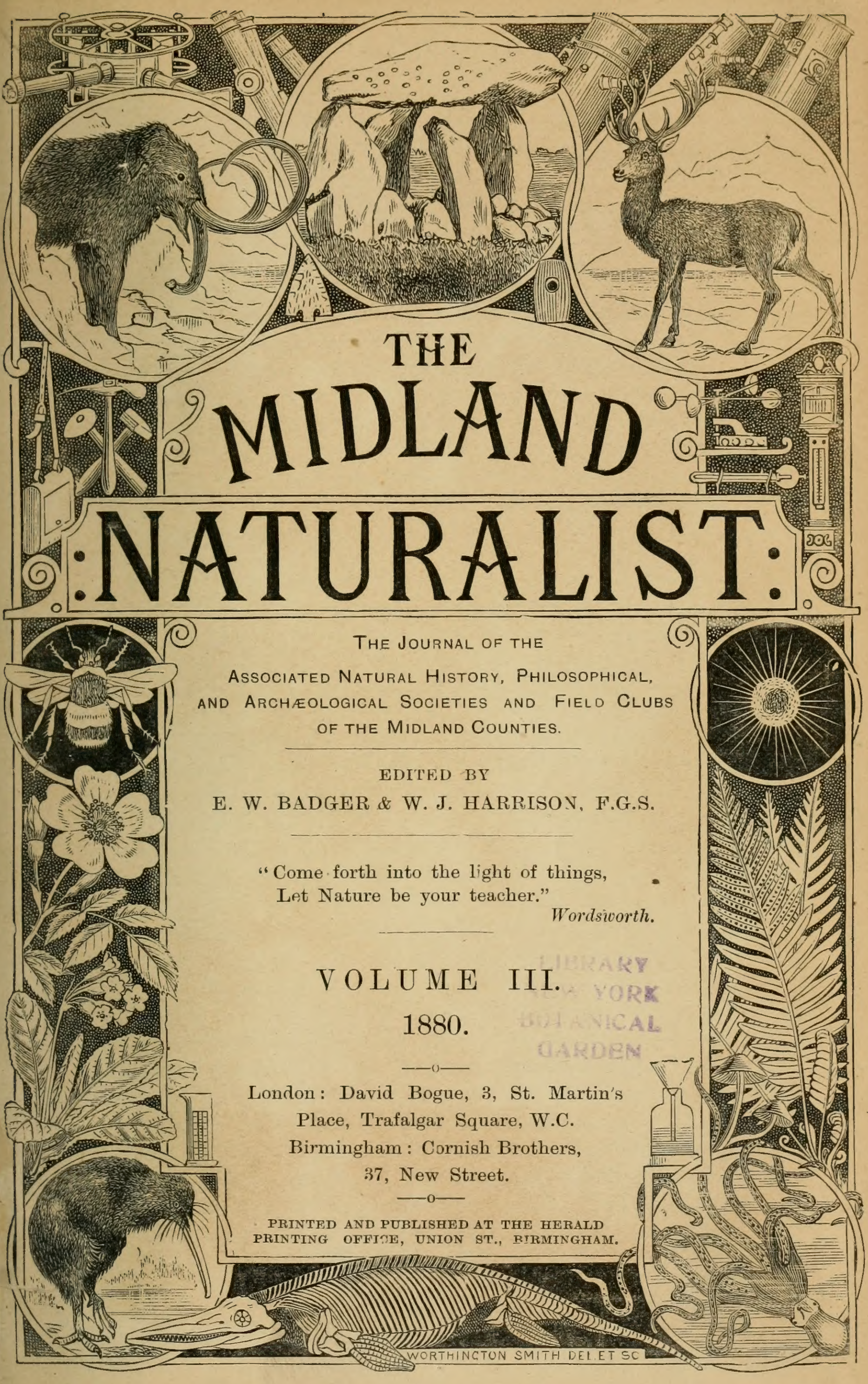

THE MIDLAND NATURALIST:

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.

VOLUME III.
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PREFACE.

The "Darwin Prize" scheme has a special interest for the readers of this magazine, for the prize is to be awarded from time to time for papers indicating original research upon subjects within the scope of the Societies in the Midland Union, contributed by members for publication in these pages. The Editors earnestly direct the attention of their readers to the details of the scheme at page 181 of this volume, and solicit suitable contributions, which, to be eligible for the prize to be awarded at the Cheltenham Meeting next year, must reach them not later than the 31st March, 1881.

Attention is also directed to the prize offered by Sir Herewald Wake, Bart., for the best Original Essay on the Life History of any one genus of Insects indigenous to the Midland Counties, full particulars of which are given at page 223. The essays must be sent in not later than May 1st, 1881.

The idea is rapidly gaining ground that local Natural History Societies and Field Clubs will increase their usefulness and add to their strength by following the example of the Yorkshire and Midland Unions and amalgamating together, so as to utilise such of their separate labours as are of general interest, afford opportunities for the interchange of ideas, and by placing on record what they are severally doing, make it easy for the scattered workers in science to refer to fellow-workers at a distance. The pages of the "Midland Naturalist" have been the means of making public many valuable papers, which would otherwise have been but little known outside the societies before which they were read. The monthly reports of some of the Societies in our Union contained in these pages have been found of great service; and if all would follow the example of the few, an inducement might be given to many members to become subscribers, and the usefulness of the magazine would be increased. We therefore urgently ask the Secretaries to send us regularly concise reports of the proceedings of their several Societies, and such papers read before them as are worthy of extended publication.

The present volume contains a large number of phenological observations; but it is felt that in order to make such information of permanent value, it is desirable that they should be recorded on some well-considered and uniform plan. In an early number we hope to offer some useful suggestions on the subject, meanwhile we shall be glad to hear from correspondents who are interested and are willing to give their assistance.

It is our pleasing duty to acknowledge much helpful assistance, and to thank our contributors one and all. Our Meteorological observers still continue their useful labours; Mr. W. B. Grove, B.A., has given us the same valuable help that we have had to record in former years; the Birmingham Natural History and Microscopical Society has supplied free of cost eight of the eleven plates by which this volume is enriched; Mr. A. W. Wills with like generosity contributed the two beautiful plates which illustrate his valuable paper on Volvox globator; and Mr. John Hopkinson, F.L.S., the plate of Well Sections in the London Basin. Last, but certainly not least, we acknowledge our indebtedness to Professor Huxley, F.R.S., for his kindness in allowing us to present his admirable paper on "The Work of Microscopical Societies" to our readers, and to the Quekett Club, before whom it was read, for their cordial assent.

NOTICES TO SUBSCRIBERS AND CORRESPONDENTS.

The Subscription for 1881 (6s.) will be due on January 1st.

We cannot too strongly enforce upon our readers the importance of every one who can do so assisting us by sending for publication short notes of personal observations on Local Natural History.

Our charges for advertisements may be had on application.

All communications to be addressed to the Editors of the Midland Naturalist, *Herald* Office, Birmingham.

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THE MIDLAND NATURALIST.

"Come forth into the light of things,
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Wordsworth.

THE AGE OF THE PENINE CHAIN.*

BY E. WILSON, F.G.S.

The Penine Chain is the name for that hilly tract of country which stretches from the borders of Scotland on the north to the centre of Derbyshire on the south. This important range possesses the structure of a great though complex anticlinal, the result of a meridional movement of upheaval that took place at a remote period in the physical history of our island. The axis of elevation of the chain, which ranges a little west of north, through North Derbyshire and the West Riding of Yorkshire, throws off the coal measures of Yorkshire and Derbyshire on the one side and those of Lancashire and North Staffordshire on the other, with a steeper dip on the west, and a much gentler inclination on the east. The maximum upheaval is attained in the north of Derbyshire, where a large dome-shaped mass of mountain limestone has been brought to the surface at an altitude of 1,500 feet above the sea. In many ways this prominent feature in the physical structure of our island is worthy of notice. It has had a great deal to do with the distribution of the mineral wealth of the North of England; and if as one result of that elevation a vast amount of valuable coal measures has by subsequent denudation been swept away, still many mineral substances of great economic value are brought within our reach that would otherwise have been hopelessly buried in the bowels of the earth. At the same time we are indebted to this ancient earth-movement for that bold and beautiful scenery—moorland and mountain, scar and dale—that characterises the Penine Chain in its range from the Weaver Hills northwards through the counties of Derby and York. It is not, however, from an economical or an æsthetic, but from a physical point of view that I propose to consider this ancient mountain chain. In particular I seek to arrive at the geological date of its upheaval.

The age of the Penine Chain has long been a matter of conjecture with physical geologists. While all are agreed that the uprising of this great anticlinal took place before the Triassic epoch, the question still remains whether it occurred before or after the Permian era. In 1861

* Read before the Natural Science Section of the Nottingham Literary and Philosophical Society, Oct. 8th, 1879.

Prof. Hull stated his belief that the Penine Chain was elevated into land *during* the deposition of the earlier Permian strata. In 1868, however, the learned professor had come to the conclusion that this earliest upheaval took place between the *close* of the Permian period and the *commencement* of the Trias, "that it belonged to that period of general stratigraphical disturbance which marked the close of the Palæozoic age." As a rule geologists appear to have been content to follow in the wake of so high an authority. Several years ago my local rock studies led me to believe that the Penine Chain was older and not younger than the Magnesian Limestone, and later observations have tended to fortify me in that opinion. Before considering the evidence in favour of this hypothesis, let us in the first place examine what is to be said for the opposite view. The chief, if not the only item cited by Prof. Hull in support of an after-Permian upheaval, is the *supposed* identity in origin (in Lancashire, Cheshire, and Staffordshire) of two important lines of fracture known as the Anticlinal Fault and the Red Rock Fault. Prof. Hull's argument is somewhat as follows.* The Anticlinal Fault and the Red Rock Fault run meridionally (approximately) parallel with each other and with the Penine Chain, therefore all three were the results of a common earth-movement. The Anticlinal Fault which runs from Colne on the north to Leek on the south, near Leek, passes under New Red Sandstone (Bunter conglomerate) without faulting it, therefore this common movement was pre-Triassic; the Red Rock Fault, (an important fracture running parallel with the Anticlinal Fault from Staleybridge southwards, and forming the boundary between the Carboniferous and more recent formations from Bredbury and Poynton, in Cheshire, southwards for several miles,) near Stockport, faults Permian against Carboniferous beds, therefore this common movement was post-Permian. But the same Red Rock Fault elsewhere, viz., near Macclesfield and Congleton, displaces New Red Sandstone (Upper Keuper) rocks, and it might, therefore, be inferred that this fault was (wholly) of later date than the Trias. To evade this difficulty Professor Hull assumes that the Red Rock Fault is the result of *two* independent displacements, the first of which took place before the Permian, the second after the Trias. To this style of reasoning I object, in the first place, that it is unphilosophical to base an argument on a mere assumption; in the next place, that, on the hypothesis of two movements for the Red Rock Fault, the failure of participation in the second of such movements by the Anticlinal Fault shows that faults may run parallel to one another and to great anticlinals without their being contemporaneous; and lastly, that on the assumption that the Red Rock Fault, the Anticlinal Fault and the Penine Chain *were* coeval, and that the Red Rock Fault *has* undergone a second displacement, there is still no evidence against its having been the *second*, instead of the first of such movements, that for the first time faulted the Permians near Stockport, and that an earlier displacement of the Red Rock Fault, together with the Anticlinal Fault, and the elevation of the Penine Chain, took place *before* the Permian epoch.

* "Quarterly Journal Geological Society," vol. xxiv., p. 323.

I now proceed to the consideration of the evidence I have been able to gather together in favour of a pre-Permian upheaval.

I. The great Yorkshire Coal Basin was evidently formed before the commencement of the Permian epoch; for, all along the eastern borders of the exposed portion of this coalfield, wherever the coal measure strata are seen to pass under the Magnesian Limestone, the easterly dip of the coal measures is, more or less, evidently greater than that of the Permians. Now, as the north and south axis of the Yorkshire Coalfield Synclinal runs parallel with the axis of the Penine Chain Anticlinal, we may safely infer that these had a common origin, consequently the Penine Chain is also pre-Permian. In the magnificent sections recently opened out by the railway extensions at Kimberley, near Nottingham, you may see the Middle Coal Measures dipping north-east at angles varying from 5° to 10° or 15° beneath Permian, (Marl Slates and Lower Magnesian Limestone,) that dip east at about 1°. In consequence of this greater inclination of the coal measures, any particular seam of coal is found at constantly increasing depths going east. The "Top Hard" or Barnsley Seam, for instance, which at Kimberley is only 284ft. below the Permian base, is 630ft. beneath the same horizon at Cinderhill, two miles to the east. Again, the same coal at Clowne is 890ft. deep, but at Steetley, which lies about three miles further east, it is 1,590ft. down to it. "All along the edge of the escarpment of the Magnesian Limestone," says Professor Hull, "and for a short distance beyond, in Notts and Derbyshire, as far north as Rotherham, the coal seams are found to dip eastward at a greater angle than the limestone itself, which (with the Lower Red Sandstone) rests unconformably on the coal measures."

II. The Marl Slates, a series of blue thin-bedded argillaceous and dolomitic sandstones and shales that come beneath the Lower Magnesian Limestone, attenuate slowly but surely in a westerly direction, as if approaching a margin. In some recent unsuccessful explorations for coal in Lincolnshire, (South Scarle, between Newark and Lincoln,) the Permians proved to be much more developed than in West Notts. Under Lincolnshire the Lower Magnesian Limestone and Marl Slates together amount to about 220ft. in thickness, at Bestwood to 95ft., at Kimberley to from 53ft. to 33ft., while west of the Erewash no Permians are found, and Triassic rocks repose directly on various members of the carboniferous formation.

III. Coincidently with this attenuation of the Marl Slates the Lower Magnesian Limestone becomes intermingled with sedimentary materials on the west. Though no thicker on the east than on the west the Lower Magnesian Limestone is a very different rock. Under Lincolnshire it is a pure cream-coloured compact limestone, while on the west it is instead a coarse granular dolomite, interleaved with seams of marl and micaceous sand, and may become gritty and even conglomeratic. These phenomena would seem to indicate the shallowing of the waters and the vicinity of land on the west in the Zechstein epoch.

IV. Mountain Limestone pebbles are said to have been found in Permian rocks on the east, and certainly occur in Permian breccias on the west of the Penine Chain. Such pebbles could only have been derived from the wear of a central tract of land composed of carboniferous rocks, and their presence clearly indicates that not only had the Penine Chain come into existence in pre-Permian times, but also that denudation had supervened to such an extent that rocks so low down as the Mountain Limestone were then laid bare in that range.

V. Though the Bunter Sandstone of West Notts and East Derbyshire contains numerous fragments of carboniferous rocks, limestone, chert, and millstone grit, no *débris* of Permian rocks is to be found in that or any other member of the Trias. This fact, though negative, and therefore inconclusive, would seem to show that the Permians were formed subsequently to the elevation of the Penine Chain, and consequently were not uptilted so as to be exposed to denudation on the flanks of that range in Triassic times.

VI. The absence of Permian outliers at any distance west of the Magnesian Limestone escarpment, taken in conjunction with the absence (of fragments) of Permian rocks in, and their overlap by, the Triassic deposits of the neighbourhood, indicates that the original margin of the Magnesian Limestone waters did not lie very far west of the present escarpment.

VII. There is no similarity either in character, thickness, or succession of the Permians on the opposite sides of the Penine Chain. In Lancashire and Cheshire the Lower Permians are represented, according to the Government surveyors, by a mass of unfossiliferous red sandstone, estimated to attain a maximum thickness of 1,500ft., (near Stockport.) while the Upper Permians of South Lancashire consist of from 100 to 250 feet of red calcareous marls with thin bands of earthy limestone and gypsum. Omitting from consideration the "Lower Permian Sandstone," the true horizon of which seems somewhat doubtful, we still find a very dissimilar grouping of the Permians on the two sides of the Penine Chain. In Lancashire and Cheshire we look in vain for any deposit answering to the highly characteristic marl slates of the north-east of England, nor do we find any considerable masses of dolomite comparable with those of Durham and Yorkshire. From Notts to Northumberland the Marl Slates, Magnesian Limestone, and Upper Marls are severally distributed, but on passing across England from Notts to Lancashire—a much less horizontal distance—we find that we cannot positively recognise one of these members of the Zechstein. This marked dissimilarity is in part, at least, to be accounted for by the presence of an intervening land barrier; this barrier was no doubt the range of high land known as the Penine Chain.

We may then, I think, without hesitation, conclude that the elevation of the Penine Chain took place before the Permian era, or at any rate prior to the deposition of the Permian rocks of the North of England.

I have already drawn your attention to some of the results of the elevation of this important range. Its influence on the distribution of the rock masses of the neighbourhood, which began in early Permian times, persisted into the Keuper epoch. Having in pre-Permian times acquired the elevation and stability of an arch, this great anticlinal still maintains that relative superiority to the surrounding country that has justly earned for it the epithet "the Backbone of England." Though marine denudation has planed away its top, while sub-aerial decay has cut deeply into its framework, the great hardness and extreme durability of its more axial rocks have enabled this ancient mountain chain to resist those agents of destruction so successfully that it still forms a broad elevated tract of country, while rearing its loftier peaks from two to three thousand feet above the level of the sea.

NOTES ON THE STRUCTURES OF PITCHER PLANTS.*

BY LAWSON TAIT, F.R.C.S., PROFESSOR OF ANATOMY TO THE BIRMINGHAM ROYAL SOCIETY OF ARTISTS, ETC.

(Continued from Vol. II., page 297.)

SARRACENIÆ CONTINUED.

Sarracenia rubra closely resembles *S. flava* in all the above details, and the amount of fluid in both was always exceedingly small, only enough to moisten the hairy zone and sometimes not sufficient even for that.

S. flava maxima.—I found the zones here to correspond closely with those above detailed. At the base of this pitcher the development of the trichomes and their relations to the intercellular canals can be especially well seen. I have had no opportunity of examining a fresh lid of this magnificent pitcher.

S. Drummondii.—Unless this plant is in extremely good growth its leaves abort and do not grow pitchers. It can evidently make use of only very small insects, for anything larger than a house-fly kills the pitcher. Its first two zones correspond exactly with those already described, and its third, which is homologically its fourth, is destitute of glands, but studded with numerous trichomes. Below this is a very extensive continuation of this zone destitute of everything but epithelium. I have never found any fluid at all in its pitchers. The species is evidently an instance of imperfect or early development.

