or is too uninteresting to repay further trouble.

G. C. Druce.

BIOLOGICAL ANALOGIES.*

BY M. C. COOKE, M.A., LL.D., A.L.S., ETC.

The phenomena of reproduction in animals and plants present many features worthy of comparison. It is scarcely rash to say that sexuality is as common and universal in the vegetable as in the animal kingdom. Not many years ago such an assertion could scarcely have been ventured upon with confidence, when the reproduction of the lower cryptogamia was so little known, but every new discovery adds strength to a belief in universal sexuality. The completeness of the sexual organs and their functions is not a matter of mere speculation. The male and female organs are definite and distinct. They approach each other, as it were, instinctively, and unite. The ovary receives the contents of the antheridium, which, in many cases, are multitudinous active spermatozoa, with a remarkable similarity to the same bodies high up in the zoological scale. The opening of the ovary just as the spermatozoids are matured, as in the genera *Œdogonium* and *Vaucheria*, the entrance of these and their absorption, and finally the maturing of the fertilised ovum, are notable analogies. If we seek more special and particular examples these can be found. What, for instance, could be more suggestive of the fusion which takes place in some of the Infusoria, in which two individuals meet, collide, and finally coalesce in one individual, than the conjugating zoospores in *Botrydium granulatum*, where two active zoospores unite, and by their union become a true fertilised isospore, in which all motion soon comes to an end, and is followed by the development of a young plant like its original parent. These are some of the phenomena which startled certain of our progenitors into the supposition that infusoria were generated within, and ultimately escaped from, the tissues of living plants.

Metamorphosis, such as we are acquainted with in insects, has also its analogue in the vegetable kingdom. From the egg of a butterfly emerges, not a form like the parent, but a caterpillar, which passes through a period of existence and then comes to rest; it changes into a pupa or resting condition, in which it remains for a more or less lengthened period, then its final change takes place, and the perfect imago appears, the true image of the original parent. In some of the lower plants we may recognise a similar metamorphosis. In some of the Myxogasters, for instance, the spore, which is the ovum or egg, produces a larval form, an active zoospore. After a time this becomes amœboid, more sluggish, and quite different from either zoospore or

* This extract is taken from a most interesting address delivered by Dr. Cooke, President of the Quekett Microscopical Club, at the Annual Meeting, held July 27th, 1883.

parent, and finally from the amœboid form results the perfect imago, or image of the plant from which originally the ovum was derived. If exception should be taken to any of the Myxogasters being employed in illustration, inasmuch as their vegetable nature has been called in question, then we can fall back on the life history of *Volvox globator*, *Stephanosphæra*, and other of the *Volvocineæ*, to say nothing of mosses and *Characeæ*, already alluded to, which furnish less perfect transformations. Although not conducted on so large a scale as in the animal kingdom, it is clear that we have at least suggestions of metamorphosis also in the vegetable world.

Alternation of generations, as applied zoologically, differs materially from metamorphosis, although they are sometimes confounded as though they were convertible terms. The fundamental idea is that of an organism "producing an offspring which at no time resembles its parent, but which, on the other hand, itself brings forth a progeny which returns, in its form and nature, to the parent animal, so that the material organism does not meet with its resemblance in its own brood, but in the descendants of the second, third, or fourth degree or generation, and this always takes place in the different animals which exhibit the phenomenon in a determinate generation, or with the intervention of a determinate number of generations." The characteristic difference between this and a simple metamorphosis is that each generation completes its career in the same form as it commenced, so that each starts from an ovum, and the cycle is *not* the career of a single individual, but of a consecutive series of individuals, which revert to the original form after one, two, or more intermediate and differing generations.

In Ferns an alternation of generations is evident. The fronds of mature ferns bear on their under surface, or margin, clusters of spore-cases containing minute spores, which themselves are produced without sexual fertilisation. These spores germinate and produce a little plant called a prothallium, not at all like the parent fern, but a small simple plant nourished by root-hairs. This prothallium is capable of repeating itself by buds, but finally it produces male and female organs, and the result of fertilisation is a true embryo, sexually produced, which develops into a Fern, like its asexual parent. Thus there is an alternate asexual and sexual generation, the sexual being the small prothallium, and the asexual that more imposing form which we are in the habit of calling a Fern.

In Mosses a somewhat similar alternation prevails. The germinating spore produces a confervoid thallus called a *Protonema;* from this the leafy moss is developed by buds on the branches. Sexual organs are formed, and finally, after fertilisation, spores are produced.

It is unnecessary to repeat instances, since my object is more suggestive than exhaustive, and in fact the subject could not possibly be extended in all its details within the narrow limit of time at my disposal.

THE FLORA OF WARWICKSHIRE.

AN ACCOUNT OF THE FLOWERING PLANTS AND FERNS OF THE COUNTY OF WARWICK.

BY JAMES E. BAGNALL.

(Continued from page 236.)

SCROPHULARIACEÆ *(continued)*.

LINARIA.

L. **Cymbalaria,** *Mill.* *Ivy-leaved Toad Flax.* *Mother of Thousands.*
Denizen: On old walls and ruins. Local. May to October.

I. Sutton Churchyard wall; Coleshill Rectory wall; walls at Springfield, Astley; walls near Oldbury Hall; Maxtoke Churchyard wall.

II. St. Mary's Churchyard wall; wall in Meller's Lane, Warwick; *Per. Fl.* 52; New House, Radford; Whitley Abbey; walls at Arbury Hall; Coton House, near Rugby, *Kirk. Phyt.*, ii. 971. Tachbrook, *Y. and B.* Wall at Thurlaston, *R.S.R.*, 1877; Honington Hall in several places! *Newb.;* near Wixford; walls near Farnborough.

In many of these stations truly established, but not a native in any of the districts from which I record it.

L. **Elatine,** *Mill.* *Sharp-leaved Fluellen.*
Native or Colonist: In cultivated land. Rare and local. July to September.

I. Sandy cornfield near School rough, Marston Green

II. Grafton; Kinwarton; *Purt.*, i., 287. Whitnash; Bidford! Wyken Colliery; *Herb. Perry.* Tachbrook, Morton, *Y. and B.*, Woodloes! *H.B.*; Field at Birdingbury, *R.S.R.*, 1877; near Whatcote; Lambcote; *Newb.* Lighthorne, *Bolton King*; Drayton, near Stratford; Billesley; Exhall, near Alcester; Brandon.

L. **spuria,** *Mill.* *Round-leaved Fluellen.*
Colonist: In cultivated fields. Rather rare. July to September.

II. Grafton, *Purt.*, *i.*, 288; Bidford! *Bree, Mag. Nat. Hist.*, iii., 165; near, Chesterton Windmill, *Herb. Perry*; Field at Birdingbury and near Little Lawford, *R.S.R.*, 1877; Tachbrook; Morton, *Y. and B.*; Whatcote, *Rev. J. Gorle*; Tredington, Lambscote, *Newb.;* Chadshunt, *Bolton King;* Honington; Bidford; Exhall; Billesley; Drayton, near Stratford; Wilmcote.

L. **repens,** *Mill.* *Creeping Toad Flax.*
Native (?): On old walls. Very rare. July to September.

II. Old Walls at Claverdon! *H.B.*

The plant is well established here, but is merely an escape from some near garden, I think.

L. vulgaris, *Mill.* *Yellow Toad Flax.*

Native: On hedge banks and borders of fields. Common. July to September. Area general.

Although a common plant on the whole, it appears rare in some portions of the county.

L. minor, *Desf.* *Least Toad Flax.*

Colonist: In cultivated land. Local and rare.

I. Railway siding, Knowle Station, *W. Mathews.*

II. In corn fields, Exhall! and Grafton! *Purt.*, iii., 366; Leamington, *Perry, Fl.*, 52; Quarries between Bidford! and Binton! *Herb. Perry;* Cornfields near Newbold, *R.S.R.*, 1874.; Highdown, *Y. and B.*; garden weed, Honington Hall! *Newb.;* Exhall; Redbill; Billesley; Brandon.

[**L. purpurea,** *Mill.* Casual, on old walls. Walls of Warwick Castle Park, and other old walls about Warwick; probably extinct now].

LIMOSELLA.

L. aquatica. *Linn.* *Mudwort.*

Native: In pools and ditches. Rare. July to September.

I. Coleshill Pool! *Aylesford, B.G.* 1805.

II. In waters near Arbury Hall, *T. Kirk, Phyt.*, ii., 970; Barwood Green, near Coventry, *Kirk;* Shrewley Pool, *Bree, Herb. Perry;* Stoke Heath, *Kirk, Herb. Brit. Mus.*, 1854.

VERONICA.

V. hederifolia. *Linn.* *Ivy-leaved Speedwell.*

Native or Colonist: In cultivated land and on waysides. Common. February to June or August. Area general.

V. polita. *Fries.* *Grey procumbent Speedwell.*

Native or Colonist: In cultivated land, and as a weed in gardens. Local. January to October.

I. Field by Chelmsley Wood; near Knowle Station; fields by Bannersley Pool, Coleshill.

II. Coventry Park; Stoneleigh, *Kirk., Phyt.*, ii., 191; Myton, *W.C. Herb. Perry;* Tredington, Honington, *Newb.;* Fields at Bidford; Wixford; Exhall; Binton; Red Hill; Billesley; Alveston; Loxley; Kenilworth; Hatton; Rectory Garden, Harboro-Magna; Cubbington.

V. agrestis, *Linn.* *Green procumbent Speedwell.*

Native or Colonist: In cultivated land, waysides, wall tops, &c. Common. January to October. Area general. In some seasons in flower all the year round.

V. Buxbaumii *Ten.* *Buxbaum's Speedwell.*

Colonist: In cultivated land, waysides and banks. Locally common, January to November. Area general.

I have seen this plant more or less abundant in every part of the county, it appears to have spread widely within the last sixteen years.

V. triphylla, *Linn.* *Trifid Speedwell.*

Native (?). Sandy fields. April. May.

II. Sandy fields, not rare. *Purt.*, i, 53. "a plant of local Eastern type, found as a cornfield weed." *R. S. R.* 1871. I have never heard of this plant being found in the Alcester district since Purton's time, it is a most unlikely plant to occur other than as a casual introduction. Mr. Newbould informs me that Mr. Crotch stated that the specimen in Purton's Herbarium (Worcester) is a form of *V. hederifolia.*

V. arvensis, *Linn.* *Wall Speedwell.*

Native: On banks, wall tops, fields, waysides, etc. Common. March to October. Area general.

V. serpyllifolia, *Linn.* *Perennial Smooth Speedwell.*

Native: In pastures, and on banks, waysides, etc. April to July. Area general.

V. officinalis, *Linn.* *Common Speedwell.*

Native: In woods, on heaths, waysides and banks. Common. May to July.

I. Middleton Heath; New Park; Stone Quarries, Hartshill; Marston Green; lanes about Solihull; Hockley; Earlswood.

II. Near Dumington, Coughton, *Purt.*, i., 51; Greens Grove, near Hatton, *Perry*, *Fl.*; Honington, *Newb.;* Rowington; Alveston pastures; Lapworth.

Purton considered this plant rare, I have seen it in several places in the Alcester district.

V. Chamædrys, *Linn.* *Germander Speedwell.*

Native: On hedge banks, waysides, &c. Common. April to June. Area general.

With lavender-coloured flowers, near Berkswell.

V. montana, *Linn.* *Mountain Speedwell.*

Native: In woods and on shady banks. Local. May, June.

I. Sutton Park. *Freeman, Phyt.*, i., 261; Road from Saltley to Stechford, *Ick. Anal.;* Trickley Coppice; Middleton Park; New Park; Shustoke, near Maxtoke; Harding's Wood, Maxtoke; Kinwalsey; Arley Wood.

II. Woods at Beausale, near Wedgenock Park. *Bree*, *Mag. Nat. Hist.*, iii., 163; Hatton *Y. and B.*; Haywoods; lanes about Baddesley Clinton; Combe Woods; Seas Wood, Arbury.

V. scutellata, *Linn.* *Marsh Speedwell.*

Native: In bogs and marshes and near pools. Rare. July, August.

I. Ditches about Tamworth. *With.* ed. 3. Coleshill Bog! *Purt.*, i., 53; Coleshill heath! *Bree*, *Mag. Nat. Hist.*, iii., 163; margin of Canal, Atherstone, *Blox.*, *MS. note.* Sutton Park; Forge Mills; Coleshill Pool; Olton Reservoir.