S. variolaris.—I selected this plant as representing Dr. Hooker's second group. I found the surfaces of the lid the same as in *S. rubra.* The first zone of the pitcher had no stomata and very few glands, and these were evidently not sub-epithelial, though the mammillary process of the cells was produced over them. The second zone had no glands or stomata, and the third had the usual tubular trichomes. I found one pitcher of *S. variolaris* filled with natural food, amongst which a little moisture had gathered. The source of this moisture is probably the air of the hot-house, for I found quite as large an amount gather in a narrow test tube containing a number of flies, placed under similar circumstances. I squeezed the fluid out of the flies from the pitcher, but it had no acid reaction.

Darlingtonia Californica.—I have had opportunities of examining pitchers from four plants, one of which was sent living from its native soil at Sacramento, and a description of a pitcher of this plant, which was fourteen centimetres long and two in greatest diameter, will answer my purpose best. The curious two-lobed organ hanging from the lip, stated by Dr. Hooker, on the authority of Professor Asa Gray, to be smeared with honey, is abundantly supplied with spiral vessels. Both surfaces are numerously supplied with stomata, and situated on or close to the twigs of spiral vessels are large epithelial cells containing brown protoplasm and a large, bright nucleus. (Fig. 10.) I think these are nectaries. The first zone of the pitcher was spiked as in Sarracenia, there was abundance of spiral tissue, but no brown cells, ostioles,

* The figures referred to in this paper will be found in the Plates Nos. VII. and VIII. in Vol. II.

stomata, or glands were found. There was only one other zone, which was covered with the tubular trichomes as in Sarracenia, and had also a few scattered stomata. This surface retained water when wetted, and it extended for ten centimetres from the base of the tube. I failed as completely to obtain any evidence of a process of true digestion in Darlingtonia as I did in Sarracenia. The lacunar spaces on the lip, having brown nuclei, are probably nectaries.

Cephalotus follicularis.—The amount of material at my command for experiment in this case was limited, but what results I did obtain were so decided that I think my conclusions are well founded. The plants examined were all grown in this country. The pitchers of Cephalotus seem to rest their base on the ground, and have three ridges or wings, the outer two of which are fringed, and afford excellent guides into the pitchers for insects creeping off the ground. The lid completely covers the mouth, and in all the specimens which I have examined it is very slightly raised from the lip, this arrangement, with the fluted structure of the lip, allowing the passage of only small insects. The pitchers averaged about 25mm. in depth and fifteen in greatest diameter, the development of erythrochrome being principally on the under surface of the lid. On the unaltered leaves there is abundant erythrochrome on the under surface and numerous stomata. Besides these there are papillary prominences with deep crypt-like cavities. In a young leaf the occurrence of transition forms between these craters and the stomata make it certain that they are developed from the latter, and ought, therefore, to be regarded as additional respiratory organs. We might call them tracheoles, for stomata are sometimes visible within them. On the upper surface of the unaltered leaf the epithelium is of the sinuous kind, and there are stomata sparsely distributed and multifid buds nearly sunk under the epithelial surface. These buds are about ·05mm. in diameter, round, the cells being seen in many cases to have their protoplasm divided into processes or even into distinct cells. On section of the leaf they can be recognised by their brown colour, and can be seen to be only modifications of ordinary epithelium, and that in their most complete form they occupy a nest in the parenchyma, whilst the stomata occupy the top of small papillary eminences. On the under surface of the leaf they are also found, but there they are much less numerous than on the upper surface, and the reverse is the case with the stomata. This is one of many reasons which make me regard the upper surface of the unaltered leaf as the representative of the inner surface of the pitcher. On the outer surface of the pitcher stomata and buds are numerous, especially the former; but inside the pitcher there are no stomata, and the buds can be seen enlarging into glands of great size and importance. In a very young pitcher which I examined I really could not tell, in a section, except for the curve, which was external and which internal surface, for on both the buds were the same. But in the mature pitcher the protoplasm in the buds is divided, and large compound glands are to be found situated in cavities of the parenchyma, which are lined by epithelium. Of these glands only the upper part is presented above the surface, so that the appearances on section very much resemble those of the solitary glands of intestine. They vary in size, even in the mature pitcher, from that of the multifid bud on the outside (·05 mm.) to a size which rivals that of the largest glands in Nepenthes, (·275 mm.,) and are then quite visible to the naked eye. These largest glands are situated on two eminences, composed of a thickening of the parenchyma, situated obliquely, near the bottom of the pitcher, and symmetrically, one on either side. These glandular bodies are crescentiform, and measure about 11mm. by 3. The smaller glands are distributed very irregularly over the surface of the pitcher, but each gland, whatever its size, seems to have a close relation to a twig of spiral tissue with which the pitcher is very liberally supplied. The glands are composed of polygonal cells, between which run intercellular canals. I have never been able to trace any direct connection between the glands and the spiral tissue. On the inner surface of the lid the cells are spiked and point inwards, and the multifid buds exist just as in the Sarracenia. In a completely formed pitcher, which still had the lid adherent to the lip, I found a few drops of clear and slightly viscid fluid, perfectly neutral, and containing two substances, to which I have given the names of Droserin and Azerin, described elsewhere, together with traces of chloride of potash and soda. In two pitchers I found insects bathed in fluid, with a strongly acid reaction, and this fluid digested shreds of albumen exactly as I found the fluid of Nepenthes pitchers did. I conclude, therefore, that a true digestion of its victims is carried on by the Cephalotus pitcher.

NEPENTHES.

In this family I have been able to examine a large number of pitchers from the following varieties:—*N. distillatoria*, *ampullacea*, *ampullacea vittata*, *hybrida*, *hybrida maculata*, *lanata*, *Rafflesiana*, *phyllamphora*, *gracilis*, *levis*, *Hookeri*, *Sedeni*, *Khasyoma*, and *sanguinea*.

I have made a large number of observations on their gland structure and its functions, but they may be all liable to correction, as I have not yet had an opportunity of examining native-grown pitchers. The discrepancies which I have met with are very few, and being confined entirely to minor details of the quality and action of the secretion of the pitchers, I do not attach much importance to them. Still I feel certain that these interesting structures must be studied each in its native place before our knowledge of them is complete.

The form of the pitchers is too well known to need description. On their outer surfaces two ridges occur very constantly, which, in some varieties *(Rafflesiana* and *Veitchii)* reach to a large size, and are deeply fringed at the margins. They extend from the base of the pitcher in an angle from the stalk up to the lip, and include a space which I propose to call the *platform.* In such pitchers as have these wings there is a constant tendency for the stalk of the pitcher to rest in contact with the platform, and I have watched plants and seen that this is of essential service to them in procuring insect food.

This particular kind of nutrition seems to be most necessary for the plants during their youth, for as those which have winged pitchers grow old they tend to produce pitchers without wings, with other changes in their structure, and with very much impaired digestive powers.

Thus the pitchers of *N. Rafflesiana* in a young plant are flask-shaped, the largest diameter being near the bottom, the wings are very wide, and the stalk touches the platform. The pitchers of an old plant, however, have only very slight ridges to represent the wings, they are prolonged into conical funnels, and are bent on the stalk in the direction opposite to that of the young pitchers, whilst the stalk does not approach the side of the pitcher. Their structure is likewise altered in that the pitchers of the young plant are soft and easily withered, whilst those of the old are hard and coriaceous, and are scarcely altered either in colour or shape by prolonged drying. Digestive powers in the latter can hardly be said to exist, and the pitchers seem to have degenerated into mere receptacles of water.

On this most interesting point I have the following information from Messrs. Veitch, the well-known growers of pitcher plants:—"Flowers and pitchers are never borne on the same plant at the same time, the production of the latter always preceding that of the former, and when the plant is in a condition to produce flowers the pitchers become abortive and cease to be formed. The leaves of seedlings and young plants form their pitcher appendages from the very first. In young plants the winged side of the pitcher is turned towards the petiole, the lamina or lid being of course opened on the opposite side. As the plants increase in age and strength, the newly formed pitchers are elongated, and finally become curved something like the horn of an ox; their position with reference to the petiole being then changed, the winged side being turned away from it. During these gradual changes the wings cease to be developed. When the plants are several feet high, and are in a condition to bear flowers, the pitchers cease to be formed."

It is clear, therefore, that the pitchers and their digestive processes are useful for the development of the reproductive function of the plant. This is also shown by the fact, stated to me by growers, that if it is wished that a plant of Sarracenia should continue to grow pitchers, its flower must be nipped off before it is impregnated.

These changes take place in the pitchers of other varieties of Nepenthes apparently sometimes independently of age, but rather in consequence of an abundance of food and its being easily obtained. Thus the pitchers of *N. gracilis* and *N. distillatoria* are quite wingless, but have always very active digestion. The real significance of these changes can be determined only by a study of the plants under their natural conditions, and when this has been done I have little doubt that they will afford very striking illustrations of the modification of structure by the influence of surrounding circumstances. Another noteworthy matter in the general structure of the pitchers is the lid. Sometimes it covers the mouth completely, as in *N. distillatoria*, *N. phyllamphora*, *N. Khasyoma*, &c. In other cases, it either stands erect, as in *N. Rafflesiana*, or covers the mouth very imperfectly. When it covers the mouth the pitcher is nearly always bottle-shaped, having a very distinct constriction about its middle, which marks the abrupt cessation of the secreting surface. In such cases the amount of secretion is always small, but its action is very powerful, and the lid covering the pitcher is evidently for the purpose of excluding rain. Mr. Albert Ratcliffe, a very successful grower and a minute observer, informs me that the lid of *N. distillatoria* closes over the mouth towards evening. This may be to prevent the ingress of nocturnal insects too large for its digestive powers. When the lid is erect, the glandular surface comes up close to the lip of the pitcher, the secretion is large in quantity and slow in action, and the addition of rain-water does not seem of much consequence. This is well seen in *N. Rafflesiana* and in *N. ampullacea vittata*. These differences are sure to be dependent upon some conditions peculiar to the native habitat of the plant, or to the food of which it partakes.

(To be continued.)

AN ANTIQUITY AND A PHENOMENON ON A WELSH HILL.

BY THE REV. O. M. FEILDEN, M.A.

On an out-of-the-way hill, close to the sea coast of Carnarvon Bay, about ten miles from Pwllheli, and four from Nevin, there is a curious relic of great antiquity. The hill is called "Yr Eifi," corrupted by Saxon tongues into "The Rivals." It has three peaks, the highest of which is in the centre, and in height about 1,880 feet. There is a broad marshy dip between this and the peak more to the east and most inland of the three. In this dip, and stretching up the western side of the inland peak, is the object I have referred to. It is an ancient fortification, nearly oblong in shape, surrounded by a wall of loose stones, about 900 yards in circumference, single where it runs along the nearly precipitous side of the mountain, but double (and in some places there are traces of its having been treble) where the ground is not so steep.

The main entrance was on the west side. There is an opening in the inner wall, and then an inclined causeway at right angles to the opening down to another opening in the lower wall. Within the enclosed space, scattered about apparently without much regularity, are groups of huts composed of loose stone walls, mostly circular or oval, but some nearly square. The circular ones are from ten to fifteen feet in diameter, the walls in some instances six feet high; but very few attain this height, and in most cases the area is so filled up with stones and rubbish that it is very difficult to judge what the height was. The huts were probably roofed with turf or heath. There are no traces of windows. The sides of the mountain are covered with masses of loose stones, some of great size, which doubtless served for purposes of defence.

This singular place is now known by the name of "Tre'r Ceiri," "The Town of Fortresses;" but I believe neither its age, origin, nor purpose has as yet been satisfactorily determined. Some suppose its builders to have been the Gael or Gwyddel, before they were driven out by the Cymry, though tradition assigns it to the latter. But this may be accounted for by the supposition that the Cymry appropriated to their own use a fortress of such strength and extent. However, there can be no doubt that it dates back to a remote antiquity, and it is well worth a visit. Any one who undertakes the labour of scaling the steep and strong eminence which this ancient fortress crowns will be well rewarded for his trouble, not only by the curious sight Tre'r Ceiri presents, but also by the magnificent view which the hill commands, Holyhead Mountain, Bardsey Island, Carmarthen Bay, with the Merionethshire coast beyond, being all plainly visible on a clear day; and, above all, Snowdon in all its grandeur, and the magnificent pile of adjacent mountains, which remind one of a monarch surrounded by his court.

Taking leave of Tre'r Ceiri, I made my way to the highest point of Yr Eifi, and while there witnessed a very remarkable phenomenon, which I believe is but rarely seen. It was the evening of a summer day, and the sun was near the horizon due west. A few light clouds came up from the south, and passed very near me on the eastern side of the hill; and, as they passed, I saw my shadow cast upon them by the sun, at first small and at a distance; but as the clouds came nearer the mountain the spectral shadow increased to gigantic proportions, and faithfully imitated my own actions. When I stretched out my arms, or waved them about, the spectre did the same, and as the clouds got denser, a beautiful rainbow surrounded the shadow, sometimes circular or oval, but at other times quite pointed at the top and bottom. When the clouds were thin and light the appearance was very shadowy and indistinct, but the thicker the clouds got the more distinct and visible became the spectre; and, framed as it was with the rainbow, it was a most beautiful as well as a most curious sight. I have heard of this phenomenon being seen in Switzerland, where it is called a Brocken Spectre; and I should like to know if any one has witnessed it, or heard of its being seen on the mountains of Wales or Cumberland.

THE CRYPTOGAMIC FLORA OF WARWICKSHIRE.

BY JAMES E. BAGNALL.

(Continued from Vol. II., page 280.)

BRYACEÆ.

312.—*Leptobryum pyriforme* L. *Bryum aureum* E. B., Purt. Sandstone rocks and walls, local. Olton Reservoir! Rowington! Stone Quarry, Warwick! Leek Wootton! Birdingbury (Kirk)! Willenhall, near Coventry (Kirk)! Shrewley canal bank! tree pots Botanic Gardens! "Walls of Warwick Castle" (Purt.) May.

317.—*Webera nutans* Schreb. *Bryum nutans* Schreb., Wils., Hobk. Damp places, thatched roofs, &c., frequent. Sutton Park! Coleshill Pool! Acocks Green! Yarningale Common! &c. A peculiar densely-tufted form occurs abundantly on thatched roofs by Powell's Pool, Sutton Park! May.

319.—*W. annotina* Hedw. *Bryum annotinum* Purt., Wils., Hobk. Damp sandy places, local. Rare in fruit. "Coughton Lane" (Purt.) In fruit Marston Green! Canal bank Rowington! Sutton Park! Quarries near Nuneaton! Dripping Well, Milverton! June.

321.—*W. carnea* L. *Bryum carneum* L., Wils., Hobk. Sandy and clayey banks, local. Clay pits Erdington! Canal bank Shrewley Heath. April.

322.—*W. albicans* Wahl. *Bryum Wahlenbergii* Schwg., Wils., Hobk. Marshy sandy places and damp rocks, rare. Stone quarries near Nuneaton! near Corley Village! near Middleton Hall! Bearley canal bank! Binley, near Coventry (Kirk)! May.

325.—*Bryum pendulum* Hornsch. *Bryum cernuum* Wils., Hobk. Sandstone walls, rare. On the outside walls of Kenilworth Castle! walls of Bracebridge Pool, Sutton Park! on walls by Rowington Church! May.

326.—*B. inclinatum* Swartz. Sandstone walls and banks, rare. Railway bank near Stechford! [Abundant on walls by aqueduct, Hampstead.] June.

328.—[*B. lacustre* Brid. Should be looked for in moist sandy places; it occurs in such habitats at Weolley Sand Quarries, Harborne.]

333.—*B. intermedium* W. and M. Walls, frequent. Sutton Park! Erdington! stone quarries, Warwick! Rowington Canal bank! Berkswell! June.

334.—*B. bimum* Schreb. Marshes, bogs, &c. Often abundant in the barren state. Sutton Park! bog, near Packington! Canal banks, Rowington! Olton! Holywell! &c. June.

338.—*B. erythrocarpum* Schwg. *Bryum sanguineum* Brid., Wils. *B. bicolor* Purt. "Coleshill Pool," Bree. Sandy places in quarries, &c., local. Near rail way, Whitacre! Canal bank, near Kingswood May.

339.—*B. murale* Wils. On the mortar of walls, rather local. Sutton Park! Canal bridge, near Olton Pool! Bridge, near Shrewley Heath! Ufton Church yard wall! Baulk Lane, near Berkswell! June.

340.—*B. atropurpureum* W. and M. Walls and heathy places, not uncommon. Near Milverton Church! Whitacre Heath! Sutton Park! Ufton Churchyard wall! May.

343.—*B. cæspiticium* L. Walls, thatch, &c., common. Sutton Park! Erdington! Lea Marston! Acocks Green, &c. May.

345.—*B. argenteum* L. Banks, walls, roofs, &c., frequent. Erdington! Sutton Park! Fenny Compton! &c., &c. October.

346.—*B. capillare* L. Trees, walls, thatch, bank, common. Sutton Park! Erdington! Fillongley. May.

Var. b. majus. Often very abundant on thatched roofs. Marston Green! Berkswell! &c.

A barren form often very abundant on the trunks of trees, which I cannot refer to any of Wilson's varieties.

350.—*B. pallens* Swartz. Marshy sandy places, rare. Usually barren, and abundant in this state at several pools in Sutton Park. In fruit on railway siding near the engine-house, Small Heath, 1877, locality probably destroyed now. June.

353.—*B. pseudo-triquetrum* Hedw. Marshes, rare, barren flowers found only. Sutton Park! bog, near Packington!

357.—*B. roseum* Schreb. Sandy banks, very rare, always barren. Marston Green! Sutton Park, near Bracebridge Pool, 1878!

MNIACEÆ.

362.—*Mnium affine* Bland. Shady banks, marshes, bogs, rather local. Olton Canal bank! Marston Green! Haywoods! Sutton Park! abundant in bogs above Blackroot pool, with female flowers always barren.

363.—*M. undulatum* Hedw. *Bryum ligulatum* Purt. "Marsoms Gate, Dunnington." Very rare in fruit. Shady woods and banks. Sutton Park! Marston Green! Olton! in fruit in a quarry near Allesley village! June.

364.—"*M. rostratum* Schrad. *Bryum rostratum* E. B., 1475, Purton. "Subalpine counties, rare. Oversley Hill." (Purt.) April.