II. Shelfield, *Purt.*, i., 53; in a field beyond Swan meadow, footway to Hampton-on-the-Hill, *Perry*, *Fl.*; Windmill field, Haseley, *Perry*, *Fl.*; Alveston pastures, *W. C.*, *Herb. Perry*; Lye Green! *Y. and B.*; fields beyond Barby, near disused mill, *R. S. R.*, 1877; var. *pubescens*, Corley Moor, *Kirk.*, *Herb. Perry.*

V. Anagallis, *Linn.* *Water Speedwell.*

Native: In ditches and by rivers and streams. Local. June, July.

I. Sutton Park, *Freeman, Phyt.*, i., 261; ditches about Tamworth, *With.*, ed. 3; Water Orton; Middleton; Forge Mills; marshy land near Packington Park; Elmdon; Bradnock's Marsh; Righton End.

II. Nicholas Meadow, Warwick, *Perry*, 1817; Stoneleigh, Warwick, *Y. and B.;* near St. Dennis, *Newb.*; cattle pool near Billesley Hall; Canal, near Bishopton; Canal bank, near Shrewley Common.

The glandular form occurs near Forge Mills.

V. Beccabunga, *Linn.* *Brook Lime.*

Native: In marshes, ditches, and muddy places. Common. May to August. Area general.

EUPHRASIA.

E. officinalis, *Linn.* *Common Eyebright.*

Native: On heaths, commons, pastures, etc. Common. June to September. Area general.

I think that the whole of the Warwickshire plants would be included in the var. *b*, *E. nemorosa*, Pers. Var. *a* I have not seen in any of the districts. A marked form, having a dwarfed habit, much branched stem, and large flowers is abundant on Sutton Coldfield; but I cannot look upon this as more than a state or form of *E. nemorosa.*

BARTSIA.

B. Odontites, *Huds.* *Red Bartsia.*

Native: In fields, woods, on waysides and heaths. Common. June to September. Area general.

a, *verna*, Reich. Common.

I. Sutton Park; Middleton; Shustoke; Hartshill; Marston Green; Hampton-in-Arden; Knowle, etc.

II. Honington; Tredington, *Newb.;* Moreton Morrell, *Y. and B.;* Exhall, near Alcester; Drayton; Kingswood, etc.

b, *serotina*, Reich. Frequent in Avon basin, local in Tame basin.

I. Middleton; Coleshill Heath.

II. Whitnash; Chesterton! *Y. and B.;* Tredington; Brailes; Lambcote, *Newb.;* Exhall; Alcester; Drayton; Spernal Ash; Harborough Magna.

PEDICULARIS.

P. palustris, *Linn.* *Upright Lousewort.*

Native: In marshes, damp meadows, and waysides. Local. June to August.

I. Coleshill! *Freeman, Phyt. i.*, 262; Sheldon, *Rev. J. Gorle;* Sutton Park; Middleton; Coleshill Pool; Marston Green; Knowle.

II. Sowe Waste Canal; canal near Lowson's Ford.

P. sylvatica, *Linn.* *Procumbent Lousewort.*

Native: On damp heaths, waysides, and in pastures. Common. June to August.

I. Sutton Park; Middleton Heath; Arley; Coleshill Pool; Olton Pool; Knowle; near Packwood Mill; Kemp's Green; Chalcot Wood, etc.

II. Combe Woods, 1871; Yarningale Common; pastures near Bushwood; Lapworth.

RHINANTHUS.

R. Crista-galli, *Linn.* *Common Yellow Rattle.*

Native: On waysides, in meadows and pastures. Common. May to July. Area general.

MELAMPYRUM

M. pratense, *Linn.* *Common Cow-Wheat.*

Native: In woods and copses. Very local. July, August.

I. Edgbaston, with white flowers, *With.*, ed. 7, iii., 730; Sutton Park, near the wagon road, *Ick. Anal.*; Barber's Coppice; Hampton-in-Arden, *R. Rogers;* in most of the woods in Sutton Park; Gin Wood, and Iron Stone Wood, Oldbury; Kingsbury Wood; Chelmsley Wood; Clew's Wood, near Earl's Wood.

II. Woods about Studley, Spernal Park, *Purt. i.*, 291; Green's Grove, Hatton, *Per. Fl.;* Prince Thorpe Wood! *R. S. R.*, 1877; Tile Hill Wood, and North Waste Wood, Tile Hill; Ufton Wood, near Southam.

A broad-leaved form approaching *M. latifolium*, is occasional in Sutton Park and Ufton Wood.

OROBANCHACEÆ.

LATHRÆA.

L. squamaria, *Linn.*

Native: In thickets. Very rare.

I. In a thicket at Oldbury, near Atherstone, *J. Power, B. G.*

OROBANCHE.

O. major, *Linn.* *Greater Broom-rape.*

Native: In woods, pastures, and dry grounds. Very rare. June.

I. In a wood a mile N.E. by E. of Packington Hall, *Perry, Fl.;* Bickenhill, *Bree, Purt.* iii., 367.

II. Amongst some gorse by the side of the road from Pophills, *Purt.* i., 296; Allesley; Leek Wootton, *Bree, Purt.* iii., 367; Bush Common, Kenilworth, *T. Cox, Herb. Perry;* Myton, *H. B.* On the root of Broom in Whitby Grove, *Kirk, Phyt.* ii., 971.

O. elatior.

Native: July, August.

I. Polesworth, Hoo Hills, rarely found there now, *J. Power, Bot. Guide;* Coleshill, Bickenhill, *Bree, Mag. Nat. Hist.*, iii., 165.

II. Allesley, *Bree, Mag. Nat. Hist.*, iii., 165.

O. minor, *Linn.*
Native. July, August.

II. Sandy field, near Luddington, *Cheshire, Herb. Perry;* roadside between Brinklow and Combe, *Rev. A. Blox., R.S.R.*, 1874; near Myton, *H. B.*

VERBENACEÆ.

VERBENA.

V. officinalis, *Linn. Common Vervain, Simpler's Joy.*
Native: On banks near Churchyards and old ruins. Rare. July to September.

II. Foot of Stankhill near Warwick, *Perry*, 1817; Green's Grove, Hatton; Wixford! *Herb. Perry;* Salford Priors, *Rev. J. C.;* Tredington by the Churchyard! *Newb.;* about Rugby, *Baxter;* Kenilworth Castle! *Y. and B.;* Chadshunt, Lighthorne, *Bolton King;* appearing in newly cut hedges about Binton and Stratford, *Cheshire.*

(To be continued.)

Reviews.

Zoological Notes. By Arthur Nicols. 370 pp., 3 plates, woodcuts. Price, 7s. 6d. L. Upcott Gill.

This work consists of an accumulation of little-known and interesting facts relating to (1) Snakes, (2) Marsupials, and (3) Birds. The author is evidently a keen and close observer, and the mass of observations here collected will prove attractive to every lover of natural history.

The Origin of Civilisation, and the Primitive Condition of Man. By Sir J. Lubbock, Bart. Fourth Edition. 548 pp., five plates, 20 woodcuts. Price, 18s. Longmans and Co.

This book has now become classical; it is a standard book of reference and study for the ethnologist, for the student of pre-historic man, and for every intelligent being who wishes to know something of the early condition of mankind. The subjects taken up are the Art and Ornaments, the systems of Marriage and Relationship, the Religion, the Character and Morals, the Language and the Laws of Mankind, both civilised and savage; together with such information as we can glean from history and geology on the habits of bygone ages. Sir John Lubbock, in our opinion, succeeds clearly in proving that, on the whole, the history of the human race is one of continued *progress*. The book is one of absorbing interest; the origin of many of our own customs is traced back to times when our ancestors were in the condition of savage tribes, in a manner which excites general curiosity and interest, but which leaves the impression of certainty on the mind of the reader, so skilfully and scientifically is it done.

Study of the Rocks. By F. Rutley. Second Edition. 321 pp., woodcuts. Price, 4s. 6d. Longmans and Co.

This work has established itself as the recognised English text-book on the subject. The author is petrologist to the Geological Survey, and has had an excellent opportunity (of which he has well availed himself) of becoming acquainted with the properties of minerals and rocks. The first portion of the book is concerned with the microscopical characters of rocks, and their behaviour in the field; in the succeeding chapters we have an admirable account of the method of making thin sections of rocks, preparing them for examination by the microscope; the optical properties of rock-forming minerals are then described, so that we learn how to discriminate them when examined by ordinary and by polarised light, etc. Mr. Rutley's book is simply indispensable to every geologist.

The British Moss Flora. By R. Braithwaite, M.D., F.L.S., etc. Part vii. Fam. vii., Dicranaceæ (Part II.) Published by the Author, 303, Clapham Road, London. Price 6s.

This truly valuable work, if it makes slower progress than one would desire, at any rate places before the student of British bryology, in a collected form, all the additions that have from time to time been made to our Moss Flora since the publication of "Bryologia Britannica," in 1855. To many students this is most valuable help, as the records of new discoveries have hitherto been scattered among the pages of many varied works. In the present Part vii. several new species are described, and some of them for the first time as British plants.

The descriptions are clear and graphic. The plates, of which there are six, contain illustrations of twenty-four species; these are excellent —superior in finish to any that have been given before. This work deserves the earnest support of every Natural History Society in the Kingdom, and should be subscribed to by all who take an interest in botany. It is only by the united help of all, that such a work can be made in any way a success. J. E. Bagnall.

The Botanical Record Club: Phanerogamic and Cryptogamic. Phanerogamic Report for 1881-2. Manchester: Jas. Collins and Co.

This report concludes the second quinquennial volume of the record of the Club's labours. During the ten years beginning with 1873 it has published 3,180 distinct New County Records of Phanerogams (773 of them within the last two years), nearly all of which are vouched for by actual specimens. These are in addition to the localities embodied in the works of the late Hewett C. Watson, which "even at the outset mirrored with essential accuracy the phanerogamic vegetation of an island probably more fully known" than any other equal area in the whole world. It is evident that the Club has found plenty to do in the work to which it has set its hand; but the greater the progress the nearer comes the enquiry, "Is not the work nearly finished? Surely by this time the distribution of plants within Great Britain must be all but fully known." With regard to all but the modern segregates this is doubtless true, but against it we must set the curious fact that the number of novelties recorded year by year shows but little signs of falling off. Every botanist can bear witness that, however much he may have studied a large district, he can always find in it something new by stepping aside a yard or so from the ruts in which we are all apt to travel. We may therefore hope that, though the present rate of progress cannot be maintained, the Club may find work to do for many years. We find in this volume fresh localities for the latest born into the families of true British plants:—*Selinum Carvifolia*, *Senecio spathulifolius*, *Potamogeton Zizii*, *Agrostis nigra*, and others, while the distribution of those longer known is extended even into unlooked-for quarters.

One of the most noticeable features of the Report is the attempt made by its Editor to hold the balance equally between the views of extreme "lumpers" and "splitters." When he receives from a member of the Club one of those intermediate forms which no botanist can fail to meet with, he records it as, what it is, an *intermediate*, instead of forcing upon it the name of the segregate to which he thinks it is nearest. With regard to the grass first discovered in Warwickshire by our indefatigable contributor, Mr. J. E. Bagnall, *Agrostis nigra* of Withering, he quotes Professor Haeckel's opinion, expressed with reference to another genus of Gramineæ, that "it is quite impossible to distinguish all distinguishable and perhaps hereditary forms as species," unless, we may add, we are prepared to undertake an amount of labour which can at present be but dimly seen, but which, even as thus foreshadowed, is overwhelmingly great. As has been often said in these pages, there are many genera in which the process of evolution is *at the present moment* engaged in forming new species. The older botanists were ignorant that such is the case, and made the want one of the stock objections to the theory of evolution. But now the number of genera in which this manufacture is seen to be in progress is yearly increased, and when we have to do with one of these "of the naming of new species (?) there is no end." This is the true, but as yet hardly recognised explanation of the two botanical (and zoological) "schools." Among "things not generally known" is the influence of *fashion* in science, which is nevertheless one of the most potent factors of its condition. It was once the fashion to look at broad distinctions mainly, and in so doing the multitude of really existing but minute differences was overlooked; then the fashion grew of making the most of these, and now the pendulum must swing back again as is its wont. It is right to treat these intermediate forms as distinguishable at first *till we have evidence to the contrary*, but then to re-unite them. Thus will finally be solved that still unended controversy as to what constitutes a species. W. B. G.

The Fruits of all Countries: a Preliminary Catalogue. By F. T. Mott, F.R.G.S. Published by the Author, Leicester. 2s. 6d.

This is a catalogue of "Fruits" in the popular, and not in the technical sense of that word. It includes all the well-known European species, as well as those of which we now often see the strange forms in the windows of fruit warehouses, and others not yet introduced into this country. The catalogue gives the scientific and popular names of the fruit, its native region, the habit of the plant, the edible part, and the appearance and qualities of the fruit. It is well styled a "preliminary" catalogue, and makes no pretence to be complete. The author requests that all corrections or additions may be forwarded to him at Birstall Hill, Leicester, whence copies of the work may be obtained. W. B. G.