365.—*M. hornum* L. *Bryum hornum* L., Purt. "Ragley woods." Banks, woods, &c., frequent. Sutton Park! near Solihull! Middleton woods! Knowle and Rowington canal bank! &c. May.

370.—*M. stellare* Hedw. Shady wet banks, local. Shustoke! near Maxtoke Priory! Dripping rocks near Milverton! always barren.

372.—*M. punctatum* Hedw. *Bryum punctatum* Purt. "Oversley Wood." Near streams, marshes, and on wet clayey banks, local, rare in fruit. Olton canal bank! Marston Green! in fruit Long Moor, Mill Pool, and above Blackroot pool, Sutton Park! March.

373.—*M. subglobosum* B. and S. Bogs and marshes, rare. Near several of the pools in Sutton Park, fruiting sparsley. Shirley Heath, in abundant fruit 1879! March.

374.—*Aulacomnion androgynum* L. Hedge banks, in a sandy soil, woods, &c., frequent, but always barren. Sutton Park, &c.

375.—*A. palustre* L. *Bryum palustre* L., Purt. "Coleshill Pool!" marshes and bogs, local. Marsh near Packington! Sutton Park frequent! Marston Green! always barren. Fruit recorded by Webb, from Sutton Park.

GEORGIACEÆ.

378.—*Tetraphis pellucida* L. Banks, woods, old tree stumps, &c. Not unfrequent with gemmiferous shoots, rare in fruit, abundant in the gemmæ state in Sutton Park! in fruit Poors Wood, Honily! near Three May Poles, Shirley! wood near Olton! New Park, 1879! August.

POLYTRICHACEÆ.

381.—*Atrichum undulatum* L. Marly banks, woods, &c., frequent. Sutton Park! Olton canal bank! Rowington! Haywoods! Ufton Wood! &c., &c. October, November.

Var. attenuatum. Sandy banks, rare. Sandy bank, Warwick Road, near Solihull!

385.—*Pogonatum nanum* Neck. Heathy footways and banks, local. Castle Bromwich! Shirley Heath! Chalcot Wood! Kenilworth Heath; abundant 1879.

Var. longisetum *Hampe*. Rare. In drive by Chalcot Wood, 1874. October, November.

386.—*Pogonatum aloides* Hedw. On marly and sandy banks, local. *Polytrichum aloides* Purt. "Ragley Woods," Sutton Park in several places! lane from Meriden to Packington Park! Shirley! Umberslade! October, November.

Var. b. minus. Sandy banks. Near Brown's Wood, Solihull! Shirley Street!

390.—*Polytrichum gracile* Menz. Woods and heath lands, local. Sutton Park abundantly! Trickley Coppice! New Park, Middleton! Brown's Wood! Hartshill Hayes! May, June.

391.—*P. formosum* Hedw. In woods and on heath lands, local. Sutton Park! Arley Wood! Wood near Maxtoke! Brown's Wood, Solihull! Trickley Coppice! New Park! Haywoods! May, June,

392.—*P. piliferum* Schreb. Heath lands and heathy waysides, local. Coleshill Heath! Old Chester Road! Sutton Park abundant! Coleshill Pool! May, June.

393.—*P. juniperinum* Hedw. Heath lands and heathy waysides, local. Plantsbrook! Sutton Park abundant! Coleshill Heath! Coleshill Pool! May, June.

395.—*P. commune* L. Marshes and bogs! local. Near Packington Park! Coleshill Bog! Coleshill Pool! Railway Cutting Acocks Green! Brown's Wood, Solihull! New Park, Middleton! Arley Wood! Haywoods! Sutton Park abundantly!

Var. c. minus *Swartz*. In drier heathy places and woods. Sutton Park! June.

(To be continued.)

THE MAGPIE—(*CORVUS PICA.*)

AN APPEAL ON HIS BEHALF.

A Naturalist Magazine can fairly be appealed to on behalf of one of the most lively and picturesque birds of our woods, the Magpie—which bids fair to become as extinct as the Dodo. Of late, amongst other mediæval revivals, that of falconry has been making progress, and, in a recent number of the *Field*, the Secretary gives his butcher's bill for 1879, which includes sixty-seven Magpies. To this he adds the result of the Club's flying visit to Ireland, where forty-eight more Magpies were killed by the Club's falcons. Game preservers denounce Magpies as destroyers of game, but this occurs chiefly in the two months during incubation, when Magpie masculine has to bring home dainty food, and plenty of it, to his mate. This is an insufficient reason for Maggie's destruction by the Falcon Club members, for they include forty-one Partridges and three Pheasants in their game list, as well as two Peewits. Who is there, except the game preserver, who does not rejoice to see the piebald wing of the Magpie flash across the glade, or is not delighted to witness the gay blue and steel colours of his tail feathers, which Warburton, no mean judge, declared to be equal to those of tropical birds! No other bird struts about with the same jerky up-and-down motion of the tail, as he digs over and under the fallen leaves for worms and larvæ, which he devours greedily, to the great benefit of the farmer. Earwigs and cock-roaches are pecked up in great numbers by my specimen, a fine cock bird about twelve months old, who is allowed to roam about my out-premises, and is thus free to develop the vices attributed to him by unjust and prejudiced maligners. Maggie is said to be a thief, and the opera of "La Gazza Ladra," or the thieving Magpie, may be appealed to in substantiation of the charge. But surely blame should be laid on the human accusers and the blind justice, which too hastily assumed the pretty waiting maid's guilt! Maggie had seen a ring glittering in the sunshine, mistaking it for a glow-worm, he took it to his nest, and found it indigestible eating, no doubt. My bird has not developed any vice save a little unnecessary violence to the sparrows, who approach too closely to the secret hiding places where superfluous cheese-rinds and small bones are secreted for a time of need; and then he pounces on them like a British Brigadier-General, and punishes them with maiming or death. But, on the other hand, Maggie acts the good Samaritan to a lame, waddly, old duck, who is a privileged pensioner in the yard. Maggie will instantly attack any youngster disturbing the old quack, and brings her dainty morsels—a fat lob-worm, or a cabbage leaf, standing by her, and twinkling his roguish eyes while the duck tastes, and either rejects or swallows his present. Maggie's chatter of a morning, after his bath, when he sits on a hurdle and dries himself, and then favours us with his views on things in general, is to me a most enjoyable sound, and a great relief to the cock-crowing and quacking accompaniments of a poultry yard. Shut

Maggie up in a cage, cover him over, and repeat sentences to him, and he will do greater credit to his tutor than most of the human pupils at a college, who blunder for years over their French and German, without being able to speak either. Wild—he is the ornament of the woods. Tame—he is the amusement of the villagers, and the never-failing pet of all the children. Taking, then, all the points in his favour, his addition to the picturesqueness of our woods, the pleasant chatter of his "talky-talky," his practical usefulness to the farmer, his amiable qualities, and his unsurpassable cleverness, I would fain raise a plea in his favour, and hope that Falcon Clubs will not aid the gamekeepers in exterminating *Corvus pica*.

Cheltenham, December, 1879. W. B. STRUGNELL.

COMPARATIVE CALENDAR OF NATURE.

COMPILED BY MEMBERS (CHIEFLY JUNIORS) OF THE BURTON-ON-TRENT NATURAL HISTORY AND ARCHÆOLOGICAL SOCIETY.

I.—ORNITHOLOGICAL.

	1877.	1878.	1879.
Thrush's nest with eggs (*Turdus musicus*)		Feb. 23	April 2
Robin's nest with eggs (*Erythaca rubecula*)		Mar. 6	,, 22
Thrush's nest with young birds		,, 20	May 16
Hedge sparrow's nest with eggs (*Accentor modularis*)		,, 23	April 16
Swallows seen (*Hirundo rustica*)	April 13	April 11	,, 3
Cuckoo heard (*Cuculus canorus*)	,, 26	May 5	,, 20
Chaffinch's nest with eggs (*Fringilla cœlebs*)		April 30	May 8
Corncrake heard (*Rallus crex*)		,, 29	,, 8

II.—ENTOMOLOGICAL.

	1877.	1878.	1879.
Tortoiseshell butterfly (*Vanessa urticæ*) seen		Mar. 3	Feb. 12
Bee first seen		Feb. 17	Mar. 7
Wasp first seen (*Vespa vulgaris*)		,, 17	April 2
White butterfly (*P. rapæ*)		April 11	May 4
Hybernia progemmaria	April 2	Feb. 24	Mar. 7
,, *leucophearia*		Mar. 4	,, 4
,, *rupicapraria*		,, 4	,, 1
Glow-worm (*Lampyris noctiluca*)		June 2	May 24
Orange tip (*A. cardamines*)		,, 5	June 2
Ghost moth (*H. humuli*)		,, 7	,, 18
T. gothica	April 5		April 1
T. stabilis	,, 2		,, 2
T. instabilis		Mar. 6	,, 2
Brimstone moth (*R. cratægata*)		June 7	June 20
Larvæ of Streak (*C. spartiata*)		,, 8	,, 14
Clouded Magpie (*A. ulmata*)		,, 17	,, 30
Grey Dagger (*A. psi*)		,, 21	July 15
Cabbage moth (*M. brassicæ*)		,, 25	June 17
Plusia gamma		,, 27	,, 9

III.—BOTANICAL.

	1877.	1878.	1879.
Currant lf. *(Ribes rubrum)*		Feb. 23	Mar. 1
Gooseberry lf. *(Ribes grossularia)* ..		Mar. 9	,, 9
Lime lf. *(Tilia europœa)*	May 13	May 15	May 4
Chestnut lf.	,, 7	April 14	,, 5
,, fl.	June 1		June 5
Hawthorn fl. *(Cratægus oxyacantha)*	,, 1	,, 22	,, 6
Daisy fl. *(Bellis perennis)*		Mar. 9	Mar. 9
Hazel fl. *(Corylus avellana)*		,, 16	Feb. 22
Violet fl, *(Viola odorata)*		,, 9	Mar. 16
Primrose fl. *(Primula vulgaris)*		,, 9	,, 29
Campion fl.		,, 9	May 24
Oak lf. *(Quercus robur)*	May 26		,, 16
Wood Anemone fl. *(Anemone nemorosa)*		,, 23	April 14
Forget-Me-Not fl. *(Myosotis sylvatica)*		April 14	May 24
Bluebell fl. *(Scilla nutans)*		,, 14	,, 25
Stitchwort fl. *(Stellaria holostea)* ..		,, 22	,, 24
Laburnum fl.		May 17	June 7
Dandelion fl. *(Taraxacum dens leonis)*		Mar. 23	April 26
Wild Rose fl. *(R. canina)*		June 10	July 3

J. E. Nowers, Hon. Sec. for Junior Members.
The Grammar School, July 31, 1879.

Reviews.

Proceedings of the Liverpool Naturalists' Field Club for the year 1878-9.

This volume reflects great credit upon the Liverpool Field Club, not merely on account of its literary excellence, but as giving evidence that the Club is in every way a success, having many energetic and good working naturalists among its members, who are, by a wholesome system of competition in the field, kept from rusting. The Club is also a success financially, as the balance sheet shows a considerable sum in the hands of the bankers. The President (the Rev. H. H. Higgins, M.A.) contributes an excellent address on the "Biographical History of Botany, from its Origin to its Union with Zoology in the Science of Biology." This is a concise history of leading botanists, from Theophrastus down to Goethe. It is written in a very charming style, would fascinate the most unscientific reader, and yields information valuable and interesting to all lovers of natural history pursuits. This is followed by a report of the Excursions during the year, which shows that there is a great amount of healthy competition at the Field Meetings, which must necessarily keep the Club from stagnating. "The Botanical Résumé," by Mr. R. Brown, the foremost botanist of the society, gives an excellent account of the botanical work of the year, and this is followed by a goodly list of the rarer flowering plants and ferns noticed during the Excursions. The volume closes with a long list of books useful to the student of biology, their prices and the publisher's names attached to each ; a very useful list o young students. J. E. B.

The Geology of the Yorkshire Coalfield. By A. H. Green, M.A., F.G.S., R. Russell, C.E., F.G.S. (Geological Survey Memoir.) 823 pages, 125 woodcuts, 26 plates. Price 42s.

This great work has been edited by Professor Green, but a large portion is the work of Mr. Russell, and the names of five other members of the Survey appear on the title-page as having assisted in the examination of the district. It is much to be regretted that for want of sufficiently accurate maps the detailed work of the Geological Survey has been arrested on the southern boundary of Yorkshire. Professor Green remarks: "It seems hardly credible that the bogs, mountains, morasses, and unproductive wilds of the whole of Ireland should have been long ago mapped and published on the six-inch (to a mile) scale, while so many of these large mining districts, to which our country owes her wealth and importance, have still to be content with little one-inch maps; but so it is, and, till this anomaly is put right, the detailed survey of the southern portion of the great central coalfield of England must be postponed." All Midland science workers will endorse this statement, and it would be well for the Council of our Union to consider if some appeal could not be made to Government for the more rapid prosecution of this much-needed work. The country described in this memoir extends from Sheffield and Rotherham on the south to Skipton Moor and the Valley of the Wharfe on the north, and from the Pennine ridge on the west to the magnesian limestone escarpment on the east. The rocks which form this area are carboniferous limestone, Yoredale rocks, millstone grit, and lower, middle, and upper coal-measures, overlaid by drift deposits. Of all of these a most faithful and detailed account is given; indeed, the book is a perfect storehouse of facts relating to carboniferous geology, and will prove a source of most valuable information to such of the local land-owners and colliery proprietors as understand how to avail themselves of it, and this is the more important as Professor Green tells us that "The Yorkshire Coalfield is comparatively virgin ground. Along its western and northern outcrops mining operations have been, indeed, vigorously carried on, but these are, so to speak, bassett workings, exceeding, in very few instances, a depth of 200 yards. The great spread of exposed coal measures in the centre of the basin is untouched, and the portion beneath the magnesian limestone pierced by only a few shafts." The book concludes with a valuable list by Mr. W. Whitaker of 361 books and papers which have been written on the geology of the district between 1626 and the present time. It only remains to add that the price is, for a geological survey memoir, a very reasonable one. W. J. H.

A Guide to the Botany, Ornithology, and Geology of Shrewsbury and its Vicinity. Edited by W. Phillips, F.L.S. Shrewsbury: Bunny and Davies. Price 1s.

We have pleasure in drawing attention to this useful little handbook which needs no commendation from us or anyone. The Botany is by Mr. W. Phillips, F.L.S., the Ornithology by Mr. W. E. Beckwith, and the Geology by Dr. Callaway, F.G.S., &c.

Outline Descriptions of British Coleoptera. By Rev. T. Blackburn, B.A. 1875. Perth: J. Young. Price 2s. 7d., post free.

This forms the first part of what promises to be, when complete, a very useful addition to our rather meagre list of books on British Coleoptera. It is reprinted from the "Scottish Naturalist," in which excellent serial, we are informed, the "Outlines" will be continued until finished. The portion under examination, embracing the *Geodephaga*, *Hydradephaga*, and *Philhydrida*, gives a good idea of the intention and plan of the work. The author, in a short but highly practical introduction, tells us that, as his book is "designed especially for beginners," the object he has kept in view "is the provision of a ready means of identifying species, not classification." It is important to keep this in mind, as otherwise the "beginner" who takes up the book will be rather puzzled at the apparent disorder in which the specific names are arranged; anyway, he may be excused if he express his regret that the rules of identification and classification should not always run on the same lines. The plan of the work is "to furnish in the briefest possible form tables of the leading characters of the British Coleoptera." By the free use of abbreviations the matter is much compressed, and, as they are all easy to remember, at least two great advantages accrue—the student can take in the full details of a description at a single glance, and the book is brought within "pocket" limits. The author has succeeded in most cases in displaying the salient points of each species. The printing is well done, in clear, though small type; and the only typographical errors I have detected are in *Helophorus tuberculatus*, on page 62, and *Hydraena nigrita*, on page 67. Would that similar brevity, clearness and accuracy characterised all professedly scientific publications! The "Outlines" can be strongly recommended, not only to "beginners" but to "old hands."

W. G. Blatch.

Floral Dissections, illustrative of Typical Genera of the British Natural Orders. By the Rev. Geo. Henslow, M.A., F.L.S., F.G.S. London: Stanford. Price 4s.

This is a very satisfactory book, containing a large number of illustrations lithographed and described by the author. To those who, like the members of our Science Classes, have to study Botany in the winter when fresh specimens are not obtainable, it should prove of great service; and when actual specimens can be had, this book will teach the student "what to look for," the very point on which he requires instruction.

W. J. H.

An Atlas of Anatomy, or Pictures of the Human Body, with descriptive Letterpress. By Mrs. Fenwick Miller. London: Stanford. Price 12s. 6d.

This book contains twenty-four quarto coloured plates, comprising 100 separate figures, boldly drawn and highly coloured, being indeed of a high order of merit. They are quite large enough to serve as ordinary class diagrams, whilst the accompanying letterpress and index fully explain and describe them.

W. J. H.

METEOROLOGY OF THE MIDLANDS.

THE WEATHER OF NOVEMBER, 1879.

BY W. JEROME HARRISON, F.G.S.

STATION.	OBSERVER.	RAINFALL. Total for M. In.	Greatest fall in 24 hours. In.	Greatest fall in 24 hours. Date.	No. of rainy days.	TEMPERATURE. Greatest ht. Deg	Greatest ht. Date.	Great'st cold Deg	Great'st cold Date.
GLOUCESTERSHIRE.									
Cheltenham	R. Tyrer, Esq.	1·82	s)·66	21	13	56 0	18	17·0	23
Stroud	S. J. Coley, Esq.	·59	·17	21 & 24	7	55·0	19	22·0	15
SHROPSHIRE.									
Haughton Hall, Shifnal	Rev. J. Brooke	·86	s)·34	26	11	54·0	18	19·0	15
Woolstaston	Rev. E. D. Carr	1·22	·30	20	16	58·0	5	19·5	22
More Rectory, Bishop's Castle	Rev. A. Male	1·25	·38	20	17	54·0	7	20·0	11 & 15
Larden Hall	Miss F. R. Boughton	1·35	·34	20	15				
Bishop's Castle	E. Griffiths, Esq.	1·02	·30	20	12	56·0	18	21·0	21
Cardington	Rev. Wm. Elliott	1·35	·40	20	11				
HEREFORDSHIRE.									
Stoke Bliss	Rev. G. E. Alexander	·87	·32	20	13	57·0	18	25·0	30
WORCESTERSHIRE.									
Orleton, Tenbury	T. H. Davis, Esq	·99	·35	20	15	58·7	18	17·2	22
West Malvern	A. H. Hartland, Esq.	·64	·22	21	10	54·0	18	22·0	30
Pedmore	E. B. Marten, Esq.	1·15	·38	20	16	57·0	7	16·0	10
Longlands, Stourbridge	J. Jeffries Esq.	1·08	·36	20	13	56·0	18	20·0	14, 29, 30
Dennis, Stourbridge	Mr. C. Webb	·79	·34	20	12	55·0	18	18·0	14
STAFFORDSHIRE.									
Dudley	Mr. J. Fisher	1·06	·22	23	11				
Sedgley	Mr. C. Beale	·87	·32	20	11	52·0	18	23·0	30
Oakamoor	E. Kettle, Esq.	1·84	·59	21	14	53·6	12, 17, 13	17·8	15
Kinver	Rev. W. H. Bolton	·91	·31	20	16	56·0	18	21·0	14 & 30
Walsall	Mr. N. E. Best	1·11	·30	20	15	54·0	18	22·	21
Grammar School, Burton	C. U. Tripp, Esq.	1·51	·50	20	18	57·0	7	19·0	15
Weston-under-Lyziard R'tory	Hon. and Rev. J. Bridgeman	1·05	s)·30	20	13	56·0	18	20·0	22
Wrottesley	E. Simpson, Esq.	·87	s)·34	20	10	53·5	18 & 19	20·0	22
Heath House, Cheadle	J. C. Philips, Esq.	·40	·46	20	14	52·0	6, 7, 17	22·0	23 & 30
Alstonfield Vicarage	Rev. W. H. Purchas	2·09	·46	10	10	55·3	7	16·4	14
Farley, near Cheadle	C. L. Wragge, Esq.	1·68	·60	21	15	52·5	18	20·0	22
WARWICKSHIRE.									
Coundon, Coventry	Lieut.-Col. R. Caldicott	1·07	·23	20 & 23	13	52·0	17 & 18	23·0	14 & 30
Coventry	J. Gulson, Esq.	1·19	·33	20	16	58·0	17	19·0	15
St. Mary's College	Rev. S. J Whitty	1·14	·45	20	16	53·1	18	1·0	22
Henley-in-Arden	T. H. G. Newton, Esq.	1·20	·36	20	11	55·0	18	19·0	15
Rugby School	Rev. T. N. Hutchinson	1·15	·36	20	14	56·4	7	20·0	15
DERBYSHIRE.									
Stoney Middleton	Rev. U. Smith	1·68	·74	20	13	43·0	18	13·0	21
Fernslope, Belper	J. G. Jackson, Esq.	1·62	·73	20	17	54·0	17 & 18	21·0	21
Linacre Reservoir	C. E. Jones, Esq.	1·78	·70	20	14				
Spondon	J. T. Barber, Esq.	1·50	·64	20	13	54·2	7	20·0	14 & 21
NOTTINGHAMSHIRE.									
Hesley Hall	B. J. Whitaker, Esq.	1·46	·67	21	13	56·0	18	19·0	22
Tuxford	J. N. Dufty, Esq.	1·49				53·0	7	20·0	21
Hodsock Priory, Worksop	H. Mellish, Esq.	1·76	·78	20	15	56·0	7	20·4	22
Park Hill, Nottingham	H. F. Johnson, Esq.	1·60	·57	20	13	51·5	17	23·0	15
LEICESTERSHIRE.									
Loughborough	W. Berridge, Esq.	·89	·38	20	12	56·7	7	20·1	15, 16, 22,
Ashby Magna	Rev. E. Willes	1·12	·33	20	13	56·0	18	18·0	1 (23
Market Harborough	S. W. Cox, Esq.	1·24	·34	20	8	52 0	7 & 18	16·0	15
Kibworth	T Macaulay, Esq.	1·30	·38	20	14			20 0	15 & 16
Town Museum, Leicester	W. J. Harrison, Esq.	1·09	·37	21	15	55·2	18	23·5	15
Syston	J. Hames, jun., Esq.	·84	·29	20	10	53·0	19	23·0	14 & 23
Waltham-le-Wold	E. Ball, Esq.	1·50	·35	20	15	52·0	18	22·0	21
Foxton Locks	Union Canal Company	·97	·33	20	7				
Coston Rectory, Melton	Rev. A. M. Rendell	1·60	·50	21	15	53·0	17	15·0	15
NORTHAMPTONSHIRE.									
Towcester Brewery	J. Webb, Esq.	·92	·24	24	6				
Castle Ashby	R. G. Scriven, Esq.	1·33	·34	22	14	58·0	8	24·0	3
Kettering	J. Wallis, Esq.	·91	s)·23	20	11	58·0	18	25·0	16, 17, 30
Althorpe	G. S. Groom, Esq.	1·14	·24	24	11	53·0	18	20·0	14
RUTLAND.									
West Deyne, Uppingham	Rev. G. H. Mullins	·93	s)·32	20	9	53·0	18	23·4	22
Northfields, Stamford	W. Hayes, Esq.		·27	6	8	56·0	19	21·0	23
Oxford	E. J. Stone, Esq.	68	·25	21	10	58·4	18	22·1	14
Ventnor Hospital	W. T. Ryder, Esq.	·66	·35	22	2	59·7	18	26·7	30
Altarnun Vicarage	Rev. J. Power, M.A.	.67	s(·16	30	7	57·0	19	21·0	30

This month witnessed a continuation of the dry period which commenced in October; "the driest November, and one of the driest months remembered at Altarnun;" "the driest November here (Shifnal) for forty-four years, with two exceptions, viz., 1855, when ·57 inches, and 1858, when ·61 inches, fell." "The rainfall of November has not been under one inch here (Syston) since 1871, when it was ·95 inches." The dry weather proved of incalculable value to farmers in facilitating the operations of the plough, and checking the diseases to which cattle and sheep are subject when the ground is in a wet and saturated condition. Generally speaking, the first half of the month was very fair and pleasant, but after the 17th the weather became more unsettled, with heavy falls of snow and sleet from the 18th to the 27th. The barometer continued remarkably high, and with but little range. North-westerly winds prevailed; in temperature the first half of the month exceeded, and the latter half was below the average. The ice on lakes, &c., was sufficiently firm in most places for skating on the 30th, although on the 15th and 16th it was sufficiently firm for a short period to "bear" small boys and light-weights generally. A lunar halo was seen at Oxford on the 28th. At More Rectory "a bright meteor was visible for nearly a minute at 7 15 P.M. on the night of the 10th;" but of the expected showers during the last few days of the month but few were seen.

NATURAL HISTORY NOTES BY OBSERVERS.—*Coventry.*—Although there is a good supply of Hawthorn berries, I have not seen any considerable number of Fieldfares, or other winter birds. On the morning of the 8th a very large flock of Wild Geese, numbering, as I am told, some hundreds, were seen flying over a part of the town. They were flying eastward, and passed over Stoke. I regret that I did not see them, as so large a flock is of rare occurrence. *Farley, near Cheadle.*—November 2nd, Daisies still in flower. November 9th, Wild Geranium in bloom. November 10th, *Digitalis purpurea* (Foxglove) in flower still, Buttercups also, tops of Oaks bare, Birch "universally" bare. November 14th, noticed some large Blackberries ripe, apparently in sheltered places, where they were protected from the first severe frost; fruit lacking flavour and perfection, however; many shrivelled before attaining maturity. Oak trees generally bare. Ice, half an inch thick. November 18th, Oaks "universally" bare; species of Buttercup still in bloom. November 26th, *Fringilla cœlebs* (Chaffinch) feeding; this bird has lately been seldom seen. November 29th, Ice about 1in. thick. *Linacre.*—Saw the Foxglove, the Crocus, and other flowers in bloom, on the 13th of the month. An occasional Primrose in the woods. *Nottingham.*—The Oaks retained their leaves throughout the month, but all the rest have cast theirs some time since, those of the Horse Chestnut particularly being very brightly tinted. Hips and Haws are plentiful, especially the latter. *More Rectory.*—Heard a few Fieldfares on the 19th, but have seen very few. *Burton-on-Trent.*—Fall of leaves rapid in and near Burton during first week, though on the higher lands each side of the Trent Valley the fall was fully a fortnight later. Berries generally scarce. *Shifnal.*—A fine Wheat seed-time; Grey Wagtails here on 10th. *Coundon.*—The last field of Wheat in this parish cut and carried between Sunday, 26th October, and Sunday, 2nd November. Bon-Chrêtien Pears of last year's crop were ripe and consumed by 30th September. The Pears from the same tree on table this day, December 1st, unripe. White Plums, (Golden Drop,) Damsons, and Pears on trees, and unripe, after every leaf had fallen from them on 15th November.

Correspondence.

Leptodora hyalina.—The enquiry that has been made about the correct pronunciation of this name can be answered by reference to the derivation of the word, namely Le′pto-do′ra, from λεπτος, delicate, and δορα, skin, in allusion to the remarkably delicate and transparent covering of this very interesting creature. The ο in δορα being the short Greek letter, makes the sound strictly Le′pto-do′rra.—W. P. Marshall.

Abnormal Eggs of the domestic hen, similar to that named by Mr. C. Rothera, (Vol. II., p. 259,) are not I think very uncommon. I have several in my possession gathered from the hen roost during the last few months which vary much in size and appearance. One is perfectly globular and very small, not more than half an inch in diameter; another is rather larger and rather more oval in shape, and having one large lump of calcareous matter at the narrower extremity of the egg; the others are smoother and more oval, but none larger than a pigeon's egg.—Arthur S. Male, More Rectory, Bishop's Castle.

Ornithological Notes.—The Grey Wagtail is more common with us in autumn than at other times of the year. On the 15th November I observed five along the Cherwell, in this parish, and a few days afterwards I found several about the same place. On the 22nd of that month I saw what I believe to have been a Green Sandpiper. If it was of that species it was an unusually late date. I am informed by a friend that he saw Redwings about the middle of October, I, myself, did not see any till the 22nd of last month—a very late date. Neither this bird nor the Fieldfare is nearly so numerous this year as it usually is. The early winter may account for this. We have had a good many Wild Ducks coming to feed at night on the Cherwell, and one or two Teal have been shot, but the dryness of the meadows has prevented them coming in as large numbers as usual. The Heron may still be frequently seen here. About a month ago I saw four sitting in a tree in Wykham Park; and it is no unusual thing to rouse one or more in a walk along the stream. This bird looks very peculiar on leaving a tree. Its long legs hang down for the first few strokes of its wings, before they are gathered up and stretched out behind.—O. V. Aplin, Bodicote, Oxon, Dec., 1879.

Animal Sagacity.—As you ask to be furnished with instances of sagacity or instinct on the part of animals, I send the following anecdote :—" A horse of mine, which had been stall-fed for several years, was turned out to grass in one of my fields. I accompanied the man with it, feeling a little curiosity to see how it would behave. It did not kick, or gallop, or roll about as horses sometimes do on being let loose, but immediately began quietly to partake of the pasturage, nibbled for a moment, moved on a step or two, then tried again. He then, instead of moving on to bite fresh grass, remained stationary, grubbing away with his teeth on the same spot, until he had bitten through the turf into the soil, and had sunk a small cavity into it, the dirt or soil coming out with the saliva at the sides of his mouth. He did not seem to swallow, but simply to grind it between his teeth. After doing this for a short time he commenced feeding on the grass in a natural way. The theory we formed about it was that the horse found himself at first unable to nip off the blades of grass in a satisfactory manner, owing to his teeth having been worn too smooth by the long period of stall-feeding, and this led him to adopt an expedient for roughing them by grinding their surfaces with the grit of the soil. The process of grazing may, perhaps, afford a natural supply of grit in the very small quantity that is necessarily taken up with the grass. I cannot say whether this is a correct explanation, but if it is, it would seem to point to the advantage of giving stall-fed animals a little fine sand or gritty matter of some kind occasionally, with food that is free from it, to maintain the efficient grinding quality of the teeth. Perhaps some of your readers may have observed horses under similar circumstances, and can say whether this, to me, peculiar conduct, has been noticed before."—A. F. O.

Birds at Leadenhall Market, (December, 1879.)—The following list of birds which I observed in Leadenhall Market about the middle of this month may perhaps be of some interest, although of course the localities in which they were killed cannot be given—no doubt the greater number were foreign. The first on the list, and in fact a good many others, can hardly be called good eating:—Kestrel, (one,) Blackbirds, Missel and Song Thrushes, Redwings and Fieldfares, Larks in thousands, Rooks, two Jays, large numbers of Starlings, very many Capercailzies, a few Red Grouse, Common and Red-legged Partridges, and a great number of Pinnated Grouse and Blackcocks; thousands of Snipe, also a few "Jacks," Woodcocks in large numbers, Dunlins, Redshanks and Stints, Water Rails, a dozen or more; Golden and Grey Plovers, and a good many Lapwings; Curlews and Bar-tailed Godwits, one pure white Pheasant, and of course countless numbers of ordinary ones. About a dozen Herons, Moorhens, and one Coot. The duck family was well represented. Besides very large numbers of the ordinary Wild Ducks, Wigeons, Pochards, and Golden Eyes, I noticed a few Teal, two Pintails; and a fine male Shoveller, which I was informed was killed at Tralee, Ireland. There were a good many Sheldrakes and Brent Geese, and two Bewick's Swans. I saw several little Grebes, and one immature Great Northern Diver; also a few Kittiwake, Common and Herring Gulls. Amongst the live birds were a Kite, half a dozen Kestrels, a Raven, a Rook, and one or two Common and Kittiwake Gulls.—O. V. Aplin, Bodicote, Oxon.

Gleanings.

University Intelligence.—We are glad to notice that our correspondent, Mr. F. F. Grensted, of University College, Oxford, has gained a First-class in the Final School of Natural Science, at Oxford.

"The Royal Microscopical Society's Journal," which now appears bi-monthly, maintains its high position in all respects. It is most ably edited by Mr. Frank Crisp, LL.B., B.A., F.L.S., assisted by well-known specialists, and contains articles of great interest to all biological students and microscopists. In the current number, which completes Vol. II., there is an admirable paper by our contributor, Mr. H. E. Forrest, on *Leptodora hyalina*, describing the external structure, the digestive and circulatory system, the nervous system, and sensory organs, the muscles, the sexual differences, the zoological position, and the history of this interesting entomostracon. This and other articles are well illustrated. Two important features of the journal are the record of current researches relating to invertebrata, cryptogamia, microscopy, &c., including embryology and histology generally, and the bibliography of English and foreign periodical literature relating to the same branches of science, the latter giving a classified index in English to the contents of upwards of 300 scientific journals and transactions, and the former abstracts of, or extracts from, the more important of the articles noted in the bibliography.

Early Wild Flowers.—Will observers generally record and communicate to us the dates of flowering of such of the following plants as they may note in their neighbourhood: Lesser Celandine, Sweet Violet, Coltsfoot, Primrose, Dog's Mercury, Hazel, Snowdrop, Blue-bell *(Scilla nutans,)* Cowslip, Marsh Marigold, Cuckoo Flower, *(Cardamine pratensis,)* and Bulbous Buttercup *(Ranunculus bulbosus.)*—Eds. M.N.

Water and Air.—Professor Tyndall's Christmas Juvenile Lectures, at the Royal Institution, on "Water and Air" will, by special permission of Dr. Tyndall, appear in full in "The Journal of Science." The first lecture will be inserted in the number for January, 1880.

Dew, Mist, and Fog.—In a recent paper read before the Meteorological Society, Mr. Geo. Dines estimates the amount of dew which falls annually at 1½in. Mist and fog are stated to "differ only in degree;" and perhaps the best definition to be given of either is that of a cloud resting upon, or rather rolling over, the earth's surface. Morning mists are produced by the evaporation of water-vapour from damp surfaces being greater than the air over those surfaces can absorb or retain in the invisible state; evening mists by cold surfaces (good radiators as grass fields) chilling the air which rests upon them. Fog is more difficult to account for fully, and Mr. Dines is "inclined to attribute these fogs to some cause at present unknown to us, by which the whole body of the air to some distance above the surface of the earth is cooled down, and, as a consequence, part of the vapour in that air is condensed, and forms what has been called an 'earth cloud'" *i. e.* a fog. The reason why the water particles which form mists, fogs, clouds, &c., do not fall at once to the earth is, Mr. Dines says, that they "are so minute that they are unable to force their way through the air beneath them; they float in that air, like dust in our rooms or particles of smoke in the atmosphere; yet, who doubts that both of these are specifically heavier than the air by which they are surrounded?"

Reports of Societies.