Correspondence.

A Correction.—The *Boletus aluterius*, Fr., from Hints Wood, which I mentioned in last months' "Midland Naturalist," p. 236, is, I regret to say, *not* that species. The stem of *Agaricus nitidus*, also, is not pure white, as my words would seem to imply.—W. B. Grove, B.A.

Bryological Note from South Beds.—The following Pleurocarpous Mosses have fruited during 1882-3 in South Beds, besides other very common forms, viz:—*Neckera complanata*, *Thuidium tamariscinum*, *Thamnium alopecurum*, *Isothecium myurum*, *Camptothecium lutescens*, *Brachythecium albicans* (on thatch, Harlington), *Eurhynchium Swartzii*, *Rhynchostegium murale*, *R. ruscifolium*, *Plagiothecium denticulatum*, *Amblystegium riparium*, *Hypnum fluitans*, *H. filicinum*, *H. molluscum*, *H. cordifolium* (sparingly on Flitwick Marsh), *H. purum*, *H. squarrosum*, and of *H. triquetrum* only one capsule was found. In addition to these, of the other groups of Mosses the following have been gathered in fruit:—*Fontinalis antipyretica*, *Fissidens adiantoides*, *F. crassipes*, *Philonotis fontana*, *Physcomitrium pyriforme*, *Physcomitrella patens*, *Funaria fascicularis*, *Barbula fallax*, *B. brevifolia*, and *Dicranum palustre*. Duplicates of all have been examined by Mr. H. Boswell, of Oxford.
J. Saunders, Luton.

[Having, through the kindness of Mr. Saunders, seen some of the more noticeable of the above Mosses, I can bear testimony to the correctness of the nomenclature. This list is a remarkable one, and does credit to Mr. Saunders as an industrious student of Bryology. —J. E. Bagnall.]

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—Geological Section, September 25.—The following exhibits were made:—Mr. T. H. Waller: An interesting specimen of slickensides on quartzite, from Caldecote quarry, near Nuneaton. Mr. W. J. Harrison, jun.: *Ammonites caudatus*, from Desborough and Echinodermata spines in chalk matrix, from Grays, Essex. Mr. W. R. Hughes, F.L.S.: A pebble, evidently broken from the junction of a sandstone bed with a calcareous vein, as it shows both layers, from Brixham, South Devon; and a fragment of slate with vein of aragonite, from Rossthwaite, Borrowdale. Mr. W. H. France: A remarkable fungus growth which had sapped and destroyed a great part of his dining-room floor, at Sandford Road, Moseley. This fungus (*Merulius lacrymans*) is very destructive, especially as it can be eradicated only with very great difficulty. Mr. W. B. Grove exhibited *Ag. vaginatus*, *Ag. galopus* var. *candidus*, *Ag. vulvus*, *Ag. æruginosus*, *Ag. campanulatus*, *Ag. asterosporus*, *Ag. dryophilus*, *Ag. sanguinolentus*, *Ag.* (*Pluteus*) *nanus*, *Ag. melaspermus*, *Coprinus niveus*, *Bolbitius titubans*, *Russula integra*, *R. alutacea*, *Lactarius rufus*, *L. quietus*, *L. mitissimus*, *Hygrophorus virgineus*, *Marasmius androsaceus*, *Boletus chrysenteron*, *Thelephora laciniata*, *Torrubia militaris*, *Isaria farinosa*, and *Mucor macrocarpus*, from Four Oaks Park; *Ag. pascuus* and *Polyporus hispidus*, from Sutton. Mr. J. E. Bagnall: the following fungi—*Amanita verna*, *Lactarius deliciosus*, *Mycena leptocephala*, *M galopus*, *Hygrophorus pratensis*, *Collybia dryophila*, *Cortinarius elatior*, *Boletus elegans*, *Lactarius glyciosmus*, etc., from Coleshill Heath; and on behalf of Dr. Cooke, *Cantharellus cibarius*, *Agaricus prunulus*, *Pholiota mutabilis*, *Marasmius fœtens*, and *Lactarius torminosus*, from Hereford. Mr. C. J. Watson: Minerals from Barmouth, and a large number of beautiful photographs of Welsh scenery, taken by himself. General Meeting, October 2nd.—The President introduced the work of the winter session by a few graceful words of welcome to the members. A Conversazione was then held, at which the following exhibits were made:—By Mr. T. H. Waller: A section of Precarboniferous lava, from the Cheviot Hills, containing Hypersthene, and traversed by a vein of jasper, with a minute agate in its course. By Mr. W. R. Hughes: A series of slides prepared by Mr. F. W. Sharpus, illustrating the development, structure, etc., of the Cephalopoda. By Mr. R. M. Lloyd: *Formica rufa*, and *Bugula plumosa*. By Mr. J. Morley: A section of *Hippuris vulgaris* (the mare's tail), and a species of Ceramium. By Mr. J. E. Bagnall: *Ag. spermaticus*, *Clitocybe clavipes*, *Boletus bovinus*, *Cortinarius subferrugineus*, and other rare and local fungi, from Coleshill and Middleton. By Mr. J. Levick: *Carchesium polypinum*. By Mr. C. Pumphrey: Spiral fibres of root of lily, and the remarkable seeds of *Parnassia palustris*; also *Pyrola rotundifolia*, from Southport. By Mr. W. P. Marshall, a small rock-plant, *Acæna microphylla*, having the flowers grouped together in a dense head, from which the calyx-leaves, modified into four long red spines, project on all sides. By Mr. R. W. Chase: *Charadrius morinellus*, from near Bristol; *Phalaropus hyperboreus* (in winter plumage), from near Boston; *Tringa subarquata* (in summer plumage). from Breydon, Norfolk; *Phalaropus hyperboreus* and *Stercorarius crepidatus* (in the down), from Shetland; *Somateria mollissima* and *Fratercula arctica* (in the down), from the Farne Islands; Mr. Chase also gave an account of the nesting habits of some of these birds. Mr. W. B. Grove exhibited the following Fungi:—*Lactarius deliciosus*, *L. turpis*, *Boletus scaber*, *Agaricus rimosus*, from Sutton Park; *Agaricus cucumis*, *Pluteus nanus*, and *Helotium lutescens*, from Sutton; *Polyporus hispidus*, *Cortinarius elatior*, *Polyporus abietinus*, *Ag. fragrans*, and *Ag. Candolleanus*, from Hints Wood. Sociological Section.—October 4th. The fifth meeting for the study of Mr. Herbert Spencer's "System of Philosophy" was held at the Mason College. The President (Mr. W. R. Hughes, F.L.S.) occupied the chair, and there was a large attendance, including ladies. A letter from Mr. Alfred Hayes, B.A., was read, resigning the Hon. Secretaryship on the score of distance from Birmingham, and Mr. Greatheed was unanimously elected to take his place. A cordial vote of thanks was passed to Mr. Hayes for his valuable services. A letter from Mr. M. J. Savage, of Boston, U.S.A., author of "The Morals" and "The Religion of Evolution," proposing some sort of co-operation between English and American Spencerians, was read. The discussion of the "Principles of Biology," which work has been chosen by the Section for perusal during this session, was opened by Dr. Hill, F.I.C., and the first chapter lucidly explained by him in spite of its more than ordinary technicality. Mr. Spencer begins by drawing attention to the high mobility, physically speaking, and the small affinity, chemically speaking, which characterise three of the principal elements of the human body—viz., carbon, oxygen, hydrogen, and nitrogen, while at the same time the four exhibit great contrast in both respects, and thereby facilitate the differentiation and integration which is carried on in the human body. Among their binary, ternary, and succeeding compounds, it was shown that there was decreasing mobility and decreasing affinity, nitrogenous compounds reaching the extreme of instability, as instanced in nitro-glycerine and other familiar substances. The most complex organic molecules must be characterised by the least mobility, while on the other hand they are much more likely to be acted on and rearranged by physical forces. The importance of Professor Graham's differentiation of substances into crystalloids and colloids was noticed, the former consisting of simple elements or of the less compound molecules, and, therefore, able to pass through the dialyser, or through living membranes; whilst the molecules of the latter, consisting in some cases of many hundred atoms, were necessarily stationary, though supplying the *energia* of vitality. Dialysis, or the action of animal membranes, not only separates crystalloids from colloids, but assists in breaking up molecules with feeble affinities. All these circumstances point to the mechanism for the quick escape of the waste products of the body and the mechanical fixity which prevents the living tissue diffusing away with the decomposition products. The conditions necessary to the redistribution of matter and motion which constitute evolution are thus fairly shown to be fulfilled; the increased warmth or molecular vibration of the higher organisms further assisting towards this end. The discussion was continued by Messrs. Cullis, France, Major, Hayes, and W. B. Grove. Mr. J. Levick beautifully exhibited the microscopic plants *Diatomaceæ*, in their "rambling progression," as an illustration to the third chapter.—BIOLOGICAL SECTION, Oct. 9th. Mr. Bagnall exhibited Fungi: *Clitocybe clavipes*, and *Boletus bovinus*, new to the district; *Hygrophorus conicus*, *H. psittacinus*, *Scleroderma geaster;* and a Moss, *Georgia pellucida*, all from Middleton. Mr. R. W. Chase exhibited *Calcarius lapponicus*, male and female (in adult summer plumage), *Turdus pilaris* young, *Turdus iliacus* (young), all from Norway. Mr. R. W. Felton exhibited Franklin Quail, shot in Suffolk; Hobby (young), shot in Herefordshire. Mr. W. B. Grove exhibited a collection of Fungi, among which were *Lactarius cilicioides*, *L. vellereus*, *L. pyrogalus*, *Lentinus cochleatus*, *Helvella crispa*, *Clavaria pistillaris*, *C. cinerea*, *C. coralloides*, *Boletus luridus*, *Exidia glandulosa*, from Langley and Middleton; *Lactarius turpis*, *L. hysginus*, *Ag. procerus*, *R. depallens*, *R. decolorans*, *R. fellex*, and *Polyporus giganteus*, from Edgbaston Park. Mr. W. Southall exhibited *Gentiana pneumonanthe*. Mr. A. W. Wills read a "Note on *Œcidium berberidis*," by Dr. M. C. Cooke, M.A., in which he maintains in a well argued paper that the relation between *Œcidium berberidis* and *Puccinia graminis* is not proven, and points to the fact that in Australia, where *Œcidium berberidis* is unknown, the ravages of *Puccinia graminis* far exceed anything known in this country. MICROSCOPICAL GENERAL MEETING, October 16th.—Mr. J. E. Bagnall exhibited *Lemna gibba*, from Coleshill; *Plagiothecium undulatum* (rare), *Riccia glauca* (local), and *Anthoceros punctatus* (rare), from Maxtoke and Packington; also *Agaricus odorus*, *Ag. hydrophilus*, *Ag. prunulus* and *Cortinarius torvus* (the two latter new to the district), and other fungi, from Fillongley; (for Mr. G. S. Tye) an abnormal form of the common mushroom, in which one was attached by its cap in an inverted position to the cap of another; (for Dr. M. C. Cooke) *Cyathus rugosus* and *C. vernicosus*, from Norfolk; (for Mr. C. B. Plowright) *Geoglossum olivaceum*, *Agaricus ambustus*, and other fungi from Hereford; and (for Mr. J. B. Stone) a series of rare Norwegian plants, collected and named by Professor Lindberg, of Helsingfors. Mr. W. B. Grove exhibited *Ag. muscarius*, *Ag. mappa*, *Cortinarius hemitrichus*, *C. sanguineus*, *Trametes gibbosa*, and *Ptychogaster albus*, from Sutton Park; *Badhamia hyalina* (a myxomycete), from Edgbaston Park, and other fungi. Mr. R. W. Chase exhibited *Archibates lagopus*, the Rough-legged Buzzard, shot at

St. Olive's. Mr. W. H. France read a paper on "Cremation," which will appear in these pages. GEOLOGICAL SECTION, October 23rd.—Mr. T. H. Waller exhibited microscopic preparations of volcanic dust ejected during the late eruption of Krakatoa in Java, and of a lava from Montserrat, the trituration of which would produce such dust. Mr. W. B. Grove, B.A., exhibited the following fungi from the neighbourhood: *Epicoccum purpurascens*, *Fusidium cylindricum*, *Agraicus pseudopurus*, *Ag. fimbriatus*, *Ag. brevipes*, *Ag. viscipellis*, *Ag. virgatus*, *Ag. mappa*, *Ag. metachrous*, *Ag. ditopus*, *Clavaria rugosa*, *C. stricta*, *Pistillaria quisquiliaris*, *Mucor fusiger*, etc. Mr. J. E. Bagnall exhibited *Agaricus squamosus* (named by Mr. Phillips) and other fungi from Middleton; also on behalf of Mr. C. B. Plowright, of King's Lynn, *Agaricus humilis*, *Ag. conissans*, *Ag. flaccidus*, *Ag. pyxidatus*, *Ag. nebularis*, *Ag. clavipes*, *Hygrophorus lætus*, *H. hypothejus*, *Cortinarius pholideus*, *C. rigens*, and *C. castaneus*, all from Sandringham; *Panus torulosus*, etc., from Lynn. Mr. W. H. France then read a paper sent by the Rev. P. B. Brodie, M.A., F.G.S., of Rowington, on "Fossil Spiders and Scorpions."