BIRMINGHAM AND MIDLAND INSTITUTE SCIENTIFIC SOCIETY. —November 26, Mr. C. J. Watson read a paper on the "Slide Rule," which was illustrated by various forms of the instrument lent for the occasion by the Mayor, and Messrs. Rabone and Sons.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—Microscopical General Meeting.—November 18th.—Mr. T. Bolton exhibited a curious Infusorian, *Peridinium cinctum*, occurring just now in considerable abundance in the pools at Sutton. Mr. H. W. Jones exhibited *Sagartia elegans*, showing reproduction by gemmation Mr. W. P. Marshall read some notes on *Leptodora hyalina*, which will appear in a future number of the "Midland Naturalist." They were illustrated by numerous coloured diagrams and specimens under the microscopes. At the conclusion Mr. H. E. Forrest gave many additional particulars of the anatomy of the animal, and a discussion followed, in which Messrs. J. F. Goode, W. R. Hughes, G. S. Tye, R. M. Lloyd, and others took part. Geological Section.—November 25th. —The subject of the exploration of Kent's Cavern having been introduced, the section recommends that this society, recognising the importance of continued exploration in Kent's Cavern, do correspond with Professor Williamson and Professor Boyd Dawkins, requesting information as to the manner in which this society can aid the proposed extension of the exploration, and as to whether it would be possible for societies aiding to a fixed extent in the work to obtain a series of typical specimens for their own collections. Mr. Levick communicated a letter from Professor Kellicott, of Buffalo, on the new Rotifer, *Anuræa longispina*, with two photographs. Mr. Jones exhibited a young specimen of

Dog-fish, *Scyllium canicula*, showing umbilical sac, and specimen of prawn, showing the way in which it casts its skin. Mr. Waller read a paper on Obsidians and Pitchstones, showing several specimens, illustrative of the various structures observed in them. General Meeting.—December 2nd.—Mr. R. W. Chace exhibited a fine stuffed specimen of the Avocet, *Recurvirostra avocetta*, shot near Stornoway, and which he had received in the flesh. Mr. J. O. W. Barratt exhibited specimens of *Stentor Mülleri*. Mr. Doeg, of Evesham, sent for exhibition specimens of the rare Rotifer, *Tubicolaria najas* or *Melicerta tyro*, which had appeared in his aquarium, having been probably introduced with some willow roots from the banks of the River Avon, at Evesham. Mr. J. W. Cotton sent for exhibition a crystal of Fluor Spar, containing a bubble floating in a fluid, occupying a large part of its centre. Mr. H. W. Jones read a paper by Mr. W. Southall, F.L.S., on *Ervum ervilia*, the Bitter Vetch, showing the poisonous effects which it has upon pigs, when eaten dry, but after being soaked in water it loses its poisonous properties. It is not poisonous to all animals, however, as sheep eat it with impunity. Biological Section.—December 9th. Mr. J. E. Bagnall contributed *Ophrys aranifera*, var. *fucifera*, *Sisyrinchium Bermudiana*, *Stratiotes aloides*, and other rare plants; also specimens of *Anacharis Alsinastrum*, collected as a rare plant in 1847 by Rev. A. Bloxam, in Leicestershire. In reference to this last, Mr. R. M. Lloyd remarked that the original plants were apparently longer in the internodes than those of the present time, a difference which Mr. Bagnall attributed to difference of habitat, plants inhabiting deep water having longer internodes than those dwelling in shallow. Mr. W. G. Blatch exhibited a remarkable specimen of *Euplectus minutissimus*, one of the Coleoptera, new to Great Britain, and found at Repton, in blood refuse, by Mr. Gurneys and Rev. W. W. Fowler, by the latter of whom it is described in the current month's number of the "Entomologist's Magazine." Mr. T. Bolton exhibited *Stentor Barretti*, from the Edgbaston Botanical Gardens. In reference to a peculiar caterpillar from Australia, exhibited some time back to the section by Mr. Simcox, and presenting the appearance of being carved out of wood, Mr. R. M. Lloyd stated that he had found that this appearance was caused by a fungoid growth which attacks the animal, and gradually substitutes a wood-like growth for its tissues. Microscopical General Meeting.—December 16th. Mr. T. Bolton exhibited beautiful specimens of *Lophopus crystallinus*, taken from underneath ice at Chester by Mr. Shepherd. It is remarkable that this Polyzoon is more abundant in winter than in summer, and usually dies down about August. Mr. H. W. Jones exhibited a fish which is now generally supposed to be the female of *Callionymus lyra*, the Yellow Sculpin or Gemmaceous Dragonet, but which was formerly described as a distinct species under the name of *C. dracunculus*, the Sordid Dragonet. Mr. H. E. Forrest called attention to a notice in the "Journal of the Royal Microscopical Society," page 901, of a new Moneron, described and figured by M. Schneider, under the name of *Monobia confluens*. He said he had little doubt that it was identical with the animal found by Mr. Bolton, Mr. Levick, and himself, in Barnt Green Reservoir last year, and exhibited a drawing, made by himself about a year ago, for comparison with the plate in the "Journal." The Rev. H. Platten exhibited Zeiss's 1-15th immersion objective, which resolved the markings on *Navicula rhomboides* very clearly. Mr. J. Levick read a very interesting paper on *Dendrosoma radians*, (which will appear in the next number of this magazine,) in which the author for the first time works out its life history.

BURTON-ON-TRENT NATURAL HISTORY AND ARCHÆOLOGICAL SOCIETY.—December 9th. At the usual Monthly Meeting, the Rev. J. M. Mello read a paper on "The Ascent of Man." We hope to be able to induce the author to favour our readers by allowing us to print it in a future number.

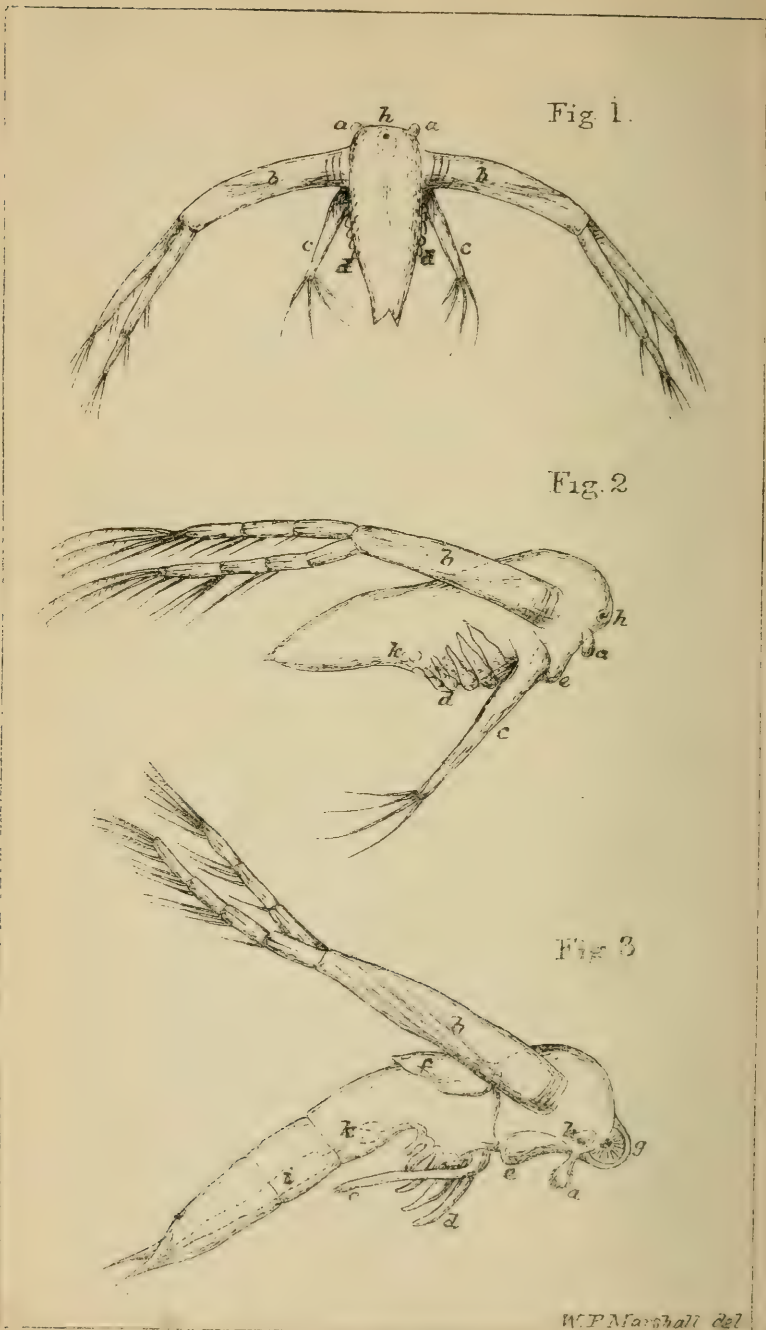
NOTTINGHAM LITERARY AND PHILOSOPHICAL SOCIETY.—December 5th. Gilchrist lecture—"Vegetable Nutrition, and Insectivorous Plants." By Professor W. C. Williamson, F.R.S.—December 12th. Gilchrist lecture—"Life History of the Simplest Animalcules," by Rev. W. H. Dallinger. —December 18th. E. Carpenter, Esq., M.A., lecture on "Abraham Lincoln."—Natural Science Section.—October 8th. "The Age of the Penine Chain," by E. Wilson, Esq., F.G.S., (which appears at page 1 of present number.)—October 22nd. General microscopical evening.—November 12th. "The Origin of the

Rocks and Scenery of North Wales," by J. J. Harris Teall, Esq., M.A., F.G.S., president of the section, (which will be printed in a future number.)—November 26th. " Sandstones, their Composition, Origin, and Colouring," by J. H. Jennings, Esq.—December 10th. General microscopical evening.

NOTTINGHAM NATURALISTS' SOCIETY.—November 19th.—This was a microscopical meeting, the subject being "The Kidneys," which was illustrated by diagrams of the structure of the organ and sections exhibited under the microscope. The hon. sec., (Mr. L. Lee,) in the course of an interesting address, in which he treated the subject lucidly, gave an instructive account of the food required by a healthy full grown man every twenty-four hours, and of the constituents of that food, and the purposes which each served in the economy of the system in building up tissues, heat producing, &c. The several excretory organs, and their distinctive work in filtering effete organic matter from the blood were next described, the functions of the kidneys in getting rid of the nitrogenous waste of the body being dwelt upon more particularly. This was followed by anatomical details of the structure of the excretory organs, especially of that which formed the special subject of the address. An interesting discussion followed.

NORTHAMPTON NATURAL HISTORY SOCIETY.—The opening meeting of the winter session was held on November 25th, when there was a good attendance. Sir Herewald Wake, Bart., in the absence of Lord Lilford, presided.—Mr. Crick (for Mr. G. C. Druce, F.L.S., who has removed to Oxford) read the report of the Botanical Section, which detailed the principal "finds" during the year. It stated that a list of plants indigenous to the county had been forwarded to the British Museum, and would shortly be printed in the society's new journal.—The Chairman expressed the hope that Mr. Druce would continue a corresponding member.—Mr. Hull said that the Geological Section had nothing of importance to record. He might say that the geological specimens in the Museum had been arranged by a gentleman who thoroughly understood his business, but a part of the collection, principally the mineralogical, had not yet been named. The only practical work in the neighbourhood that he knew anything of consisted of well-sinkings through the lias formation.—Mr. R. G. Scriven said that the weather, which had been disastrous for out-door excursions, had prevented the Photographic Section from doing much, but he might state that he had prepared the negatives of several famous trees, and they had been sent to be copied by the Woodbury process, in order to obtain a sufficient number for the new journal, which, it was expected, would be ready in February.—The Chairman, who has become president of the Entomological Section, then read a paper. It was, as he explained, rather on the science generally for the purpose of interesting his hearers in it, and, possibly, enlisting recruits. Having alluded to the bad time which the hymenoptera had had this summer, though the coleoptera might have fared better, he expressed the opinion that wet seasons tended to the destruction of insect life. He then showed that insects subserved a very useful purpose in the animal creation, remarking that if the Almighty had not created them, nothing else would have long survived. Their use as scavengers as well as fertilisers, assisting to carry and spread the pollen of flowers, as well as the important contributions of insects to our industries, were pointed out. Sir Herewald then proceeded to touch more especially upon the diptera. Selecting the common gnat, he both interested and amused the audience by explaining its structure and several stages of development, which were illustrated by drawings, relating several anecdotes, some of which had come within his personal experience when in Florida and other places abroad, concerning that formidable member of the culicidæ, the mosquito. *En passant*, Sir Herewald referred to the earwig, for the purpose of exploding a common error that it has a fondness for taking refuge in the human ear. So far from that, he said, the wax in the ear would repel the insect, and if it got into the ear it would soon be glad to get out again. In concluding, he recommended the study of entomology to the botanists, because botany and entomology, like bread and butter, went well together. Mr. Godfrey gave a short account of local entomology, and Mr. Bailey raised the question of a museum for the society, and made an appeal for support. The meeting then terminated.

Plate III.



Leptodora hyalina

ON THE HABITS AND LIFE-HISTORY OF LEPTODORA HYALINA.

BY A. MILNES MARSHALL, D.SC., ETC.,
PROFESSOR OF ZOOLOGY IN THE OWENS COLLEGE.

In view of the approach of another season for obtaining specimens of this new and specially interesting Entomostracon, and for investigating its life-history, the following notes of the Continental experience and study of this creature may be found of service. They are extracted from the German memoir by Weismann, "On the Structure and Life-history of Leptodora Hyalina," which appeared first in the Zeitschrift für wissenschaftliche Zoologie for 1874, and was subsequently republished in a separate form. This memoir, a carefully written and detailed treatise of 70 pages, illustrated by six large plates, is by far the most complete and accurate account of Leptodora that has yet appeared.

Weismann first met with Leptodora in Lake Constance during the summer of 1873, and supposing it to be new to science devoted much time and trouble to working out its life-history during this and the following year. The principal results to which he was led, as contained in the paper above referred to, are as follows.

For the capture of Leptodora Weismann employed a fine net dragged immediately beneath the surface of the water; he notes that

References to Plate III.

The Figures, which are copied from Bronn's Klassen und Ordnungen des Thierreichs, represent three stages in the development of the spring brood of Leptodora.

a. Anterior pair of antennæ, or antennules.
b. Posterior pair of antennæ, or antennæ proper.
c. Mandibles.
d. Thoracic appendages.
e. Labrum, or upper lip.
f. Carapace.
g. Compound eye of adult.
h. Larval or Nauplius eye.
i. Intestine.
k. Ovary.

Fig. 1.—First stage in the development of the spring brood, seen from the dorsal surface. This earliest or Nauplius stage possesses only three pairs of jointed appendages—antennules, *a*, antennæ, *b*, and mandibles, *c*. The great size of the second pair, the antennæ, *b*, is obviously correlated with their large size in the adult, and is a point serving to distinguish the Nauplius larva of Leptodora from the Nauplii of other Crustacea.

Fig. 2.—A somewhat older larva seen from the right side. In addition to the marked increase in size, the most important changes are the greater development of the thoracic appendages, *d*, the appearance of the ovary, *k*, (all the spring brood are said to develope into females,) and the rudiment of the compound adult eye, *g*

Fig. 3.—A still older larva, seen from the right side. The thoracic appendages, *d*, have now grown very considerably; the carapace, *f*, has begun to appear; the limb-like portion or palp of the mandibles, *c*, has undergone not only a relative but an actual decrease in size; the compound eye, *g*, has greatly increased in size; the abdomen is segmented; and the alimentary canal has acquired the arrangement characteristic of the adult.

In Figs. 2 and 3 the appendages of one side only of the body are shown.

Note.—In the original figures, which are very roughly drawn, the larval or Nauplius eye is not distinctly shown. As its presence is of extreme importance as distinguishing the spring brood from all other generations, and as my sole object in giving these figures is to facilitate the recognition of the larva, I have inserted this eye in the figures in the position which it holds according to Weismann's descriptions. I hope that before long some of the Birmingham Naturalists may be able to give us more satisfactory figures of these developmental stages

A. M. M.

wherever they occur they are found in large numbers, They appear to avoid strong light; thus, in clear sunshine none are found at the surface, though they may abound at a depth of a few feet; at night they occur quite at the surface, but bright moonlight is sufficient to drive them down again. The best time for capturing them is in gloomy weather, towards evening, or on dark nights. Weismann suggests, however, that this shunning of the light may be only apparent after all, and due to the fact that Cyclops, which, according to him, is the chief food of Leptodora, has the same habit, so that Leptodora may be merely following its prey about, instead of being itself directly influenced by light. Still the fact is one of some interest, and one a knowledge of which may greatly facilitate the capture of this interesting Entomostracon.

Swimming is effected entirely by means of the posterior antennæ, and is comparatively slow. It is only in extremest necessity, when stuck fast, that the abdomen is used for progression, while the feet appear to be never used for this purpose.

Cladocera may be divided into a littoral group and a deep-water group, to the latter of which Leptodora belongs. It is only found in water clear from vegetation, and away from the shore. When kept in captivity, algæ and particles of dirt soon attach themselves to the swimming arms or antennæ, and the animals rarely survive so long as a fortnight. They are not uncommonly attacked by a fungus, which grows inwards through the integument and gradually kills them.

Weismann describes Leptodora as habitually lying quietly stretched out in the water, like Corethra, and waiting till its prey comes within reach of its foot-jaws; he considers that the terminal dilatation of the alimentary canal partially counterbalances the thorax and head, and so aids in the maintenance of the horizontal position.

The relations of Leptodora to the other Cladocera are discussed by Weismann at considerable length. He points out how the long segmented abdomen of Leptodora is correlated with the rudimentary condition of its carapace, and shows how in such forms as Bythotrephes and Polyphemus we have a gradual increase in the size of the carapace, accompanied by a gradual diminution in the length of the abdomen and fusion of its different segments; while finally in Daphnia the carapace has grown backwards and downwards, so as to completely enclose the whole animal —a change accompanied by complete fusion of thorax and abdomen, in which no indication of the constituent segments is visible in the adult. The reduction of the body and fusion of the segments is carried to a still higher point in the Ostracoda, such as Cypris, in which also the bivalve shell reaches its highest development.

The absence of branchial lamellæ on the legs in Leptodora is also to be correlated with the rudimentary condition of the carapace; these lamellæ, which attain their greatest development in Lynceidæ and Daphniadæ, in which also the carapace is most fully developed, probably serve to maintain a current of water through the shell, rather than to act themselves as direct respiratory organs, and they are therefore needless when the shell is absent or rudimentary.

From these arguments Weismann concludes that Leptodora is the most primitive form of Cladocera with which we are acquainted—a conclusion supported in a remarkable manner by what little is known of its development.

Leptodora, like Cladocera in general, appears to form two kinds of ova, which may be distinguished as winter ova and summer ova. The two kinds of ova differ markedly in appearance and in their subsequent mode of development, though both kinds may occur at one time in the ovary of a single female. The difference between the two appears to depend mainly on the winter ova being fertilised while the summer ova develope parthenogenetically. This, however, is not definitely proved; all that is known is that males occur very rarely or not at all until late in the autumn, and that their occurrence is apparently coincident with the development by the females of winter ova. From the summer ova are developed young which undergo no marked metamorphosis, and resemble their parents at the time of leaving the egg. The winter ova, on the other hand, produce embryos which when hatched have the form known as Nauplius, and only attain the form of their parents after a long and gradual series of metamorphoses, accompanying the successive moultings of their skin.

The occurrence of this Nauplius larva is of very great interest. A Nauplius is characterised by possessing only three pairs of appendages (corresponding to the two pairs of antennæ and the pair of mandibles of the adult), a rudimentary unsegmented abdomen, and a single median eye instead of the double eye of the adult. Nauplius larvæ are very general among the Entomostraca, but till the life-history of Leptodora was worked out by Sars in 1873 the Cladocera were supposed to stand alone among Entomostraca in never passing through the Nauplius stage. Leptodora serves in this respect to connect the Cladocera with the other Entomostraca, and in this way fully proves its title to rank as one of the most primitive forms of Cladocera known.

The Nauplius larvæ of different Crustacea generally have some resemblances to the adult forms, and this is particularly well shown by the Nauplius of Leptodora, in which, while the anterior antennæ are very small, the posterior antennæ are very large indeed, thus foreshadowing their enormous size in the adult.

As these early stages are of very great interest and importance, figures of some of the most important larval stages of Leptodora accompany this paper, in the hope that they may facilitate the recognition of the forms when actually met with.

The winter ova, it appears, give rise in March or April to larvæ which hatch in the form of Nauplii; these moult several times, and gradually acquire the form of the adult. This *spring brood* may be always recognised by the fact that they retain even when adult the median eye of the Nauplius, *in addition* to the large double compound eye of the adult; the larval eye persisting as a small black spot on the under surface of the brain. The spring brood gives rise to females only; these females produce summer ova which develope into adults, and produce other summer ova, and so on; males do not appear until the autumn, and even then are much scarcer than the females.

At the end of his paper Weismann gives a list of all the localities in which Leptodora had been observed up to the date of his paper, 1874. The first specimens were found by Focke in 1844 in the town moat of Bremen, which is described as being clear water more than 100 feet wide, and moderately deep. Lilljeborg found it in Sweden in 1860. The males were first discovered by Müller in 1867 in Danish lakes, and in Lakes Geneva and Constance. In 1868 Wagner found it in a Russian lake near Kasan, and, ignorant of its previous discovery, re-named it *Hyalosoma dux.* It has also occurred in Lake Maggiore, in Italy, but according to Weismann is not found in Lake Zurich, nor in the small lakes near Lake Constance.

The above paper suggests several points well worthy the attention of our local naturalists during the present and ensuing months. The occurrence of the Nauplius form is of extreme interest, as an isolated instance among Cladocera; while the retention by the spring brood of the Nauplius eye affords a ready means of recognising them in their later stages. It will be very important to ascertain whether any of this spring brood develope into males, *i.e.*, whether any males are met with possessing the Nauplius eye. Any direct confirmation of the parthenogenetic nature of the summer ova would be also very valuable.

A point which I would ask any one to determine who has the opportunity of observing a living Leptodora, is the nature of the process of respiration. This will probably be found to be effected, as in Cyclops and other Entomostraca, by means of rhythmical contractions of the terminal dilated portion of the alimentary canal; water being alternately sucked into and ejected from this dilated portion. The arrangement of the muscular system strongly suggests that this is the real mode of respiration, a point which would probably be settled by a few minutes' observation of a healthy specimen.

THE FUNGI OF OUR DWELLING HOUSES.

BY WILLIAM PHILLIPS, F.L.S.

(Continued from page 38.)

The next twenty-three species in our list (14—36, to which 44 and 45 may be added) comprise those which are known as microscopic fungi, being so minute that they require a magnifying glass to see any of the details of their structure. They may be none the less formidable, however, in their effects on health. When it is remembered that the potato disease, *Peronospora infestans*, the hollyhock disease, *Puccinia malvacearum*, the coffee disease, *Hemileia vastatrix*, together with many others that may be mentioned, are all microscopic fungi, it will be admitted that mere size is not indispensable for effecting much injury. Nearly all this group are found on damp wall paper, or damp plaster, and produce the discolouration so frequently seen when moisture finds its way through or on to a wall. To one unacquainted with these minute organisms it will be a matter of surprise to be told that what looks like a patch of dirt or dust is in reality a curious little forest of vegetation, of various species, which spring up, flourish and decay, in the course of a few months, one crop following another in continued succession, the more minute making way for the larger and more conspicuous species. There is not more dissimilarity in the trees of an ornamental park than can be seen in these minute growths, each plant having its own characteristic outline and peculiar fruit. Many of them are exceedingly beautiful, and will well repay careful examination by those who possess a microscope. We will confine our remarks to one species (No. 30 in the list,) which is known to most people. I allude to the cellar fungus, *Zasmidium cellare.* This fungus, which forms the sombre drapery hanging over the arches of old vaulted wine cellars, and in undisturbed bins in which are deposited special vintages only to be produced with pride on festive occasions, consists of a mass of entangled threads, bearing on certain parts spherical vesicles not larger than a pin's head, of a brittle carbonaceous texture. These vesicles are the sporangia, filled with minute spores, destined to reproduce the species.

By the kindness of Mr. Allen Harker, of Gloucester, we are able to exhibit to you some specimens from the bonded cellars of that city, bearing fruit. One of the specimens varies from the normal colour, being of a rusty brown. This colour arises from its being impregnated with a solution of some salt of iron. Mr. Harker says, "I have analysed the incinerated ash, and find iron in large quantities." The only injurious effect of this fungus is that it occasionally penetrates the corks, rendering recorking necessary, but not injuring the wine. Time will not allow of our saying anything about the many interesting species contained in this group, besides which it would be difficult without drawings to give anything like an adequate notion of their interesting and often elegant structure.

The last group in our list to which we would direct attention are the cup-shaped fungi, of which there are eight species, (Nos. 37 to 44,) found on damp wood or walls, in various places about dwellings not properly cared for. Their form is that of a miniature tea cup, from the fraction of an inch to two or even three inches across. The colour of several is of a sober drab or dirty white. They appear on the vertical surface of wood or walls, often on ceilings, attached by their base, at which there is often a manifest development of white, root-like threads (mycelium,) to which they owe their origin. No. 39 in our list, called Balfour's Peziza, is a pretty, purplish-white species, about one inch across. It occurred, for the first time it had been noticed, on the walls of Inverleith House, near Edinburgh, occupied by Professor Balfour. This house had been burnt down previous to the Professor's occupation of it, and gave evident signs that it had never become thoroughly dry since. Indeed, the presence of any in this group indicates a confirmed state of dampness, quite incompatible with a healthy condition of a dwelling house.

We have thus briefly glanced at a subject which deserves much more extended notice, especially that part of it which relates to their sanitary influence. It has been established, beyond doubt, that the spores of fungi are capable of producing evil effects, such, for example, as those of the common puff-ball when passed into the lungs by breathing, and it is not unreasonable to conclude that many of these household species may exert a like evil influence. The case of one of the assistants in the Botanic Gardens of Edinburgh having experienced injury from this cause, and the fact quoted in that admirable little book entitled "Fungi: their Nature, Influence, and Uses," as to the black rust of the seed, *Arundo donax*, producing eruptions on the skin, point clearly to this conclusion. Who shall say how many of the ailments of children, as well as grown people, may be attributed to this cause, though never for a moment suspected. The showers of invisible spores thrown off by a patch of black mould the size of a human hand may fill the atmosphere of a room with disease-producing bodies none the less potent because they cannot be seen. Besides this, as we have already shown, the presence of fungi invariably indicates a state of unwholesome dampness in the apartment where they are found, suggesting the necessity of better drainage and ventilation. They thus perform for us, in one way, the office of a friend, by warning us of the unhealthy condition of our house; while, if such warning be despised, they may become our most formidable foes.

Hymenomycetes.

1.—*Coprinus aphthosus*, Fr. Scaly Coprinus. On decaying moist wood in cellars, cold kitchens, &c.

2.—*Coprinus radians*, Fr. Radiating Coprinus. On plaster walls.

3.—*Coprinus domesticus*, (Pers.) Domestic Coprinus. On damp carpets.

4.—*Lentinus lepideus*, Fr. Scaly Lentinus. On rafters.

5.—*Panus violaceo-fulvus*, Batsch. Violet-brown Panus. On wood in cellars; not British.

6.—*Polyporus destructor*, Fr. Destructive Polyporus. On worked wood in houses.

7.—*Polyporus cryptarum*, Fr. Cellar Polyporus. In cellars; not British.

8.—*Polyporus hybridus*, B. and Br. Dry-rot Polyporus. On oak in houses and ships.

9.—*Polyporus Vaillantii*, Fr. Vaillant's Polyporus. In cellars.

10.—*Merulius lacrymans*, Fr. Dry-rot Merulius. On beams and wood in houses.

11.—*Stereum hirsutum*, Fr. Hairy Stereum. On damp wood and water butts.

12.—*Corticium puteaneum*, Schum. Well corticium. On damp wood in cellars, wells, &c.

13.—*Corticium aridum*, Fr. Parched Corticium. On pine wood in houses.

Myxomycetes. Slime Fungi.

14.—*Lycogala parietinum*, Fr. Paper Lycogala. On paper.

CONIOMYCETES. Dust Fungi.

15.—*Torula murorum*, Cord. Wall Torula. On walls.

16.—*Sporidesmium alternaria*, Cooke. Paper sporidesmium. On damp wall paper.

HYPHOMYCETES. Thread Fungi.

17.—*Isaria furcellata*, Mont. Forked Isaria. On chips in cellars; not British.

18.—*Stilbum typhinum*, Wallr. Tub Stilbum. On vinegar barrels; not British.

19.—*Sporocybe alternata*, B. Alternate Sporocybe. On damp wall paper.

20.—*Stachybotrys atra*, Corda. Black Stachybotrys. On wall paper.

21.—*Macrosporium cheiranthi*, Fr. Common Macrosporium. On damp wall paper.

22.—*Aspergillus glaucus*, Lk. Blue Mould. On anything damp.

23.—*Aspergillus roseus*, Lic. Pink Aspergillus. On damp wall paper, carpets, &c.

24.—*Rhinotrichum lanosum*, Cooke. Woolly Rhinotrichum. On damp wall paper.

25.—*Penicillium chartarum*, Cooke, Paper Penicillium. On damp wall paper.

26.—*Oidium chartarum*, Cooke. Paper Oidium. On damp paper.

27.—*Sporotrichum sulphureum*, Grev. Sulphury Sporotrichum. On wood in cellars, &c.

28.—*Sporotrichum fenestrale*, Dit. Window-glass Sporotrichum. On glass in windows.

29.—*Myxotrichum deflexum*, B. On damp wall paper.

PHYSOMYCETES. Vesicle-bearing Fungi.

30.—*Zasmidium cellare*, Fr. Cellar Fungus. In cellars on walls, bottles, corks, &c., &c.

31.—*Mucor phycomyces*, Berk. Shining Mucor. On greasy walls, fat, &c.

32.—*Mucor mucedo*, L. Common Mucor. On fruit, paste, and many other things.

ASCOMYCETES. Ascus-bearing Fungi.

33.—*Perisporium princeps*, B. Princely Perisporium. On old beams.

34.—*Chætomium murorum*, Corda. Wall Bristle-Mould. On plaster walls.

35.—*Chætomium chartarum*, Ehb. Paper Bristle-Mould. On damp wall paper.

36.—*Chætomium glabrum*, B. Smooth Bristle-Mould.

37.—*Peziza viridaria*. B. and Br. Greenhouse Peziza. On damp plaster walls.

38.—*Peziza tectoria*, Cooke. Plaster Peziza. On damp plaster walls, similar to the preceding.

39.—*Peziza Adœ*, Cooke. Balfour's Peziza. On damp walls.

40.—*Peziza cretacea*, Cooke. Chalky Peziza. On plaster ceiling.

41.—*Peziza domestica*, Sow. Domestic Peziza. On damp wall paper and on plaster.

42.—*Peziza Pigottii*, B and B. Pigott's plaster Peziza. On plaster ceilings.

43.—*Peziza hœmastigma*, Fr. Blood-red Peziza. On walls.

44.—*Peziza Bullii*, Smith. Bull's Peziza. On water butt.

45.—*Orbicula cyclospora*, Cooke. Paper Orbicula. On varnished wall paper.

46.—*Orbicula perichœnoides*, Cooke. On beams in old houses.

A GARDEN SNAIL SHELL.*

The snail is an architect whose house-work does not fall within the denunciations of Professor Ruskin, or Gambier-Parry. His three-storyed building has no want of curvilinear lines, it is not only weatherproof and waterproof, but is also ornamented with bands and mosaics, and has its interior floored with enamel. Its drainage is perfect, and its ventilation irreproachable—cool in the summer and no icy-draughts in the winter.

The Garden Snail, *Helix aspersa*, is but one of 253 species of a sanitary scavenger, whose function it is to consume and assimilate into living organism much superfluous and decaying vegetation, that otherwise might not only offend the human nostrils but, in a state of putrescent decay, would emit carbonic acid gas, and so poison the air for human beings.

The writer, one fine spring morning, had scooped up a trowel-full of mould from the base of a greenhouse wall, and in so doing noticed therein a dozen snail eggs, round and glistening substances, the size of peas. Wishing to obtain a minuter inspection of these globules, he went in-doors for a pocket-lens. Not more than ten minutes elapsed, when, on looking for the "objects" for the lens, it was discovered that they had evolved into living and moving snails, and had briskly commenced their march of vagabondage, henceforward "eating to live and living to eat." It was evident that the sunlight or sun heat in which the eggs had been left was too much for their pulpy bodies and transparent envelopes, and that they had simultaneously and instinctively determined to decamp and search for a lee-side and a shady corner.

Of a pale amber hue, the twelve travellers resembled twelve animated beads. Their horns were very prominent, and the salivary track they left behind was very slight. They did not as yet betray any ornament on their shells by way of band, or motley brown. Soft to the touch, they possessed a consistency greater than was expected in shells only ten minutes old. Within one week they hardened and darkened in hue, and an increase in marginal growth and thickening of the layer or band which wound round the columella or pillar was plainly evident. The activity of the little things was quite frolicsome, wandering away from green lettuce leaves and nibbling only at various portions, as if their spiral confinement required extra exercise or stretching out of the foot muscles.

The snail's shell is formed in successive layers or laminæ, its calcareous and earthy growth proceeding simultaneously with the growth of the animal by sympathetic exudations from the secretive glands of the fleshy neck of the mantle. The neck (or collar, as it is called) of the snail increasing in growth daily, it is able to push the collar from time to time beyond and outside its original shell margin. In these motions,

* This paper, written at the request of the Editors, gives a popular account of the formation and growth of a Garden Snail Shell, in answer to a correspondent at page 53, in Vol. II.

additional membranous and calcareous matter is exuded, which adheres to the shell edge, or mouth, and hardens into an additional diagonal line of thatch. The colouring deepens, and gradually becomes more pronounced, as line upon line is added daily. It is bound or strapped on the back of the snail by two muscles which begin at the pillar, and, having penetrated the body below the spiral part, trend forward under the stomach. The fibres having interlaced the "foot" muscles, on their contraction, the body of the *Helix* is drawn within. The motion may be likened to the shutting up of a lady's flounced parasol, the whalebone ribs representing the muscles. Egress is facilitated by circular fibres which surround the body, above the foot, and this motion is aided by the polished surface of the interior, which is formed by an excretion of pure lime. An old shell has a highly-polished lining, from the constant friction of the soft body passing in and out.

When about a month old, the snail begins, for some practical end, to be prettily ornamented with the tattoo of his species; and by this time the glands on the neck of his mantle are well furnished with the mucous slime and the colours which pervade the pores of the shell and vivify it. If you look at any empty garden snail shell, you observe that the upper two out of his three whorls have no tattoo marks; they are of a pale, horny hue. That important organ, the liver, has not up to that period developed into the fat and plump liver which marks a well fed, pluralist snail. Probably, with an increased power in the odontophore, or teeth-cushion-saw, strong flavoured and thicker vegetation is attacked and digested, and thus the exudations are of more marked and decided tints than before. What we may term the *pattern* is produced by the admixture of the albuminous or white mucous with the dark-brown excretions from the larger glands of the collar. The process is exemplified in the mechanical arts in the "marbling" of the bookbinder, where different coloured pigments are adjusted in a trough and interspersed, and, as the mechanic is so disposed, either a Scotch plaid pattern or a simple mottle is produced when the book-edges are dipped therein and dried. There is no perceptible growth in the tattoo marks after their first formation—that is to say, no expansion has been traced.

The power of repairing the shell is worth noticing. In a human habitation, if a roof-tile is broken off, one or two artificers, one or more ladders, and one or two days are employed to repair the damage; but when *Helix aspersa* sustains a fracture or damage in his roof, a nerve telegram is sent from the surface of his mantle to the cerebral ganglia or principal nerve centre, and an order is transmitted simultaneously to the nearest mucous glands in the collar (the thickest part of the body nearest the shell) to exude the necessary cement. This hardens quickly, being a coagulating cement, free from animal matter.

Eyesight, in our conception of the word, the snail can hardly be said to possess, and so the creature repairs the roof without "surveying" the damaged spot, or overlooking the process of reparation, except by the local sensation of comfort or discomfort. For whether the ocelli or black spots in the posterior or hinder pair of horns are eyes is a moot question.

It has been observed that snail shells of the same species differ in brilliancy of pattern from various causes. The lesser or greater supply of lime, the more or less prevalence of succulent vegetation, and ample or deficient sunlight decidedly affect the shells. Confine handsomely-marked snails in a Wardian case with little sunlight, and the colours will exhibit a falling off in a short time. As an abnormal instance of absence of colour, Mr. Mann, the lepidoptera collector, of Clifton, had, a few years ago, white shells of *H. aspersa*, which he found in one spot near the Downs. It would be interesting if some Bristol correspondent would take notes respecting this variety. If the snail shells—empty shells, of course—are dipped in boiling water the outer scarf skin will come away, and leave them more bright in colour than before. This epidermis is put on (like a light overcoat) at the approach of winter in increased thickness, probably to preserve the shell during the long hybernation.

This paper will have no sympathy from some reader who has suffered from an excessive immigration of snails into his garden, and he will not concur in the estimate, given at the outset, of the snail's utility; but if the birds provided to keep the species in check—the blackbird and thrush—were not scared away or killed off with such persistence, snails would only be seen in moderate quantities, and would pursue their functions, usefully and not destructively.

Time was when the rustic maiden in English rural parts read her fortune in the movements of a snail. It is thus poetized by Gay:—

"Last May-day I searched to find a snail
That might my lover's name reveal."

She placed it on "the milk-white embers spread;" when

"Slow crawls the snail; and, if I right can spell,
In the soft ashes marked a curious L.
Oh! may this wondrous omen lucky prove,
For L is found in Lubberkin and love."

W. B. Strugnell, Cheltenham.

NOTES ON THE STRUCTURES OF PITCHER PLANTS.

BY LAWSON TAIT, F.R.C.S., PROFESSOR OF ANATOMY TO THE BIRMINGHAM ROYAL SOCIETY OF ARTISTS, ETC.

(*Continued from page 8.*)

On the outside of all Nepenthes pitchers multifids and their buds are seen in great numbers, and they are always most numerous and largest at those parts of the pitchers where rain water would be most likely to lodge. They are also best marked in the young condition of the plant in such an instance as *N. Rafflesiana*.