NOTTINGHAM NATURALISTS' SOCIETY.—September 18th.—Mr. T. W. Cave, M.R.C.V.S., read an important paper on "The Life-history of a few Parasites of Domestic Animals," being the second part of a subject brought before the Society during the previous session. The author dealt with the principal species of the Nematoda or round-worm family, and gave some instructive facts about the much-dreaded *Trichina spiralis*. He said it only lived three or four weeks. Each female produced at least 1,000 embryos, and often ten or fifteen thousand. It had been found that one ounce of flesh from an infected pig contained 80,000 *trichinæ*. The best means of prevention consisted in care being taken that all pork was in a well-cooked condition throughout before being eaten. The remainder of the paper was devoted to other representatives of the class, such as the *Strongylidæ*, which caused the disease called "husk" in calves and lambs. October 2nd.—Dr. E. Seaton (President) occupied the chair, and the evening was devoted to the reading of short communications. The first was a paper on the "Hedgehog," by Mrs. W. A. Brown, in which the subject was treated in a highly practical way, and gave the results of long-continued personal observation of the habits of these animals. Mr. W. Wright followed with an account of "Local Entomological Captures made during the Summer," and the 131 specimens he had collected, all neatly mounted, were inspected by those present with much interest and admiration. Mr. J. Shipman then read a paper on a "Boulder from the Bunter Pebble Beds," a slice of which (showing the shape and surface dimensions) he exhibited. The boulder was found in the Bunter Pebble Beds in a small sand quarry at the south-west corner of Wollaton Park wall. It attracted his attention first on account of its size, being the largest boulder he had ever seen in the Bunter, and very much larger than the pebbles that usually occur in that formation. It measured 7in. by 6in. by 3½in., and weighed over 9lbs. It was quite angular, being only very slightly worn along the edges, and therefore not much rolled about by the action of currents. It resembled Caradoc sandstone more than anything else, and was quite unlike the coal measure sandstone of the adjacent coalfield in texture. It consisted of hard fine-grained white sandstone, finely but unevenly laminated, and very fissile. The author then dwelt briefly on the wonderful interest that was connected with these pebbles, for it was by their means that geologists were trying to solve the problem of where the source was whence the Bunter sandstone was derived. He referred to the rival theories of Professor Bonney, F.R.S., and Mr. W. J. Harrison, F.G.S., the former believing they came from the north-west of Scotland, and the latter assigning their source as a ridge of high land that stretches in Bunter lines across the South Midlands of England, and concluded by remarking that wherever the boulder came from it must have come direct from its parent rock. The boulder was examined with much interest. Mr. J. J. Ogle then read a paper on "Some Plant Defences," which was much appreciated.

ON THE ECHINODERMATA.*

BY DR. T. WRIGHT, F.R.S.

The *Echinodermata* are highly organised animals, for the most part covered with a coriaceous or calcareous skeleton, and their surface armed with numerous spines, which aid in locomotion, and serve as defensive instruments. They have a complicated system of aquiferous canals, connected with the motion of their sucking feet, which, in the sea urchins, escape through holes in the shell, and in the starfishes, through intervals between the plates. They formed the highest group of Cuvier's Radiata, but are far in advance in their organisation of any of the singular animals with which they have been classed.

As this is an elementary lesson, I shall take the leading orders in succession, commencing with the lowest form, and ascending gradually to the highest. We divide the Echinoderms into six orders: *1, Holothuridea; 2, Echinoidea; 3, Asteroidea; 4, Ophiuroidea; 5, Cystoidea; 6, Crinoidea.*

Crinoidea.—The name is derived from the resemblance which some of the fossil forms of this order have to the flower of a lily, hence stone lilies, from their infolded rays, resembling the petals of that flower. They have a body more or less spherical, supported upon a jointed stem, as in this *Rhizocrinus Lofotensis*, discovered by Sars near the Lofoden Islands, 100-300 fathoms deep. The cup-like calyx is formed of close-fitting calcareous plates, varying in number in the different genera, and investing the surface like a coat of mail. The calyx is provided with five solid arms, which are independent of the visceral cavity, and are adapted for prehension in seizing their prey. They have a mouth intestine and vent distinct; no retractile suckers, and the ovaries open by special apertures at the base of the arms. Their skeleton is complicated and composed of many plates closely joined together; the number and arrangement of the elements are determinate in the different families, the multiples of five being the numbers which predominate; the central part of the body is supported on a long-jointed stem, which is sometimes rooted to the bed of the sea, or coiled up as a portable support. The mouth is central and prominent, and the vent opens near its side. The arms are mostly ramose and multi-articulate, and when expanded form a net-like structure of considerable dimensions. The mouth is always placed upwards, so that the normal position of a Crinoid is the reverse of the starfish. In our present seas we have *Pentacrinus Caput-Medusæ*, from the seas of the Antilles, *Rhizocrinus Lofotensis*, from the Lofoden Islands, *Bathycrinus Aldrichianus*, and *Bathyocrinus Bethellianus*, found in 1,850 fathoms water, during Challenger expedition; 1° 47′ W. long., 24° 26′ W., in a bottom of globigerina ooze. We shall see presently that the Crinoids played a wonderful part in the ancient seas of the world.

* Read before the Cheltenham Natural Science Society.

Cystoidea have a more or less spherical body, supported on a jointed stem; the basiform calyx is formed of close-fitting plates, of a polygonal figure, and varying in number in different genera, investing the surface like a coat of mail, except above, where there are three openings—one for the mouth, one for the vent, and one with a valve for the reproductive organs; the fourth aperture is below, and is continuous with the canal in the stem. Some have two or four arms, others are armless. Certain species possess articulated tentacula and curious comb-like appendages, or pectinated rhombs in connection with the plates. This order is extinct, and their remains are found in the Devonian and Silurian rocks. *Pseudu-crinites bifsasciatus* is a good type of this order.

Ophiuroidea.—The body is discoidal, distinct and depressed, provided with long slender arms, in which there is no excavation for any prolongation of the viscera. They are, in fact, special organs for locomotion, independent of the visceral cavity. They have spines developed from their sides, which form highly movable and important aids for locomotion. The mouth is always on the lower surface and is central, and surrounded by tentacula. The skeleton is extremely complicated, and composed of numerous calcareous pieces, which vary in number, size, shape, in the different genera. The long, slender, snake-like arms are supported by a number of vertebral-like pieces, which form the pliable rays for locomotion only. The common sandstar (*Ophiura texturata*), Lamk, is a typical form which well represents the order.

Asteroidea have a depressed stelliform body, provided with five or more rays, or hollow arms, which are continuations of the body, and contain prolongations of the viscera. The mouth is always below, and central; some have a vent opening on the upper surface. Several rows of tubular retractile suckers occupy the centres of the rays. The skeleton is complicated and composed of numerous solid calcareous pieces joined together, and movable on each other, by which strength and flexibility is at once provided for; the outer surface is coriaceous, or studded with calcareous spines of various forms and sizes. A singular body, called the madreporiform plate, inasmuch as it resembles a miniature head of madrepore coral, is situated between two rays, and is in connection with a canal, through which water passes into the aquiferous system, the plate acting as a sieve to strain off all impurities from entering the channels. The suckers are tubular organs erected by injecting water into them, and by these they move slowly along. The nervous system consists of a cord of nervous matter which surrounds the mouth, and has ganglia or nervous centres opposite each ray, where branches are given off to the organs and a branch is sent out to the end of the rays where the eyes are placed. The stomach is very capacious, and sends a prolongation into each ray, so that each ray is, in fact, a portion of the body. The blood is circulated in one system of vessels and the water in another. The ovaries are very large, and produce an enormous number of eggs, the development of which leads to a strange series of metamorphoses, until the final or parental figure is attained. The order is divided into several families, each containing many genera. The common Starfish *(Uraster rubens)*, the Sun Star *(Solaster)*, the Bordered Star *(Astropecten)*, and the Cushion Star *(Goniaster)*, are representatives of the order.

Echinoidea.—The sea urchins are enclosed in a calcareous box of marvellous structure. The body is spheroidal, oval, or depressed, without arms, the whole body being shut up in its calcareous skeleton. They have a distinct mouth, situated at the under surface, and sometimes armed with a most complicated set of jaws and teeth; in other forms the mouth is edentulous, and the intestine opens in various parts of the body, often opposite the mouth, sometimes in a groove on the upper surface, or on the posterior border, or underneath the margin. The shell consists of twenty columns of calcareous plates. Ten of these, small and narrow, are called ambulacral, and ten, large and broad, inter-ambulacral; and between these two systems of plates ten other narrow columns of small plates are placed, between the pieces of which ten rows of holes are formed for the passage of vertical tubular sucking feet. The surface of the plates supports a number of tubercles, with a round polished surface, on which are placed spines of various sizes, shapes, and dimensions, in the different families of this group. The articulature between the tubercle and spine is that of a ball and socket joint, and in some a small ligament passes from one to the other, just as we observe in the thigh bone of mammals. Besides the large species, there are many secondary spines, and the surface of the plates is moreover covered with a more or less abundant development of fine granules. At the summit of the test is the apical disc, composed of five ovarial plates, perforated for the passage of the ovarial and seminal tubes, and five ocular plates for lodging the five eyes. One of the ovarial plates, the right anterolateral, carries the madreporiform tubercle, which is in connection with a sand canal. Scattered over the surface of the test are a great number of curious forms called *Pedicellariæ*, which we shall show in the microscope demonstration. These remarkable organs play an important part in the life-history of the urchin and starfish. These bodies are supported on a long stem, which is attached either to the skin or shell; the movable head consists of two or three prongs, which move upon each other, and form a forceps, the blades of which open and close upon any body which irritates the tegumentary membrane. They appear to serve the animal for removing foreign materials from the surface of the shell, by picking it away from the spines and integument. They are incessantly in motion, and will grasp a pin placed near the open forceps which the head forms. The mouth of the common Echinus is provided with a complicated armature of jaws and teeth, forming what is called Aristotle's lantern, which consists of five long three-sided triangular sockets with jaws united together, with their apices pointing downward, so as to form a pyramid. Each jaw is keeled on its outer surface, and bordered by raised margins. The corresponding sides of the two contiguous pieces are bound together by strong muscles, and moved about in every direction by a complicated arrangement of cords and levers. Each of the contiguous sides are grooved like files, between which every particle of food must pass to be filed down, as in a mill, before it can enter the stomach; each jaw or socket carries a tooth which projects beyond the mouth. The tooth is developed from a pulp, which surrounds the root of the tooth, so that just as the tooth wears away at the point it is renewed at the root. The tooth has a prismatic form, and is never blunted by work. This apparatus in construction and uses is quite unique among animal structures, the jaws being destined to rub down all fragments upon which the urchins feed, so that the last crumbs which fall to the bottom of the sea, from Nature's bounteous banquet, may be all rubbed down and used up as nourishment by these lowly Echinoderms. The intestinal canal makes two and a half turns round the shell, and is always filled with sand and other débris from which nourishment is extracted, just as the earthworms in our soil are constantly passing the vegetable mould through their intestines and loosening the earth, nourishing their bodies at the same time. The blood moves in a true circulation of vessels, which are spread out upon the surface of the digestive organs and distributed throughout the body, forming the blood vascular system, in opposition to another set of vessels destined for the circulation of water throughout the body, called the water vascular system. The water enters freely through appropriate apertures in the shell and washes all the included viscera, giving out its oxygen to the blood and renovating the circulatory fluids; the water flows in currents created by the action of the cilia, which are developed on the living membrane of the shell, so that ciliary motion urges on the water, and constantly renews the streams that everywhere meander throughout the interior of the calcareous box. The nervous system of Asterias and Echinus consists of a nervous ring which surrounds the gullet and develops knots or ganglia at each of the five divisions of the body. From these ganglia nerves proceed to the organs, and one long branch passes out to the end of the ray in the starfish and becomes its optic nerve, and in the Echinus the nerve passes up inside the shell and supplies the eyes placed in the apical disc.