In the subepithelial parenchyma a number of cells may be seen to send up slender processes to be in contact with the insertion of the multifids. Bubbles of air may, in rare instances, be seen breaking the column of fluid contained in the multifids, just as in the tubular trichomes of Sarracenia. This is probably the result of injury.

Stomata are not very numerous on the outsides of any kind of pitcher which I have examined, and they are not found at all on the inner surfaces. Numerous multifids and buds exist on the upper surfaces of the lids of all pitchers and on the under surfaces of such lids as do not cover the mouth. On such lids as do cover the mouths of the pitchers, as in *N. distillatoria*, they exist only as buds, and usually are not numerous, but they are also found inside the pitcher on a short zone immediately above the true glands. This, together with other reasons already given, leads me to believe that these structures are for the absorption of water and substances dissolved in it. It may be here just noted that these multifids exist in great abundance on the backs of the lobes of the Dionæa, and that when the trap is closed, they afford a spongy surface on which water remains for a long time, and its absorption there I think must be of great use to the plant when the trap is closed and the process of digestion is going on. On all the surfaces mentioned these buds are seen occasionally to be sunk beneath the epithelial surface, and to present the peculiar appearances already described in Cephalotus. This appearance in Nepenthes has been described by Lindley as a special kind of stoma, but he admits that they do not open into cavities of the parenchyma as is the case with the latter. (Introduction to Botany, Vol. I., p. 142.)

On the under surface of the lids of most pitchers are to be seen glands identical in structure with those to be immediately described as occurring on the inner surface of the pitcher. Dr. Hooker believes these to be honey glands, but I differ from that eminent authority for the following reasons:—That they are identical in structure with the true digestive glands, and that they are better marked in the pitchers where the lids cover the mouth completely than in those which do not; that in many such, as in *N. distillatoria*, they are hooded in exactly the same way as the glands of the pitcher; that when the gland is excited by food I have been able to detect acid secretion collected in the hoods of the lid glands of *N. distillatoria;* that nectaries are usually very inconspicuous, and only a small spot of tissue which, without being transformed, produces the nectar. (Sachs.)

Spiral tissue abounds in every part of the parenchyma of Nepenthes' pitchers. The most important structures in Nepenthes' pitchers are the round or oval glands found regularly distributed over a greater or less extent of the inner surface. These glands are sometimes to be found throughout the whole extent of a pitcher, as in *N. Rafflesiana;* but in many kinds they are limited to the lower part. When this is the case there are always two clearly defined zones, the upper of which resists wetting, and throws off water, while the lower readily retains it. On this upper surface the epithelium is irregularly polygonal in some pitchers, but in the majority it is of the sinuous kind and interspersed with regularly distributed crescentic markings of very small size, (·03mm. in length by ·01 in breadth,) which are arranged with the concavities downwards, and in the same position as the hoods of the glands lower down. Occasionally at a little distance below one of these markings an epithelial cell can be seen enlarged, and with an increase of protoplasm, sometimes even having a semblance of segmentation, which makes it appear as if it were making an effort to become a gland. The crescentic markings on section can be seen to be formed by the doubling of one epithelial cell under another, so that beyond doubt they are rudimentary hoods. These hoods, as will be afterwards seen, have a very important purpose, but even in this rudimentary condition they would prove serviceable by affording an increase of absorbent surface, just as the valvulæ conniventes do in the intestine. These latter structures are found in quite as rudimentary a state in the intestine, as those by which the perfect hoods are represented in the upper surface of the Nepenthes' pitcher.

The line of commencement of the glands (in a pitcher where there is a non-glandular surface) is quite abrupt, and corresponds with the ampullary enlargement generally seen outside. From this point the glands are found distributed with great regularity, and increasing in size towards the bottom of the pitchers, where, on the lower or greater curvature, the largest are always found, that spot being, of course, the position in which the gland function will most frequently be called into action. These glands resemble in structure very closely those seen in Drosera and Dionæa, though, of course, their details differ somewhat. They are sessile, and are placed in depressions of the parenchyma, lined with epithelium, which, at the top of the pit, is produced into a double fold of modified epithelium, between the cells of which run intercellular spaces, and each gland is placed on a twig of spiral tissue, in this arrangement being identical with the glands of Drosera. It requires favourable sections to display this fact, and it gave me much trouble to make myself certain of it. The cells of the outer layer of the epithelium of the gland are regularly columnar, and do not seem to be nucleated, except in virgin pitchers. (Fig. 11.) When crushed between the cover and the slide they do not seem to have fluid contents, but spread out as if they had a putty-like consistency. The inner cells are larger, more irregular, and have coloured nuclei. In a few cases I have seen appearances as if the intercellular canals had direct communication with the spiral tissue; but the possibility of this being an optical illusion is so considerable, that I could not venture to assert it as a conclusion. There is, however, as great probability that such connection does exist as there is in the view of the origin of the hepatic ducts advanced by Chrzonsczsczewsky and others. Examination by high immersion powers have convinced me that these intercellular canals are really walled, and that they contain streams of colourless protoplasm, which is in a state of slow movement. These glands vary very greatly in size in different varieties of Nepenthes, the largest which I have seen being at the bottom of a mature pitcher of *N. distillatoria*, which measured ·375mm. by ·2, whilst the smallest were at the top of a virgin pitcher of *N. Rafflesiana*, measuring only ·045mm. (Fig. 12.) The rule of their progressive increase towards the bottom of the pitcher is quite uniform, and with their increase in size they have a varying relation to the hood. Thus in a mature but unopened pitcher of *N. Rafflesiana* I made a set of careful measurements of the glands and their hoods over the whole surface, the results of which are embodied in the following table:—

MEASUREMENTS OF THE GLANDS OF A MATURE BUT UNOPENED PITCHER OF NEPENTHES RAFFLESIANA.

	Millimetres from the top of the Pitcher.	Size in largest diameter.	Depth of Hood.	Dist. from lip to lip of Hoods.	From centre to centre of Glands.	
I.	0	·045	·03	·1	·1	Round glands, wholly covered by the hood.
	5	·045	·04	·1	·1	Average size of glands, ·053.
	10	·05	·06	·11	·1	Average depth of hoods, ·056.
	15	·055	·05	·11	·11	Estimated number of glands to one sq.mm., 73
	20	·065	·055	·11	·125	Proportion of gland surface to the whole area, ·09225.
	25	·065	·065	·15	·125	
	30	·07	·09	·16	·13	Here the glands become oval.
II.	35	·135	·09	·18	·18	Glands covered by hoods in proportions varying from 3/4 at the top. to 1/3 at the bottom of the zone.
	40	·135	·11	·19	·18	Average size of glands, ·163.
	45	·165	·11	·2	·21	Average depth of hoods, ·086.
	50	·165	·075	·185	·21	Estimated number of glands per sq. mm., 25.
	55	·19	·075	·175	·175	Proportion of gland surface to whole area, ·3.
	60	·19	·075	·175	·175	
III.	65	·19	·05	·175	·175	Hoods cover less than 1/4 of the glands.
	70	·2	·04	·175	·175	Average size of glands, ·2.
	75	·2	·035	·175	·175	Average depth of hoods, ·04.
	80	·21	·035	·175	·175	(At this point hoods are entirely above the glands.)
	85	·2	·035	·175	·175	Estimated number of glands per sq. mm., ·36.
	90	·2	·035	·175	·175	Proportion of gland surface to whole area, ·84.

The measurements in the last two columns are only relative and not absolute.

The epithelial cells and the intercellular canals have a corresponding increase in their size.

It will be seen from this table that the increase in size of the glands from the lip of the pitcher downwards is gradual up to a certain point, about a third of the way down. This zone clearly may be taken to represent the non-glandular surface of pitchers whose lids cover their aperture. We may also conclude that at one time the lid of *N. Rafflesiana* covered its mouth, but that some advantage being derived (probably that of a subsidiary insect trap, which it may readily be) from the modification of the lid now seen, the disadvantage of the admission of rain-water had to be made up for by an increase of the gland surface. This appears to me to make it certain that the minute crescentic markings already described on the non-glandular surface of *N. phyllamphora* are not retrogressions, but structures only needing the necessity for development which *N. Rafflesiana* has incurred. As all Nepenthes' pitchers have the lids of their pitchers originally over their mouths, it is again in evidence that the arrangements of *N. Rafflesiana* are an advance, and this is borne out by the whole appearance and character of the plant, for it is said even to digest small vertebrata in its native haunts. The size of the glands, their number, and relative area are all less in this zone than in those below, because its digestive power would be less frequently called into action than would be that of the others.

The complete covering of the glands in this zone may be of advantage in protecting them and their secretion from accident and the depredation of insects, for the glands here are much more likely to be uncovered by water than those further down. I think it also very likely that these hoods store up the digestive principles of the pitcher until they are required or until it is washed out by the contact of water, it being retained in their cavities by capillary attraction.

In the second zone the glands gradually alter from a round shape to an oval one, increasing at the same time in size as they are viewed from above downwards, and they become less covered by the hoods. The relative gland area is also greatly increased. The greatest amount of work would necessarily fall on the third zone, so we have here the glands at their maximum, and almost uncovered by the hoods, which still remain in existence, however. The glands are so large and so close that the bulk of the surface is occupied by them.

The epithelial surface of the pitcher *(N. Rafflesiana)* is composed of irregularly polygonal cells, which, in the young pitcher, are regularly nucleated. Between these run continuous interspaces, forming a perfect network over the whole surface.

On the surface of the hoods the cells are elongated, and the spaces run up between them, at right angles, to the lip of the hood, where a canal seems to run, into which they all enter. These intercellular spaces are truly walled on the upper surface, whether they may be or not on their surfaces next the cells; for, in a mature pitcher, recently fed and perfectly fresh, I am quite satisfied they are slightly raised above the cellular surface. In a virgin pitcher they are scarcely perceptible, whilst in a mature pitcher they are large and distinct, and especially large in the lowest zone.

Further, I have on several occasions compared two pitchers as nearly alike as possible from the same plant, one of which I had fed, and the other I had starved, and I have been satisfied that in the fed pitcher the intercellular spaces were larger than those in the one which had not been fed. The stream of protoplasm in these canals can be occasionally seen broken, and in such a state the reality of their canalicular structure can be demonstrated. In one observation which I made on a fragment of a mature pitcher of *N. distillatoria* which had never been fed, I placed over it a drop of fluid taken from the results of the digestion of albumen in another pitcher. I then saw the canals present slight dilatations here and there, and I was satisfied that some of them underwent general increase in calibre. But in several repetitions of this observation I did not obtain convincing results, probably because it was getting late in the season and the pitchers were inactive.

In old pitchers the superficial canals sometimes seem to communicate with a deeper set.

Silver and gold staining did not help me in the investigation of these structures. From what I have seen I am inclined to regard these canals as absorbent vessels.

Reviews.

Observations on the Fauna of Norfolk, and more particularly on the District of the Broads. By the late Rev. Richard Lubbock, M.A. New Edition. Norwich: Jarrold and Sons. 1879. Price 6s.

Among the works descriptive of the Natural History of particular districts or counties in England, the "Fauna of Norfolk" occupies a conspicuous position. To quote the words of Mr. H. Stevenson, F.L.S., "There is scarcely a writer, since 1845, on the birds of the United Kingdom that does not quote Lubbock, and in ornithological works comprehending a far wider geographical range, his name as surely finds an honoured place in reference to the habits of wild fowl and species extinct only in the last half century in the marshes of Norfolk. His classical attainments lent that charm to his writings which only an acquaintance with ancient as well as modern literature can afford, and the happy combination, in his case, of the well-read naturalist with the practical experience of the sportsman, gave the stamp of truth to his graphic descriptions."

The first edition of the work was published in 1845, and has long been out of print, and the author died in 1876, at the ripe age of seventy-eight. This new edition has been edited by Mr. Thomas Southwell, F.Z.S., (President of the Norfolk and Norwich Naturalists' Society,) who has performed his work with great care, distinguishing by brackets the new work derived from the author's own MS. notes, and appending initials to all editorial and other passages.

While Mr. Lubbock's personal observations were chiefly directed to the neighbourhood of the Broads, the editor has endeavoured to make the work as comprehensive in its scope as possible, and he includes the district known as Lothingland, between Lowestoft and Yarmouth, which, though in Suffolk, belongs geographically to Norfolk.

The Broads form the most picturesque part of East Norfolk, constituting a lake-district, unrivalled for boating expeditions in any other part of the country. As their name implies, they are broad, though shallow, expanses of water that are found along the valleys of the Bure and Yare; sometimes they lie in the direct course of the river, at others they are only connected with the main stream by narrow channels. The fishes of these waters receive due attention from Mr. Lubbock, and it is mentioned as a matter for the angler, that on Ranworth Broad upwards of ninety pike have been taken in a day by two amateur fishermen. Among the mammals, the Otter is still common in Norfolk; its stronghold, as Mr. Southwell observes, being in the district of the Broads, but there is scarcely a stream in the county near which it has not been found.

Particular notes of the Decoys are given, and their position is shown on a map. Some notes on Hawking, from the pen of Prof. A. Newton, F.R.S., are appended; as well as notes by other naturalists, on the Reptiles and Amphibians, the Sea Fish, Lepidoptera, and Botany. A

Memoir of the late Rev. R. Lubbock, by Mr. Stevenson, is given in the introduction. The work cannot fail to be interesting to Midland naturalists, especially with the many new and interesting facts recorded by Mr. Southwell.

H. B. W.

Botanical Note Book: A Practical Guide to a Knowledge of Botany. By E. M. Holmes, F.L.S. London: Christy and Co., 1878.

This little book is evidently compiled for the purpose of helping pharmaceutical students to prepare for examination, and is probably well suited for that purpose. Within a small space a great amount of useful knowledge has been brought together; all, however, is of an elementary nature. It is illustrated by three diagrams, which will be useful in pointing out the position of the various organs composing plants, and they will be a great help to those students who are unacquainted with the names and positions of those organs. Directions are given as to the mode in which plants should be examined. An ample glossary of the terms applied to each organ is also given, with the accentuation and derivation of each term. Two charts are also given—one of the main divisions of the Vegetable Kingdom, and the other of the British Natural Orders. These are very good, and the student will find them useful. The book contains a number of blank schedules to be filled up by the student, and these, if properly used, will be the means of imparting a fair knowledge of descriptive botany. The book is written with a good intention, and if used in conjunction with other and more advanced books will be found very helpful.

J. E. B.

A Text-book of Field Geology. By W. H. Penning, F.G.S., with a section on Palæontology, by A. J. Jukes Browne, B.A., F.G.S. 2nd Edition. Bailliere, Tindall and Cox.

This is a greatly improved book; indeed, in its present form it is one of the most useful books a geologist can have in his library. It is divided into five parts. The first treats of geological surveying, describing the instruments used, and their method of application in clear and simple language; the second part shows how to fully examine any section of rocks that may be met with in a quarry, cutting, &c.; it contains very useful instructions for the determination of the true dip from the observed dips. Rocks and minerals are treated of in Part III., and fossils in Part IV.; in the latter two very valuable tables are given showing (1) the characteristic *genera* of the British formations, and (2) the characteristic *species*. The latter is sufficiently full (containing over 500 species) to be most useful as a guide in forming either a public or private collection of fossils. In the last part the importance and interest of Field Geology are insisted on and illustrated with reference to the questions of water-supply, scenery, &c.

W. J. H.

METEOROLOGY OF THE MIDLANDS.

THE WEATHER OF JANUARY, 1880.

BY W. JEROME HARRISON, F.G.S.