Holothuroidea have the body in general elongated, the skin usually soft and leathery, in a few genera strengthened by calcareous or horny spines; five avenues of suckers, which divide the body into as many longitudinal nearly equal, lobes or segments; the mouth is surrounded by plumose tentacula, the numbers of which are, in general, multiples of five; vent at the opposite extremity of the body. The digestive organs consist of a long intestine, which makes some coils in passing through the body. Respiration is carried on by a singular arrangement of ramified tubes, like a miniature tree, rising from the cloaca, which inhales and exhales the water many times a minute. In this chamber a Mediterranean species of fish—the Fierasfer—lives and luxuriates. Locomotion is effected by contractions and extensions of the body, and by action of the rows of tubular suckers. The British forms are grouped into five families, viz., i, *Psolidæ;* ii, *Pentactæ;* iii, *Thyones;* iv, *Synaptæ;* v, *Sipunculidæ.*

Such, then, is an outline of the zoological portion of my subject. Let us now see what are the relations of these animals to the past history of our earth. Let me remind you that we divide the rocks forming the earth's crust into Tertiary, Secondary, and Primary series, taking them in a descending order from the present unto the past, and each of these great divisions are formed of several groups. In the Tertiaries we have—1st, Lower or Eocene; 2nd, Middle or Miocene; 3rd, Upper or Pliocene; 4th, uppermost or pleistocene. In the Secondary—1st, the Cretaceous, or chalk formations; 2nd, the Jurassic, or oolitic formations; 3rd, the Triassic, or new red sandstone formations. In the Primary—1st, the Permian, or magnesian limestone; 2nd, Carboniferous, or coal bearing; 3rd, Devonian, or old red sandstone; 4th, Silurian; 5th, Cambrian; 6th, Laurentian. Now most of these great rock groupings possess special forms of Echinodermata, the skeletons of which are found in a wonderful state of preservation, and capable of the most careful and minute examination. The specimens on the tables are sufficient to prove the correctness of this statement: therefore, when the naturalist comes to deal with these fossil forms he can speak with as much certainty anent their organisation as he can do of recent animals.

I know of no class of the animal kingdom so well adapted for illustrating some of the laws which have governed the animalisation of the earth as the class we are now studying; for the hard parts that we examine form an integral part of the organism, and reflect many of the leading features of their organisation. So that in examining the different groups of rocks we find that the Echinoderms of the one group entirely differ from those of another, the generic forms are all perfectly distinct, and the specific characters of most of the species are quite unmistakable, so that an experienced palæontologist is capable of reading out a history of these rocks from the Echinoderms they are found to contain.

The *Crinoidea* have played a very important part in the animalisation of the globe, and the remains of their skeletons are strewn in great abundance. In some of the Palæozoic and Mesozoic Rocks, they commenced their life-history in the Silurian epoch, and have peopled the bed of the sea with their varied forms through all subsequent epochs down to the present time. The Lower Silurian Rocks of North America afford a great many remarkable forms of Crinoids which are collected from the Chazy Trenton and Hudson River groups, but their numbers largely increase in the Upper Silurian beds. The Upper Silurian in the British Islands contains a very fine series. In the Upper Silurian Limestone of the Island of Gothland it is stated that forty-three genera, containing 176 species, are found, whilst in the Upper Silurian in North America there are sixty-two genera and 450 species, so that in Europe we have a greater number of genera, but a smaller number of species, than are found in North America. The Lower Silurian forms are quite distinct from the species found in the Upper Silurian Rocks. The Devonian Rocks of England contain very few forms, whilst the Devonian Limestone of the Eifel, Nassau and the Hartz, Thuringia, Ardennes, Mayenne department France, Austria, Spain, and Russia contain many species, and the Devonian Rocks of North America are likewise rich in species, so that at the present time it is estimated that forty genera and 230 species are known from the Devonian formations of the Old and New Worlds. The *carboniferous limestone* contains an immense abundance of the plates and stems of Encrinites, so much so that this formation has been called the Encrinital Limestone. Bolland and Richmond in Yorkshire, Bakewell, Derbyshire, and Clifton, Gloucestershire, and the carboniferous limestone of Scotland and Ireland have yielded many remains. Germany and Belgium have added their contingent. North America has largely added to our knowledge of the Encrinital Limestone, and the five divisions into which the American geologists have divided their carboniferous group, Kinderhook, Burlington, Keorur, St. Louis, and Chester groups, have yielded an immense addition to our European lists. In the *Trias* we are surprised to find so few Crinoids after the wonderful devolpment the genera and species attained in carboniferous times. The best known to us is the *Encrinus moniliformis*, of which I have a fine specimen in my hand from the Muschelkalk of Germany, and this figure will give you a good idea of its structure. When we compare this Crinoid with the forms from the carboniferous rocks we see at a glance the wide gap that separated the genera of these two formations from each other. The *Jurassic Rocks* contain an entirely new set of generic forms, the *Pentacrinidæ*, of which the *Pentacrinus basaltiformis* is the best known. The specimens on the table and figures on the wall show us the beautiful form this genus assumed in the rocks beneath our feet. The stem is five sided, and in some species attains many feet in length, and is provided with a great number of side arms. It does not appear to have been attached by a thickened root to the bed of the sea, as was at one time thought to be the case, but to have attached itself by its side arms or the lower part of its stem into the mud, just as the *Pennatula* and *Funiculina* of our shores do now. Of the *Pentacrinus*, there are several living species which live in deep water. The Bristol Museums and the College of Surgeons, London, contain interesting examples from the Antilles. The *Apiocrinidæ*, with a pear-shaped cup, supported on a long round stem, which was firmly rooted to the bed of the sea, of which *Apiocrinus Parkinsoni* Bradford Pear Encrinite is the type. Upon the upper portion of the stem rests a broad centrodorsal plate, with five elevated radial borders, upon which the pieces of the radial arms are built, as you see in this figure and section of the fossil.

In reviewing what I have said in this meagre outline of a large subject I desire to impress on your minds the fact that the study of the Echinoderms enables us to illustrate some of the great natural laws which the study of Palæontology has unfolded to us. First, then, we see that the species of animals of one geological epoch neither lived before nor after that epoch, and that no species of Echinoderm is common to two epochs of a different age. This great fundamental truth is abundantly verified in the study of this class. Second, we have seen that between fossil and recent Echinoderms the difference is greatest in proportion to the length of time which separates living from fossil forms. Third, a comparison of the species of different epochs with each other shows us that the temperature of the sea in given localities has varied much from time to time, and dredging operations have taught us that species have lived at much greater depths than was formerly considered possible. Fourth, that the species which lived in the ancient seas had a much wider geographical distribution than those which now live, as shown by the species of carboniferous times. Fifth, another important lesson—the permanence of generic types—is derived from the study of this class: that generic forms have only very slightly varied through long periods of time, and, in fact, that many of the Brittle Stars and Sea Stars that lived thousands, or it may be millions, of years ago, are anatomically the same as the Brittle Stars and Starfishes of our own coasts. This I have shown you to be so in the case of the Ophiura and Uraster from the Lias beds, compared with the Ophiura and Uraster of British seas. The microscopic demonstration prepared in the next room by our worthy Secretary, Colonel Basevi, displays a beautiful series of preparations of the Echinodermata. One portion consists of the Sharpus collection, prepared and presented to the Birmingham Natural History and Microscopical Society by Mr. Sharpus, for the loan of which I am indebted to my friend Mr. W. R. Hughes, F.L.S., and to whom I beg to return our very best thanks. The other portion consists of an admirable series of slides illustrating the embryology of the Asteriadæ and Echinidæ, prepared in the Zoological Station at Naples, from recent specimens obtained in the Mediterranean. In fact, such is the beauty and excellence of these preparations, that I have no hesitation in stating that no similar exhibition of the microscopic anatomy of this class has ever been placed before the members of any society.

FUNGI OF THE NEIGHBOURHOOD OF BIRMINGHAM.

SECOND LIST, 1883.

This list includes no species repeated from the former one, except occasionally when the new locality is in a different county from those previously given. I have again to acknowledge the constant and kindly help of Mr. W. Phillips and Mr. C. B. Plowright in determining some species and confirming others. It is difficult to draw up such a list as this without remarking how utterly incongruous are the various species included under the so-called "Coniomycetes." The Sphæronemei and Melanconiei should form a group apart, placed near to the Pyrenomycetes. The last three orders, constituting the leaf-fungi proper, the Hypodermieæ, should be distinct from these; while the Torulacei are nothing more than the simplest type of the Hyphomycetes, and are in fact absolutely undistinguishable from some of the genera which are ranked with the latter. It is to be hoped a list of British Fungi (a "London Catalogue" in fact) will soon be published, by which British Mycologists may become more generally acquainted with the modern systematic arrangements, in place of the obsolete and unscientific one to which we are at present condemned. I may add to this list that I have eaten this year *Ag. nebularis*, *Ag. rhacodes*, *Coprinus comatus*, *C. atramentarius*, *Hygrophorus pratensis*, and *Helvella crispa*, all of which are delicious; *Ag. ulmarius* I have tried, but would not touch it again; it resembles underdone pork fat, if my specimens were characteristic of the species.

AGARICINI.

Agaricus (Amanita) mappa, Batsch. Sutton Park; Trickley Coppice. Sept., Oct.

Ag. (Am.) muscarius, Linn. Sutton Park; Edgbaston Park; Trickley Coppice. Forma "*minor, sine verrucis*" occurs occasionally. Sept., Oct.

Ag. (Am.) nitidus, Fr. Coleshill Pool. I find forms of this which it is difficult to distinguish from *Ag. mappa*. Sept.

Ag. (Lepiota) procerus, Scop. Edgbaston Park. Oct.

Ag. (Lep.) carcharias, Pers. Water Orton; Trickley Coppice; New Park, Middleton. Oct.

Ag. (Tricholoma) stans, Fr. Edgbaston Park, amongst trees. Agreeing with Cooke's Illustrations, pl. 198. The two forms mentioned by Fries occurred together. Oct.

Ag. (Trich.) virgatus, Fr. Coleshill Pool; Edgbaston Park. Sept., Oct.

Ag. (Clitocybe) opacus, With. Sutton Park. Resembling *Ag. cerussatus*, but differing in the presence of an umbo, and in the pileus being covered with a shining floccose film. Oct.

Ag. (Clitoc.) inversus, Scop. This is the species recorded as *Ag. flaccidus*, Sow., in the "Midland Naturalist," Vol. V., p. 234 (and repeated, by a clerical error, on page 250), from Sutton Park. Sept., Oct.

Ag. (Clitoc.) metachrous, Fr. Trickley Coppice. Oct.

Ag. (Clitoc.) ditopus, Fr. Edgbaston Park. Oct.

Ag. (Clitoc.) fragrans, Sow. Hints Wood. Sept.

Ag. (Collybia) dryophilus, Bull. Sutton Park; Coleshill Pool; Four Oaks Park; New Park, Middleton. Sept., Oct.

Ag. (Myc.) purus, Pers. Kenilworth, in a copse. Sept.

Ag. (Myc.) pseudopurus, Cooke. Illustrations, pl. 158. Edgbaston Park; Trickley Coppice. Oct.

Ag. (Myc.) pullatus, Cooke. Illustrations, pl. 237. Coleshill Pool. Remarkable for the contrast between the pure-white gills and purple-black pileus. Sept.

Ag. (Omphalia) muralis, Sow. On a wall amongst moss, Edgbaston. Nov.

Ag. (Omph.) fibula, Bull. Amongst moss, Warley Woods. Aug.

Ag. (Pleurotus) fimbriatus, Bolt. In a garden, Handsworth. Oct.

Ag. (Pluteus) nanus, Pers. On stumps, Four Oaks Park, Sutton. Sept.

Ag. (Entoloma) sericeus, Bull. Rubery Hill. Aug.
Ag. (Clitopilus) prunulus, Scop. Sutton Park. Oct.
Ag. (Claudopus) variabilis, Pers. Sutton Park, on sticks. Aug.
Ag. (Nolanea) pascuus, Pers. Coleshill Pool; Sutton Park; Sutton; Four Oaks Park; Langley; Edgbaston Park. Sept., Oct.
Ag. (Pholiota) præcox, Pers. Edgbaston; Erdington; Sutton; Water Orton; Kenilworth; in borders of fields and roadsides. June, July.
Ag. (Phol.) spectabilis, Fr. Coleshill Pool; Edgbaston Park. Aug.—Oct.
Ag. (Hebeloma) versipellis, Fr. Trickley Coppice; Sutton. Oct., Nov.
Ag. (Heb.) fastibilis, Fr. Sutton Park; Sutton. Oct.
Ag. (Inocybe) rimosus, Bull. Four Oaks Park; Coleshill Pool; Sutton Park. Sept.
Ag. (Inoc.) asterosporus, Quel. Four Oaks Park. Sept.
Ag. (Inoc.) geophyllus, Sow. Coleshill Pool. Aug.
Ag. (Flammula) inopus, Fr. Coleshill Pool. Sept.
Ag. (Naucoria) semiorbicularis, Bull. Hints Wood. Sept.
Ag. (Psalliota) campestris, Linn. Middleton; Four Oaks; Sutton Park; a scaly variety in Edgbaston Park. Aug.—Oct.
Ag. (Stropharia) squamosus, Fr. Sutton. Oct., Nov.
Ag. (Hypholoma) pyrotrichus, Holmsk. Sutton; Langley. Sept., Oct.
Ag. (Hyph.) Candolleanus, Fr. Solihull; Hints Wood. June—Sept.
Ag. (Psilocybe) udus, Pers. Lickey Hills; Coleshill Pool. Sept., Oct.
Var. Polytrichi, Fr. Lickey Hills. Sept.
Ag. (Psil.) spadiceus, Schäff. New Park, Middleton. Oct.
Ag. (Panæolus) fimicola, Fr. A form which I believe to be this species has occurred at Warley and at Sutton. Aug., Sept.
Cortinarius elatior, Fr. Sutton Park; Hints Wood. Sept., Oct.
C. sanguineus, Fr. Sutton Park. Sept.
C. cinnamomeus, Fr. Coleshill Pool; Sutton Park. Sept., Oct.
C. torvus, Fr. Sutton Park. Oct.
C. armillatus, Fr. Coleshill Pool; fine specimens. Sept.
C. hemitrichus, Fr. Sutton Park. Sept.
C. castaneus, Fr. Trickley Coppice; Coleshill Pool. Oct.
Hygrophorus hypothejus, Fr. Hams Hall. Oct.
H. pratensis, Fr. Coleshill Pool; Water Orton; Four Oaks Park; Langley; Edgbaston Park. Sept., Oct.
H. coccineus, Fr. Water Orton; Sutton Park; Langley. Sept., Oct.
H. puniceus, Fr. Sutton Park; Langley. Sept., Oct.
Lactarius cilicioides, Fr. Langley; Trickley Coppice. Oct.
L. turpis, Fr. Four Oaks Park; Sutton Park; New Park, Middleton; Edgbaston Park. Sept., Oct.
L. hysginus, Fr. Edgbaston Park. Withering ("Syst. Arr.," ed. iv., vol. iv., p. 178) records this species from the same locality, under the name *Ag. depressus*. Berkeley ("Eng. Fl.," v. 26) refers Withering's plant to *Lact. hysginus*, but observes that Withering describes the stem as solid. It is interesting to observe that the fungus which I find in Withering's old locality has also a decidedly solid stem, exhibiting no tendency to become hollow when old. Oct.
L. uvidus, Fr. Coleshill Pool; Four Oaks Park; Langley. Sept., Oct.
L. pyrogalus, Fr. Rowington; New Park, Middleton. Sept.
L. vellereus, Fr. New Park, Middleton; Edgbaston Park. Oct.
L. deliciosus, Fr. Sutton Park; abundant in one locality. Sept.—Nov.
L. pallidus, Fr. Four Oaks Park. Sept.
Russula adusta, Fr. Coleshill Pool; Solihull; New Park, Middleton. Oct.

R. depallens, Fr. Edgbaston Park. Oct.
R. heterophylla, Fr. Earlswood. Aug.
R. fellea, Fr. Four Oaks Park; Edgbaston Park. All pale buff, rather than straw-colour; disk darker, bay. Sept., Oct.
R. drimeia, Cooke. "Grevillea," x., 46. Sutton Park; abundant in the same locality as *Lactarius deliciosus*. Identical with specimens collected by Mr. J. E. Bagnall, from Packington. Nov.
R. integra, Fr. Coleshill Pool; Four Oaks Park; Rednal. Sept., Oct.
R. decolorans, Fr. New Park, Middleton; Edgbaston Park. Oct.
Nyctalis parasitica, Fr. Solihull; New Park, Middleton. On *Russula adusta*, and (?) *R. nigricans*. Aug.—Oct.
Marasmius peronatus, Fr. Sutton Park; Four Oaks Park; Trickley Coppice. Sep., Oct.
M. ramealis, Fr. Coleshill. Aug.
Lentinus cochleatus, Fr. New Park, Middleton. Oct.
Lenzites betulina, Fr. Sutton; Marston Green. Nov.
L. sepiaria, Fr. Sutton; on an old fir-pole. Dec.

POLYPOREI.

Boletus flavus, With. Sutton Park; Earlswood; Coleshill Pool. Aug., Sept.
B. bovinus, Linn. Trickley Coppice. Oct.
B. subtomentosus, Linn. Coleshill Pool; Sutton Park; New Park, Middleton; Edgbaston Park. Sept., Oct.
B. edulis, Bull. Coleshill Pool; Sutton Park; Hints Wood; New Park, Middleton; Langley. Aug.—Oct.
B. luridus, Fr. Langley. Oct.
B. scaber, Fr. Coleshill Pool; Sutton Park. Aug.—Oct.
Polyporus rufescens, Fr. Solihull; *W. H. Wilkinson.* Aug.
P. intybaceus, Fr. ("Hym. Eur.," ed. ii., p. 538). Sutton Park. Nov.
P. giganteus, Fr. Edgbaston Park; several specimens. Oct.
P. hispidus, Fr. Sutton; Hints Wood. Sept.
P. dryadeus, Fr. On oak, Stonebridge; Berkswell; on ash, Edgbaston Park. Aug.—Oct.
P. betulinus, Fr. Coleshill Pool. Sept.
P. fomentarius, Fr. Edgbaston Park; Salford Priors. Aug.—Oct.
P. abietinus, Fr. Hints Wood. Sept.

HYDNEI.

Hydnum ferruginosum, Fr. Sutton, on dead wood. Nov.
H. udum, Fr. "Mid. Nat," v., 251. This was recorded in error; I am as yet uncertain to what species my specimen must be referred.
Phlebia merismoides, Fr. Sutton, on bark. Nov.
Var. *albo-marginata*, Phillips. Differing from the type in its beautifully white byssoid border. Sutton, on bark. Dec., Jan.

AURICULARINI.

Craterellus cornucopioides, Fr. New Park, Middleton. Oct.
Thelephora puteana, Schum. In a well, Edgbaston; *C. B. Caswell.* Aug.
Hymenochæte rubiginosa, Lev. Sutton, on dead wood. Dec., Jan.
Auricularia mesenterica, Bull. Sutton. Nov.—Feb.
Corticium evolvens, Fr. Sutton; Edgbaston Park. Sept., Oct.
C. giganteum, Fr. Sutton Park, on larch. Aug.
C. lactescens, Berk. Earlswood Reservoir, on willow. Aug.
C. comedens, Fr. Solihull; Edgbaston Park, etc. Aug.—Oct.
C. sambuci, Pers. Sutton; Harborne; on elder. Dec., Jan.
Cyphella Curreyi, Berk. Sutton. May.

CLAVARIEI.

Clavaria fastigiata, DC. Langley. Oct.
C. coralloides, Linn. Langley. Oct.
C. cinerea, Bull. New Park, Middleton. Oct.
C. cristata, Holmsk. Coleshill Pool. Aug., Sept.
C. rugosa, Bull. Trickley Coppice. Oct.
C. stricta, Pers. Handsworth. Oct.
C. pistillaris, Linn. New Park, Middleton. Oct.
Calocera viscosa, Fr. Coleshill Pool. Sept.
Pistillaria micans, Fr. Solihull, on a dead thistle-stem. June.
P. quisquiliaris, Fr. Trickley Coppice, on fern stems. Oct.

TREMELLINI.

Tremella mesenterica, Retz. Sutton. Nov., Dec.
Exidia glandulosa, Fr. Kenilworth; New Park, Middleton. July—Oct.
Ditiola radicata, Fr. Sutton, on deal planks. Feb.

CONIOMYCETES.

Coniothyrium glomeratum, Corda. Sutton, on planks. May.
Darluca filum, Cast. Barton Green; Harborne; on Uredo. Aug.
Septoria polygonorum, Desm. On *Polygonum Persicaria*, Coleshill; Sutton. Aug.
S. dianthi, Desm. "Mich." i., 187. Rednal. New to Britain. Aug.
Phyllosticta vulgaris, var. *Loniceræ*. Water Orton; Solihull, etc. Aug., Sept.
Dinemasporium graminum, Lev. Edgbaston. July.
D. hispidulum (Schrad.), Sacc. *Peziza hispidula*, Schrad. "Handbook," p. 687. On dead wood, Sutton. May—Nov.
Pestalozzia Guepini, Desm. On camellia leaves, Sparkhill; Sutton, etc. Oct., Nov.
Torula ovalispora, Berk. Sutton, on sawn planks. May.
T. pulveracea, Corda. Marston Green, on a stump. May.
Speira toruloides, Corda. Sutton, on dead wood. Feb.
Bactridium helvellæ, B. and Br. On hymenium of *Peziza scutellata*, Sutton. Nov.
Bispora pusilla, Sacc. "Fung. Ital.," fig. 21. "Mich." i., 78. "Effused, black; hyphæ short, filiform, ascending, pallid; conidia inserted on the apex of the hyphæ, in rather long, rarely branched chains, ovoid, dusky, rounded at each end (not truncate), $6—8 \times 3{\cdot}5—4{\cdot}5\mu$, with a thick and dark septum in the middle, not or scarcely constricted." New to Britain. Named by Mr. Phillips. Sutton, on dead wood. Dec., Jan.
Helicomyces roseus, Link. Sacc., "Fung. Ital.," fig. 813. On dead wood, Sutton. Feb.
Xenodochus carbonarius, Schl., II., III. On *Sanguisorba officinalis*, Water Orton. Rare. June, July.
Phragmidium mucronatum, Link, II., III. Stonebridge. Aug.
P. bulbosum, Schl. *P. violaceum*, Schultz, II., III. Berkswell; Solihull; Coleshill Pool; etc. Aug., Sept.
P. obtusum, Link, II., III. Harborne; Clent; Marston Green. Solihull. July, Aug.
Triphragmium ulmariæ, Link, II., III. Solihull; Hampton. July, Aug.
Puccinia straminis, De B., II., III. Berkswell, Solihull, Harborne, etc. Aug.
P. coronata, Corda III. Berkswell, on Arrhenatherum. Aug.

P. Baryi (B. & B.), Winter, II., III. *P linearis* (?), Rob., Cooke. "Micr. Fung." p. 203. On *Triticum repens*, Harborne; uredo-spores only (*Lecythea Baryi*), on *Brachypodium silvaticum*, Solihull. Rare. Aug.
P. luzulæ, Lib., II., III. Edgbaston; Coleshill Pool; on *Luzula campestris*. July, Aug.
P. suaveolens (Pers.), Winter, II., III. *Trichobasis suaveolens*, Lev. Edgbaston; Water Orton, etc. June—Oct.
P. striola, Link, II., III. Barton Green, on *Carex pendula*. Aug.
P. valantiæ, Pers., III. Rednal, on *Galium cruciatum*. Aug.
P. galiorum, Link, II., III. Solihull, on *Galium cruciatum*. Aug.
P. violarum, Link, II., III. Clent; Earlswood; Hampton-in-Arden, etc. Aug.
P. pulverulenta, Grev., II., III. Solihull; Hampton-in-Arden. Aug.
P. ægra, Grove (*Jour. of Bot.*, Sept. 1883), II., III. On *Viola cornuta*, Moseley; Sutton; Perry Barr. See "Midland Naturalist," vi., 209. Aug.—Nov.
Uromyces poæ, Rabenh., II., III. Harborne; Salford Priors. July, Aug.
Melampsora salicina, Lev., II. Earlswood, etc. Aug.
M. betulina, Desm., II. Coleshill. etc. Aug., Sept.
M. tremulæ, Tul., II. Coleshill Pool. Sept.
M. populina, Lev., II., III. New Park, Middleton; etc. Sept., Oct.
Uredo potentillarum, DC. Marston Green; Harborne; etc. May, June.
U. bifrons, Grev. Marston Green. May.
Rœstelia lacerata, Tul. Water Orton. June.

HYPHOMYCETES.

Isaria umbrina, Pers. Sutton Park, on and round *Hypoxylon coccineum*. Aug.
Anthina flammea, Fr. "Mid. Nat.," v., 274. This was recorded from Sutton by mistake.
Tubercularia nigricans, Link. Edgbaston Park. Oct.
Epicoccum purpurascens, Ehr. Sutton; Edgbaston Park, on herbaceous stems. New to Britain. Named by Mr. W. Phillips. Oct.—Jan.
Dendryphium comosum, Wall. On nettle stems. Alvechurch, Water Orton. May, June.
D. laxum, B. & Br. Harborne. Aug.
Monotospora megalospora, B. & Br. Sutton Park; Sutton; Coleshill Pool. On dead wood and bark. May.—Aug.
Helminthosporium folliculatum, var. *brevipilum*, Corda. On dead wood, Sutton. May.—Nov.
H. obclavatum, Sacc. "Fung. Ital.," fig. 52; "Mich. i.," 85. New to Britain. Named by Mr. Phillips. Sutton, on dead wood. Feb.
H. fusiforme, Corda. Cooke. "Blk. Moulds," fig. 4. Sutton, on dead wood. Nov.
H. apicale, B. and Br. Crackley Wood, Kenilworth. July.
H. stemphylioides, Corda. Cooke, Blk. Moulds, fig. 2. Sutton, on dead wood. Feb.
Acrothecium simplex, Berk. On nettle stems, Harborne. Nov.
Triposporium elegans, Corda. Sutton, on dead wood. Nov.—May.
Helicocoryne viridis, Corda. Sutton, on dead wood. Feb.
Helicosporium lumbricoides, Sacc. "Fung. Ital.," fig. 56, "Mich." i., 86. This was detected by Mr. Phillips on a piece of dead wood, which I sent him. Sutton. Feb.
Polythrincium trifolii, Kunze. Earlswood; Salford Priors. Aug.

Botrytis coccotricha, Sacc. "Fung. Ital.," fig. 694. On oak chips. Kenilworth. Named by Mr. Phillips. New to Britain. July.
Peronospora nivea, Aug. On umbellifers. Sutton; Clent. May, June.
P. gangliformis, Berk. On Scabiosa, Langley. Oct.
P. densa, Rabenh. On *Bartsia Odontites*, Harborne. Aug.
P. effusa, Grev. Sutton; Solihull; Water Orton, etc. May, June.
P. grisea, Ung. Marston Green; Solihull; Wixford. May—Aug.
P. arborescens, Berk. On Poppy, Wixford. Aug.
P. ficariæ, Tul. On *Ranunculus repens*, Sutton. May.
Cystopus candidus, Lev. Wixford; Earlswood; Sutton, etc. Aug.
Dactylium obovatum, Berk. Sutton, on willow twigs. Feb.
Menispora ciliata, Corda. Sutton; Harborne. Nov.—July.
Arthrobotrys oligospora, Fresen. Edgbaston. New to Britain. Probably accompanying *Sordaria fimiseda*. April.
Fusisporium aurantiacum, Link. Sutton. Dec.
Ovularia sphæroidea, Sacc. "Fung. Ital.," fig. 979. On leaves of *Lotus corniculatus*, Solihull, Berkswell. New to Britain. Aug.

ASCOMYCETES.

Sphærotheca castagnei, Lev. On hop, Berkswell. Aug.
Erysiphe graminis, DC. Harborne, Sutton, Wixford, etc. July, Sept.
E. tortilis, Link. On leaves of Cornus, Kenilworth. Aug.
Helvella crispa, Fr. New Park, Middleton. Oct.
Rhizina undulata, Fr. Sutton Park; Coleshill. Aug., Sept.
Peziza cochleata, Huds. Sutton; Edgbaston. June—Aug.
P. villosa, Pers. Edgbaston; Four Oaks Park. Aug., Sept.
P. coronata, Bull. On nettle stems, Sutton. Nov.
Helotium æruginosum, Fr. Oak impregnated with the mycelium of this fungus, Crackley Wood, Kenilworth. July.
Helotium lutescens, Fr. Sutton; Edgbaston Park. Sept.
Hypomyces Baryanus, Tul. On *Nyctalis parasitica*, Solihull; New Park, Middleton. New to Britain. Named by Mr. Plowright. Aug.—Oct.
Hysterium curvatum, Fr. Marston Green. Aug.
Nectria aquifolia, Berk. Sutton Park; Four Oaks. April.—Sept.
N. flavida, Fr. Sutton, on dead wood. Nov.
Hypoxylon rubiginosum, Fr. Sutton; Marston Green. May.—Nov.
Eutypa lata, Tul. Marston Green, on maple. May.
E. scabrosa, Fckl. Marston Green. May.
E. velutina (Wallr.) Marston Green, on maple. Named by Mr. Plowright. May.
Melanconis aceris, Plowright. Marston Green. New. May.
Rosellinia ligniaria (Grev.) On dead wood, Sutton. Named by Mr. Plowright. May.
Stigmatea Robertiani, Fr. Barton Green. Aug.

ICE-GROOVED BOULDERS.

One of the most interesting points in an admirable paper on the "Basalt Boulders of the Rowley Hills," by Dr. Crosskey, lately published in the Transactions of the Birmingham Philosophical Society, refers to the remarkable manner in which some of the grooves *pass round the corners* of the boulders; so that a broad deep groove, for example, may begin on one face of a boulder, be continued round a tolerably sharp corner of the stone, and end on the next face.

In the discussion which followed the reading of the paper, much doubt was thrown on the possibility of such grooves being made while the stone was firmly frozen into the ice, but I then ventured to affirm that the well-known plasticity of ice would permit any amount of motion of the stones held within its grasp, so long as that motion was slow and long continued, so that it would be quite possible for a boulder, held within and moving along with the ice, to perform a partial revolution and become grooved in this curious manner. But it is, I think, more probable that such grooves were made when the stone formed a part of the solid rock over which the glacier, or local ice-mass, passed. If that early surface was uneven, and before the first invasion of the ice it would certainly be uneven, the ice would accommodate itself to a large extent to the irregularities of the rocks, and where there was a little ridge the ice would rise up one side, flow over the top, and descend on the other side. Embedded in the ice would be numerous fragments of hard rock, and by the points of these, frozen into and carried along with the under-surface of the ice-sheet, the grooves which pass round the corners of the boulders would very commonly be produced. Subsequently, the jointed blocks forming the inequality or ridge in question were torn up bodily, or removed in other ways, carried along by the ice-mass, and left where we now find them.

A grand mass of stony boulder-clay fringes Cardigan Bay; it is splendidly shown in the Cambrian railway cutting near Harlech, and forms a cliff of 30 feet in height at Criccieth. At the latter place I was pleased to find a boulder (built into a wall near the School and just at the foot of the little hill called Dinas) which showed grooves passing round a corner in exactly the same manner as those on the basalt boulders exhibited by Dr. Crosskey. The Criccieth boulder is of Greenstone and measures 21 by 19 by 15 inches. I should imagine that such examples of curved grooves cannot be of very rare occurrence, although I have not seen them referred to in any books or papers on glacial action with which I am acquainted. Perhaps some readers of the "Midland Naturalist" may know of other examples?

W. Jerome Harrison.

ANIMAL-LORE OF SHAKESPEARE'S TIME.*

A strangely interesting book, the title of which I give below, has recently been written by Miss Emma Phipson. It presents in a very compact form the references to and descriptions of animals found in books of travels and other contemporary literature of the age of Elizabeth, as well as of the periods immediately preceding and following that age. Looking at this book as a natural history student,

* "The Animal-lore of Shakespeare's time, including Quadrupeds, Reptiles, Fish, and Insects." By Emma Phipson. London: Kegan Paul, Trench, & Co.

I think it will be found full of attractiveness if for no other reason than this, that it gives such a definite idea of the kind of knowledge which prevailed in the 16th and 17th centuries regarding the Animal Kingdom. The book is full of quaint and curious information, and will afford a good deal of amusement to the general reader. It will, however, I think, prove most attractive to the literary man who has a bias towards archæology. I propose in this paper to give a few specimens of the contents of this book, which will, perhaps, induce all interested who may read what follows, to consult the book itself.

I commence my extracts with those relating to the sea-anemone, which the authoress thinks is the creature referred to by Du Bartas in the following lines:—

> "And so the sponge-spye warily awakes
> The sponges' dull sense, when repast it takes."

On this the commentator who wrote "A learned Summary upon the Poeme," (folio 1637) discourses as follows:—

"This is a little fish (as Plutarch saith in his treatise of the industry of living creatures) like unto a spider of the sea. He guardeth and governeth the spunge (called properly the hollow animal plant), which is not wholly without soule, neither without blood and sence; but (as divers other sea-animals) cleaveth to the rocks, and hath a proper motion to restrain her selfe outwardly; but to effect this, shee hath neede of the advertisement and friendship of another, because that (being rare, lither, and soft, by reason of her small vents, and empty for want of bloud, or rather want of sence, which is very dull) shee feeleth not when any good substance fit to be eaten, entreth into these holes, and void spaces, which the spunge there makes her feele and incontinently she closeth her selfe, and devoureth it."—(*Learned Summary*, p. 224.)

Miss Phipson calls this, not without reason, "a long and involved note," and I quite agree with her that the commentator "does not succeed in making it quite clear what sort of creature is meant." If it proves anything it proves conclusively that very little was known about sponges or sea-anemones in the year 1637.

Michael Drayton, one of our own Warwickshire poets (born at Hartshill, between Atherston and Nuneaton, 1563), speaks of Coral in his Polyolbion, thus:—

> "Coral of each kind, the black, the red, the white."

This substance was long a sore puzzle to naturalists, and its animal nature was not discovered till about a hundred and fifty years ago. Lord Bacon (as our authoress points out) says it is a submarine plant. And then proceeds:—

"It hath no leaves, it brancheth only when it is under water; it is soft and green of colour; but being brought into the air it becomes hard and shining red as we see. It is said also to have a white berry; but we find it not brought over with the coral" (*Nat. Hist.*, cent., viii.).

But the use of coral as a "help to the teeth of children" is also mentioned by him, as it is in a passage quoted by Miss Phipson from a poem by G. Fletcher :—

"So from your growth late be you rent away,
And hung with silver bels and whistles shrill,
Unto those children be you given to play!"
(NICHOLS' Progresses of James I., vol. i., p. 17.)

One of Purchas's pilgrims wandering through Brazil, reports that on the shores of that country they "find great store of white stone corrall under water; it groweth like small trees all in leaves, and canes, as the red corrall of India, and if this also were so, there would be great riches in this countrie, for the great abundance there is of it; it is very white, it is gotten with difficulty, they make lime of it also." —(Purchas, Rev. S. "His Pilgrimes," vol. iv., p. 1316, 1625.)

Everyone will remember Shakespeare's graceful reference to coral in his lovely Ariel's Song in the *Tempest* :—

"Of his bones are coral made,"

which clearly recognises the chemical base of coral.

Miss Phipson does not quote, as she well might, Gerarde's account of coral in his "Herball," which describes it as a "Sea-moss," and where the following occurs :—

"There is found growing upon the rocks near unto the sea a certain matter wrought together of the foame or froth of the sea, which we call spunges, after the Latin name, which may very fitly be inserted among the Sea-mosses."

The most mythical of creatures is the Sea Serpent. This is no modern idea. The size of the monster varies according to the vividness of the imagination of the reporter. Of these Olaus Magnus (1658) gives a most detailed account. In a quotation reproduced in this book he says :—

"They who in works of navigation on the coast of Norway employ themselves in fishing or merchandise, do all agree in this strange story that there is a serpent there which is of a vast magnitude, namely, 200 feet long, and moreover 20 feet thick; and is wont to live in rocks and caves toward the sea-coast about Berge; which will go alone from his holes in a clear night in summer, and devour calves, lambs, and hogs, or else he goes into the sea to feed on polypus, locusts, and all sorts of sea-crabs. He hath commonly hair hanging from his neck a cubit long, and sharp scales, and is black, and he hath flaming shining eyes. This snake disquiets the shippers, and he puts up his head on high like a pillar, and catcheth away men, and he devours them; and this hapneth not but it signifies some wonderful change of the kingdom near at hand—namely, that the princes shall die or be banished; or some tumultuous wars shall presently follow. There is also another serpent of an incredible magnitude in a town called Moos, of the diocese of Hammer; which as a comet portends a change in all the world, so that portends a change in the kingdom of Norway, as it was seen anno 1522; this serpent was thought to be fifty cubits long by conjecture, by sight afar off: there followed this the banishment of King Christierung, and a great persecution of the Bishops; and it shewed also the destruction of the countrey.—("Olaus Magnus Compendious History," folio 1658, p. 235).

E. W. B.

Review.

Handbook of the British Fungi. By M. C. Cooke. 1883. Second and Revised Edition.

So many new species of Fungi have been added to the British Flora since the publication of the Handbook in 1871 that a want has long been felt for a new and revised edition of this valuable work. To in some measure meet this want the author proposes issuing instalments containing descriptions of the *Hymenomycetes* as an appendix to "Grevillea," but with a separate paging, so as to be bound separably if desired. The first instalment of sixteen pages appears in "Grevillea" for December, 1883, and is a great improvement on the former edition.

The whole of the British species belonging to the genus Amanita, and a greater part of Lepiota are described, and in each species the special characters are printed in italics. Many of the old references are omitted, but in their stead we have references to the pages of Fries "Hymenomycetes Europæi" and other recent works, and also to the plates of "Illustrations of British Fungi," which illustrate each species.

An interesting feature of the revised edition is that of giving the derivations of each of the generic and specific names so far as this is practicable. This will form a valuable companion volume to the "Illustrations," and will be welcomed by all working Mycologists.

J. E. Bagnall.

Correspondence and Gleanings.

School Museums.—Efforts are being made to establish a small Museum of common objects in each of the Birmingham Board Schools. It is hoped that the Board will supply to each School a suitable cabinet in which to store and exhibit the specimens; but for the specimens themselves reliance must be chiefly placed on the exertions of the teachers, the scholars, and those friends to the movement who are willing to give practical aid. Donations of natural history specimens—rocks, fossils, dried plants, insects, birds, small animals, etc.—will be very acceptable; as also examples of manufactures, etc., and, indeed, any articles likely to rouse the curiosity and awaken the interest of children. Mr. W. J. Harrison, 365, Lodge Road, Birmingham, will be pleased to communicate with any readers of this magazine who will lend their assistance to this very useful and desirable scheme.

Dr. Forbes Watson, who is about to return to India, has promised to give the Society of Arts a paper embodying the results of his recent experiments on Rheea fibre.

The appointment of Dr. E. B. Tylor to a readership in anthropology at the University of Oxford, is an official recognition of that modern science which has given great satisfaction to anthropologists.

Lieut. Hovgaard, commander of the "Dijmphna" Arctic Expedition, is returning with valuable collections of marine fauna and botanical species. His observations of the aurora, and of arctic meteorology generally, are also very complete.

Dr. Stecker, who is now returning from his travels in Abyssinia, brings with him a valuable collection of plants, birds, insects, fossils, and articles of anthropological interest. The specimens of the Gojam flora, which is but little known, number about 2000.

The Scientific Roll.—Mr. A. Ramsay (4, Cowper Road, Acton, W.) asks for more subscribers to enable him to complete the first volume (price 10/-) of this very useful publication. Vol. I. deals with Meteorology, and is devoted to the literature of that science.

The Scottish Meteorological Society will shortly publish the results of the observations made at Loch Fyne, Eyemouth, and Peterhead during the past summer by Messrs. Herdman, Beddard, and Hoyle, together with the results of Mr. Norman's investigations as to the food of fishes in the Scottish lochs.

Cement for Objects Mounted in Spirits of Wine.—At the meeting of the Birmingham Natural History and Microscopical Society on October 30, 1883, Mr. Thomas Clarke exhibited a number of slides of *Leptodora hyalina*, *Hyalodaphnia Kahlbergensis*, and other entomostraca, mounted in spirits of wine, 64 over proof. These were in an excellent state of preservation, the Leptodora especially being a beautiful object, remarkable for its transparent clearness and the perfection with which every organ of its body could be traced, as if the creature were still living, although it had been mounted for many months; more important still, the cement was as perfect as on the day when the cell was first closed. Mr. Clarke said that the cement used was manufactured by a friend of his who preferred to keep the secret, but a sixpenny bottle could be obtained by any one on application, by letter or otherwise, to the Sub-curator of the Society, at the Mason College. By using this the microscopic mounter can overcome the great and hitherto insuperable difficulty of preserving entomostraca, etc., in a state suitable for future examination. As an auxiliary for securing the adhesion of the cement, Mr. Clarke stated that the slides were roughened (in fact *ground*) in a circle just outside the coverglass, where the cement came in contact with it; this was effected by the use of hydrofluoric acid.—W. B. G.

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—Microscopical General Meeting, Oct. 30.—Mr. J. E. Bagnall exhibited *Sphagnum papillosum*, *S. rubellum*, *S. auriculatum* (three rare mosses), from Marston Green; *Agaricus tuberosus*, from Middleton, *Russula drimeia*, from

Packington (both new to the county), and other fungi; also (for Mr. C. B. Plowright) *Ag. butyraceus*, *Ag. maculatus*, *Ag. carcharias*, *Ag. flavo-brunneus*, *Lactarius exsulsus*, *L. glyciosmus*, *L. turpis*, *Russula drimeia*, *R. ochroleuca*, *Boletus bovinus*, *Polyporus spumeus*, *Hydnum auriscalpium*, *Cortinarius scandens*, *Peziza cochleata*, and *P. rutilans*, from Norfolk; also (for Mr. W. H. Wilkinson) *Hymenophyllum Wilsoni*, *Asplenium trichomanes*, *Plagiothecium undulatum*, *Thamnium alopecurum*, *Chiloscyphus polyanthus*, etc., from Oban. Mr. W. P. Marshall exhibited the flowers of *Acæna microphylla*. Mr. T. Clarke exhibited the specimens of Entomostraca to which reference is made on page 286. Mr. W. B. Grove exhibited *Polyporus versicolor* and *Lenzites betulina*, two fungi which, growing upon the same log and closely united with one another, presented so great a similarity on the upper surface (though they belong to two distinct orders of fungi) as to suggest that there was probably some action of the nature of mimicry involved. Mr. R. W. Chase exhibited a nest of eggs of *Rallus aquaticus*, the Water Rail, from Horsey, Norfolk, taken May 16, 1883. GENERAL MEETING, Nov. 6.—Mr. J. E. Bagnall exhibited a slide to illustrate the microscopical structure of *Sphagnum papillosum*; *Agaricus inopus* (rare), and *Ag. sublateritius* var. β, from near Packington; also (for Mr. C. B. Plowright) *Clavaria umbrina*, *C. argillacea*, *Peziza badia*, *Torrubia ophioglossoides*, *Elaphomyces variegatus*, and *Sphæria spermoides*, from near King's Lynn. Mr. W. B. Grove then read a paper on "New and Noteworthy Fungi, chiefly from the neighbourhood of Birmingham." He enumerated a list of 42 species, of which 21 were rare, and the other 21 new to Britain; and of these 21, four were new to science. The paper was illustrated by drawings of most of the fungi mentioned, made for the most part to a uniform scale. SOCIOLOGICAL SECTION.—Nov. 11.—At the sixth meeting of this Section a letter from Mr. Minot J. Savage, of Boston, U.S.A., author of the "Morals of Evolution" and the "Religion of Evolution," also of "Christianity the Science of Manhood," was read, which stated among other things that he was engaged in preparing a publication on the life and work of Mr. Herbert Spencer. Dr. Hill, in entering on an exposition of the second chapter of Mr. Herbert Spencer's "Principles of Biology," enumerated, first of all, the forces which act on organic matter—viz., mechanical force, quasi-mechanical force as exemplified by absorption of water and osmose, heat, light, chemical affinity, and indirect chemical action or catalysis. The importance of the quasi-mechanical forces was shown in the absorption of water and the introduction with it of the *agents* of chemical change as well as in the conveying away of the *products* of such change. The phenomena of osmotic action were fully described, as well as its instrumentality in the work of redistribution in organised bodies. The action of heat in increasing molecular vibration and so favouring the operation of the various incident forces, was explained, and its more direct action in effecting vital changes by producing evaporation and thus setting circulation going in the tissues of plants and animals, as evidenced by the drooping of a plant whose roots were not sufficiently supplied with water. The influence of light on mineral, animal, and vegetable forms was illustrated, and the compound nature of a ray of light explained. It was pointed out that it is the yellow or luminous portion of the ray which stimulates the plant to decompose its mineral food and fix its carbon and hydrogen in the tissues and secretions; and the undulatory theory of the nature of light by which these changes are supposed to be explained, was treated at considerable length. Independently of all hypothesis, however, it is established that light is indispensable to the production of chlorophyll, the colours of petals, and numerous other effects. Chemical affinity was shown to be the most powerful agent of the whole, and the part played by oxygen was remarked upon with considerable fulness. Ordinary chemical action and indirect chemical action or catalysis were contrasted, and the peculiar nature of the latter illustrated by the part played by yeast in fermentation, by diastase in germination, the Vinegar Plant in acetification, synaptase in the production from amygdaloid of essential oil of bitter almonds and prussic acid, etc. In conclusion, the speaker pointed out the great difference between plants and animals in the amounts of nitrogen they respectively contain, and shewed that in the former light is necessary to enable them to carry on their functions, while in the latter light is not essential. Fungi are apparently an exception to this rule, as many grow in darkness, but this class of plants is known to be particularly rich in nitrogen, and therefore to resemble animals in this respect. Again, although the parts of plants poor in nitrogen require sunlight, those parts particularly rich in nitrogen—viz., the seeds, germinate in darkness. Thus, while the "ferments" referred to are all nitrogenous, and seemed to owe their activity to nitrogen, those parts of living animals displaying the greatest vital activity are also distinguished by the presence of a comparatively large quantity of this element. The greater rapidity and completeness of the metamorphosis of a substance like sugar in the body than out of the body was shown; thus, while sugar is quickly converted in the organism into water and carbonic acid, out of the organism it has to pass through numerous chemical stages capable of the easiest verification; first, forming by fermentation alcohol and carbonic acid; next, acetic acid; and finally, by further oxidation, carbonic acid and water. As, then, these changes are shown not to be brought about by mere chemical and thermal actions it is to be concluded that they are produced in the body by the aid of that indirect influence called catalysis. The discussion was then pursued by the President, Mr. W. R. Hughes, F.L.S., and by Messrs. France, F. H. Collins, J. F. Cullis, A. Hayes, Barratt, and Greatheed. Notice was given that at a special meeting on the 18th November Mr. Rabone would read "Some Jottings about Shakespeare and Stratford." BIOLOGICAL SECTION—Nov. 13.—Mr. J. E. Bagnall exhibited Mosses:—Microscopical preparations of Antheridia of *Sphagnum contortum*, from Coleshill; *Pleuridium nitidum*, from Hampton-in-Arden; also (for Mr. J. B. Stone) *Discelium nudum*, from near Malham, Yorkshire. Mr. Bernard Baker exhibited Tarantula and nest. Mr. W. B. Grove exhibited Fungi:—*Agaricus epixanthus*, *Ag. squamosus*, *Ag. vitilis*, *Phlebia merismoides*, *Hydnum ferruginosum*, *Bactridium helvellæ*, *Peziza coronata*, *Hypoxylon rubiginosum*, *Nectria flavida*, *Triposporium elegans*, and *Trichia pyriformis*, all from Sutton. Mr. J. E. Bagnall read "Notes on some Plants collected in the Lake District, by Mr. W. R. Hughes, F.L.S." The collection consisted of flowering plants and ferns, comprising 93 species, 71 genera, and 36 natural orders, mounted and arranged with differently coloured labels to show their geographical distribution, respecting which Mr. Bagnall made some very interesting remarks, leading to a discussion in which several of the members present joined. MICROSCOPICAL GENERAL MEETING—Nov. 20.—Mr. J. E. Bagnall exhibited *Eriocaulon septangulare*, and *Asplenium adiantum-nigrum*, from Ireland; *Scirpus maritimus* from Flecknoe, and *Sphagnum intermedium*, var. *pulchrum* (new to the county); *Conium maculatum* and *Myriophyllum verticillatum*, both from a new locality, from Birdingbury; also (for Mr. J. B. Stone) *Dicranella squarrosa* (rare), from Malham, Yorkshire. Mr. W. B. Grove exhibited a number of Fungi:—*Rosellinia ligniaria* (rare), *Eutypa velutina* (new to Britain), *Perichæna depressa* (rare), *Acrothecium simplex*, and *Melanconis aceris*, Plowright (a new species), from Marston Green and Sutton. Rev. H. Boyden, B.A., then read a paper on "Our Marine Algæ," illustrated by numerous specimens. After speaking of the great advantage which we in Britain, with our 2,000 miles of sea-coast enjoy in the study of sea-weeds, he proceeded to speak of the methods of their multiplication and reproduction. In relation to the economic importance of sea-weeds, he said that it was small directly, but great indirectly, because they furnished food for hosts of molluscs and fish, which in their turn were food for man. Finally, he spoke of the æsthetic aspect of sea-weeds, and said that his splendidly-mounted series of specimens had often been exhibited in school-rooms and elsewhere, where they had afforded pleasure to many young persons, educating them in the knowledge of the beautiful, which their bright colours and graceful forms are well fitted to impart. He lamented that although a great taste for mounting sea-weeds in albums existed, especially among ladies, who were very expert in that art, yet there was little real desire for a scientific study of these plants.