STATION.	OBSERVER.	RAINFALL.				TEMPERATURE.			
		Total for M.	Greatest fall in 24 hours.		No. of rainy d.	Greatest ht.		Great'st cold	
		In.	In.	Date.		Deg	Date.	Deg	Date.
GLOUCESTERSHIRE.									
Cheltenham	R. Tyrer, Esq.	·96	·53	16	5	53·0	1	10·0	20
Stroud	S. J. Coley, Esq.	·27	·10	1	5	51·0	1	11·0	20
SHROPSHIRE.									
Haughton Hall, Shifnal	Rev. J. Brooke	·55	·27	16	7	53·0	1	12·0	20
Woolstaston	Rev. E. D. Carr	·59	·3.	16	6	48·0	6	16·0	20 & 28
Leaton Vicarage, Shr'wsb'ry	Rev. E. V. Pigott	·50	·32	16	6	58·3	1	11·5	27
More Rectory, Bishop's Castle	Rev. A. Male	·62	·23	16	8	52·0	1	14·0	20 & 21
Larden Hall	Miss F. R. Boughton	·51	·23	16	7				
Bishop's Castle	E. Griffiths, Esq.	·52	·18	16	6	53·0	1	12·0	20
Cardington	Rev. Wm. Elliott	·28	·10	13	4				
Stokesay	Rev. J. D. La Touche	·57	·15	16	5	54·4	1	13·0	27
HEREFORDSHIRE.									
Stoke Bliss	Rev. G. E. Alexander	·62	·39	15	4	47·0	4 & 31	20·0	26
WORCESTERSHIRE.									
Orleton, Tenbury	T. H. Davis, Esq	·48	·18	16	6	59·0	3	14·8	20
West Malvern	A. H. Hartland, Esq.	1·29	s)·30	13	10	50·0	31	16·5	27
Pedmore	E. B. Marten, Esq.	·65	·33	16	5	54·0	1	13·0	19 & 21
Longlands, Stourbridge	J. Jeffries Esq.	·63	·30	16	4	54·0	1	11·0	21
Dennis, Stourbridge	Mr. C. Webb	·45	·30	16	3	54·0	1	15·0	19
Evesham	T. J. Slatter, Esq.	·29	·12	16 & 17	6	55·0	1	16·5	29
STAFFORDSHIRE.									
Dudley	Mr. J. Fisher	·30	·15	15	3				
Sedgley	Mr. C. Beale	·50	·25	16	7	51·0	1	20·0	28
Oakamoor	E. Kettle, Esq.	·78	·35	16	7	53·4	1	12·0	29
Kinver	Rev. W. H. Bolton	·67	·26	16	4	55·0	1	16·0	19 & 20
Walsall	Mr. N. E. Best	·54	·22	16	5	57·0	1	25·0	28
Grammar School, Burton	C. U. Tripp, Esq.	·33	·19	17	6	54·0	1 & 2	15·0	29
Weston-under-Lyziard R'tory	Hon. and Rev. J. Bridgeman	·38	·17	16	5	55·0	1	13·0	20
Wrottesley	E. Simpson, Esq.	·54	·41	16	4	53·8	2	15·6	27
Heath House, Cheadle	J. C. Philips, Esq.	·44	·20	15	4	51·0	1	16·0	29 & 30
Alstonfield Vicarage	Rev. W. H. Purchas	·45	·35	15	3	50·4	1	16·1	29
Farley, near Cheadle	C. L. Wragge, Esq.	·61	·33	15	5	51·7	1	15·1	27
WARWICKSHIRE.									
Coundon, Coventry	Lieut.-Col. R. Caldicott	·51	·25	17	5	53·0	1	19·0	19 & 28
Coventry	J. Gulson, Esq.	·51	·27	17	5	56·0	2	15·0	2.
Bickenhill Vicarage	J. Ward, Esq.	·55	·40	17	3	47·0		15·0	
St. Mary's College	Rev. S. J. Whitty	·41	·22	16	5	53·0	1	17·9	29
Henley-in-Arden	T. H. G. Newton, Esq.	·56	·32	16	4	54·0	1	14·0	29 & 30
Rugby School	Rev. T. N. Hutchinson	·39	·25	16	6	53·6	1	16·2	2.
Snitterfield, Stratf'd-on-Avon.	J. Goodacre	·57	·33	15	6	52·8	1	11·0	18 & 19
DERBYSHIRE.									
Stoney Middleton	Rev U. Smith	·25	·19	15	3	50·0	31	12·0	19
Fernslope, Belper	J. G. Jackson, Esq.	·23	·12	16	5	53·0	1	18·0	20, 29, 30
Linacre Reservoir	C. E. Jones, Esq.	·17	·06	15 & 16	4				
Spondon	J. T. Barber, Esq.	·30	·17	16	5	46·8	5	10·0	27
Duffield	W. Bland, Esq.	·26	·16	18	7				
NOTTINGHAMSHIRE.									
Tuxford	J. N. Dufty, Esq.	·18				52·0	1	18·0	26, 28, 29
Hodsock Priory, Worksop	H. Mellish, Esq.	·22	·13	15	4	56·4	1	16·5	20
Park Hill, Nottingham	H. F. Johnson, Esq.	·53	·22	15	7	54·5	1	18·5	28
LEICESTERSHIRE.									
Loughborough	W. Berridge, Esq.	·29	·15	16	4	56·2	31	15·	29
Ashby Magna	Rev. E. Willes	·33	·21	16	4	59·0	1	15·0	29
Market Harborough	S. W. Cox, Esq.	·49	·21	15		52·0	1	16·0	20, 27, 29
Kibworth	T. Macaulay, Esq.	·47	·19	15 & 16	5			10·0	28
Town Museum, Leicester	W. J. Harrison, Esq.	·35	·21	16	6	54·8	1	17·0	29
Syston	J. Hames, jun., Esq.	·31	·15	16	4	54·0	1 & 2	18·0	21 & 29
Waltham-le-Wold	E. Ball, Esq.	·56	s)·35	15	6	46·0	31	16·0	27
Coston Rectory, Melton	Rev. A. M. Rendell	·43	·18	16	5	53·8	31	15·5	29
Dalbe Hall	Mr. G. Jones	·39	·16	16	5	52·0	1	9·0	20
NORTHAMPTONSHIRE.									
Towcester Brewery	J. Webb, Esq.	·35	·23	16	4				
Castle Ashby	R. G. Scriven, Esq.	·35	·20	16	5	55·0	1	20·0	27
Kettering	J. Wallis, Esq.	·43	·20	16	7	53·0	1	20·0	28 & 29
Althorpe	G. S. Groom, Esq.	·41	·20	16	6	54·0	1	16·0	19
Pitsford	C. A. Markham, Esq.	·52						16·0	
RUTLAND.									
West Deyne, Uppingham	Rev. G. H. Mullins	·34	·14	16	6	53·8	1	16·6	29
Northfields, Stamford	W. Hayes, Esq.	·31	·17	16	4	50·0	1	11·0	28
Ventnor Hospital	W. T. Ryder, Esq.	·57	·31	16	3	50·6	1	24·4	29
Altarnun Vicarage	Rev. J. Power, M.A.	1·34	·32	17	6	50·0	1, 2, 5, 31	13·0	26
Oxford	E. J. Stone, Esq.	·38	·29	16	5	53·2	1	16·1	20 & 26

January, like the three months which preceded it, was extremely dry. Our returns show only two stations (Altarnun and West Malvern) where the total rainfall exceeded one inch. Commencing with seven or eight days of mild weather and south-westerly winds, a frost set in on the 9th, which continued without intermission till the 28th, when it began to break up. During this cold period the Barometer ranged very high, and was steady, with light and variable winds. The amount of sunshine varied greatly; in some places local fogs were frequent and persistent, while elsewhere at the same time there was much bright sunshine. A little snow fell about the middle of the month, but only to a depth of one or two inches. On the last two or three days the hoar-frost on trees, &c., attained a length of nearly an inch, and had a beautiful appearance in the morning sun. A fog-bow ("like a colourless rainbow") was seen at Shifnal at 1 P.M. on the 15th. Solar Radiation Thermometer attained 91·2° at Cheltenham, 89° at Leicester, and 88° at Loughborough on the 31st.

NATURAL HISTORY NOTES BY OBSERVERS.—*Spondon.*—Green vegetables have suffered heavily during the last fortnight, chiefly from want of snow covering. Robins seem to have disappeared. I have not seen one here for several weeks. *Coventry.*—The protection which a covering of snow affords to vegetation has been entirely wanting, and the destruction amongst the tender shrubs and evergreens will, I fear, be found very extensive. The Bay and the Laurustinus may shoot up from the root, but the upper shoots and foliage are killed off, and I have noticed many of the Deodaras so pinched that I do not believe they will survive.—*Farley near Cheadle.*—Wild daisies in flower early and in middle of month, and saw primroses in bloom at Oakamoor on 4th January. January 10th, pair of Brown Linnets (*Fringilla linota*) seen. January 12th, *Sturnus vulgaris* feeding, evidently in hundreds, forming one large flock; same day, dead rook found on tree, apparently frozen to its perch. Saw fine *Turdus viscivorus* feeding close to this station. *Corvus frugilegus* but a fitful visitor throughout the month; and Marsh Tit (*Parus palustris*) and *Turdus merula* seen occasionally.—*Oakamoor.*—Primroses out in garden on January 1st.—*Woolstaston.*—There has been a most marked scarcity of birds here during the whole of this winter; food put outside the windows for them (our invariable custom during hard weather) remained almost untouched.—*More Rectory.*—Fieldfares and other winter birds have been scarce, but small birds—Chaffinches, Sparrows, and Linnets—are plentiful. The abundance of Moles, as evidenced by the mole-heaps conspicuous everywhere, is remarkable. May this not be owing, amongst other causes, to the general destruction in past years of birds who prey upon them, especially the Brown Owl. Noticed a pair of Ravens on January 7th; they are now very scarce.—*Stroud.*—Daisy and *Cardamine hirsuta* noted on the 4th, being the only wild flowers seen during January.

Correspondence.

HYBERNIA RUPICAPRARIA taken on a lamp in Burton on February 11th. —J. E. N.

PRIMULA VULGARIS in flower on February 4th, in a garden, Branstone Road, Burton-upon-Trent.—J. E. NOWERS.

PRIMULA VULGARIS.—I saw several blooms on the 17th January in a sheltered spot, and in my own little garden I have now several buds on one root. The only primrose in bloom I gathered on the 7th inst.—MAGGIE T. GRIFFITH, Chester, Feb. 10th, 1880.

Plants at Falmouth.—My Eucalyptus, most of my Veronicas, and many Fuchsias survived last winter. I have had a big plant of *Desfontainea spinosa* (6ft. high) continuously in flower from last summer till a week ago, quite without any protection. A *Rhododendron Nobleanum* has been grandly in flower since January.—H. F., Falmouth, February 16th.

Early Flowers.—On February 18th I found a white violet. I have noticed that white violets are much earlier than sweet blue ones. Is that the general experience, and are white the hardier of the two varieties? In this neighbourhood blue violets are very rare. There are a few pink ones, commoner than the blue, and a great many white. Snowdrops, both wild and in gardens, have been in full flower for the last week, and daisies and primroses are showing the flowers here and there.—O. M. F., Frankton, Salop.

A Bicipital Anemone.—About two years ago, a Dianthus in one of my tanks developed the above peculiarity, and the second head is now hardly to be distinguished from the original in size. If the animal be fed by both, the food is seized by each separately, and can be seen to enter the stomachic cavity; if fed by one, its course can be similarly followed; but whether fed by one or both, there is, during digestion, the usual enlargement and display of tentacles by each head. If one disc be touched, the other contracts synchronously; if, again, the base or pillar, both heads instantly close. These few observations may interest some of your readers who keep marine tanks.—G. L. B., Denmark Hill.

Mistletoe *(Viscum album.)*—Will any of your readers kindly solve the following problems? Does the mistletoe male and female occur on the same host, or does each sex occupy exclusively a separate tree? From a few observations I was able to make last year, I should suppose that the male and female are on separate hosts. Is the mistletoe insect-fertilised or wind-fertilised? The single flowers are inconspicuous, yet the male flowers have a yellow colour, and when in numbers are somewhat attractive. The pollen is not easily detached, and the flowers secrete a gummy substance, while the stigmas are so placed that wind-carried pollen could only reach them if dropped just into the flower; yet they are well adapted to take the pollen from the head of an insect endeavouring to get at the gummy substance secreted by the flower.—C. E. C.

Proliferous Cardamine.—I send some leaves of either *Cardamine pratensis* or *hirsuta*, with young plants growing from them, and should be glad to know if it is a common or unusual occurrence. The plant is a very luxuriant one, and is growing on clay soil at the foot of a fernery, having been accidentally transplanted there with others.—C. E. J.

[The leaves sent appear to be those of *Cardamine hirsuta*. This proliferous state is not unfrequent in certain seasons, as when severe cold is followed by mild damp weather. Both *C. hirsuta* and *C. pratensis* are liable to this peculiar phase in plant life. Dr. Boswell says of *C. pratensis:* "In damp seasons the stem frequently bears small bulbs at the base and buds on the leaves, which propagate the plant." ("Eng. Bot.," 3rd Ed., Vol. I., page 159.) This subject has been ably treated by Mr. John Price, M.A., of Chester, and an abstract of his paper was given in "The Proceedings of the Chester Natural History Society, 1878." Both these plants are found wild with double flowers, sometimes in abundance, and in such circumstances are mainly propagated by the young plants, which are produced by the stem and leaves. The writer has found *C. pratensis* in marshy places in Sutton Park, with foliaceous flowers, the petals being replaced by ordinary green leaves, similar to the terminal leaflet of the stem leaves. An allied species, rare in England, *C. bulbifera*, produces bulbs in the axils of the leaves constantly, and in this case, as the flowers are usually abortive, the plant is mainly propagated by these bulbs.—J. E. B.]

Ornithological Notes.—I do not think the birds suffer so much when there is no snow on the ground, even if it be hard with frost. I have noticed the Starlings busily beating over the frozen fields, and a flock or perhaps a score of Redwings on the ground, apparently finding something worth picking up. During the very cold weather the small birds evidently resort to the places where they find most warmth and shelter. At Stoke most of our tree trunks are covered with ivy, and we still have abundance of Blackbirds and others. In the town a Song Thrush comes to breakfast on the crumbs with the Sparrows, but we hear little of its song at present. The small birds seem to have deserted the hedge-rows during the cold, but in a sheltered lane where the banks are well covered by a growth of luxuriant fern and bramble, I noticed a few days ago hundreds of Finches and Linnets, which had evidently flocked there for shelter. During the frost a pair of the Common Gulls (Kittiwakes) were seen for a few days on Swanswell Pool. Two have since been shot in the neighbourhood (perhaps the same) and are now at David Smith's. David has also received a number of specimens of the common Buzzard, varying greatly in plumage from dark brown to mottled white. There is also the little Scops Owl, and some other interesting birds, shot by Mr. Browett, in France, where they are now less rare than in this country.—J. Gulson, Coventry, February 4th.

Ornithological Notes.—The winter in Leicestershire has not been prolific in natural history observations, many of our usual visitors being conspicuous by their absence. Thus, Fieldfares and Redwings have been very scarce, especially the former. The only approach to a flock of this species that I have seen was on the 4th January, when I saw about a hundred together. I have not seen or heard of any hawfinches this winter. On November 18th, two Common Scoters were shot at Thornton Reservoir. On November 5th, an Eagle was shot at Coleorton Hall. This was duly chronicled in the local newspapers, and in the *Field* as a Golden Eagle. By the kind permission of Sir Geo. Beaumont, I was able to obtain a sight of the bird whilst in the hands of Mr. White, of Castle Donington, who had it to set up. It turned out to be a young specimen of the White-tailed Eagle, *Haliaetus albicilla*. On December 16, a flock of five Wild Geese were seen, near to Kibworth, and two were shot. They were the White-fronted Goose, *Anser albifrons*. January 3rd, a Kittiwake was shot at Gumley; another was shot near the town of Leicester in the same month. In the last number of the "Midland Naturalist" I observe that one of your correspondents records a "Kingfisher shot," and he adds "seldom seen now." These lovely birds may well be seldom seen if they are shot down in wantonness. Many a time I could have shot them, but it gives me far more pleasure to note their rainbow hues as they skim over the pool, or flash along the brook, than it would to add them to my bag, or to see them, as is too often the case, adorning a lady's hat. Let me plead with your correspondent for the lives of these beautiful birds.—Thomas Macaulay, M.R.C.S.L., Kibworth.

Ornithological Notes.—There has been a great scarcity of winter migrants this season—hardly any Fieldfares, Redwing rather more numerous, Widgeon very scarce—I did not hear of any till the 24th ult., when about twenty-five were seen; last season they were much more plentiful. About the first week in December some Wild Geese flew over the village, but I have heard of none settling; perhaps the floods which have lately risen very much will attract some. On January 13th I put up five Teal off the Cherwell, and on the 12th inst. four more. On that day I saw a rather fine sight—from an ornithological point of view—four Herons, about five and twenty Wild Ducks, and a small flock of Peewits rose all at once from a small meadow partly covered with water.

Two or three Woodcocks have been shot; we never have many. Snipe were driven away by the frost, the Carrion Crow also left; I very seldom see one of these fine birds during the winter, unless it should be unusually mild. The few fine warm days at the beginning of last month deceived the birds into opening their song. On the 1st I heard Hedge Sparrow and Robin, on the 3rd Missel Thrush and Lark, and on the 8th the Starling—if the long whistles and chattering of this bird may be called a song. Song Thrushes opened on the 3rd, Chaffinch on the 6th, Yellow Ammer on the 7th, and Blackbird on the 14th inst. On January 17th I purchased a fine male Peregrine Falcon, which had been shot that morning close to the town of Banbury. It measured full 3ft. across the wings. A Curlew was shot here in the autumn. This fine bird has occurred several times in the neighbourhood.—O. V. Aplin, Bodicote, Oxon, February 20th, 1880.

Eider Ducks in Leicester.—Amongst other ducks in Leicester Market, on Saturday, January 17th, were three Eider Ducks (*Anas mollissima,*) two females and one male. The male I purchased, and have since stuffed.—Chas. Adcock, Taxidermist, Willow Street, Leicester.

Gleanings.

Midland Union of Natural History Societies.—The third Annual Meeting will be held at Northampton in June next, in connection with the Northampton Natural History Society. The date and other details will be announced in the next number. Communications should be addressed to the Hon. Sec., Mr. C. E. Crick, 1, Horsemarket, Northampton.

"Birds of Europe."—The last volume of Mr. H. E. Dresser's great work on the "Birds of Europe" is now in the printer's hands, and will be ready for delivery to subscribers in about a month's time. Some delay has arisen on account of the difficulty of arranging the order of classification, but this has at length been surmounted.

Artificial Diamonds.—Mr. N. Story-Maskelyne, of the British Museum, announces (February 19th) that artificial diamonds have at last really been produced. The gentleman who has had the fortune to solve a problem which has hitherto defied every attempt to deal with it is Mr. J. Ballantine Hannay, F.C.S., of Woodbourne, Bellensburgh, and Sword Street, Glasgow. His process will shortly be communicated to the Royal Society.

The Oligocene Formation.—Some years ago, Prof. Beyrich proposed the term Oligocene (slightly recent) for certain strata which on the Continent are clearly intermediate between the Eocene and Miocene Formations. In an important paper, read before the Geological Society on February 4th, Professor Judd proposes to include under this term all the "Fluvio-marine Series" of the Hants Basin, which he divides into (1,) the Headon Group; (2,) the Brockenhurst Series; (3,) the Bembridge Group; and (4,) the Hempstead Series. By this new grouping, the strata of the Hampshire Basin are brought into exact correlation with those of France, Belgium, North Germany, and Switzerland; and the whole series of fluvio-marine beds in the Isle of Wight, which are shown to have a thickness of between 800 and 900 feet, are proved to be the representatives of the Lower and Middle Oligocene of those countries. The use of the term Oligocene in this country is advocated on the ground that by its adoption only can we avoid the inconvenient course of dividing the fluvio-marine series between the Eocene and the Miocene.

Lias Fossils.—We are glad to hear that Mr. Martin Simpson, of the Whitby Museum, the veteran Yorkshire palæontologist, has nearly ready for publication a new edition of his "Fossils of the Yorkshire Lias," which will include descriptions of about 700 species. Mr. Simpson published a Monograph of Lias Ammonites so long ago as 1843, and the first edition of his "Lias Fossils" appeared in 1855. At the time these works attracted little attention, but the merits of the author, as a keen, acute, and hard worker, have since been amply recognised by Prof. Phillips, and by Messrs. Tate and Blake.

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—Microscopical General Meeting.—January 20th.—Mr. H. E. Forrest read a letter from Professor A. Schneider, relative to a new species of Moneron, *Monobia confluens*, supposed to be identical with one he had found at Barnt Green Reservoir.—Mr. J. F. Goode exhibited foraminifera, from sand dredged during the Falmouth expedition.—Mr. T. Bolton exhibited *Pycnogonum littorale*.—Mr. H. E. Forrest read a very interesting paper by Mr. W. Saville Kent, F.L.S., F.R.M.S., on some of the more remarkable forms of infusoria, captured during the Falmouth expedition of July, 1879, (which will appear in next month's "Midland Naturalist,") and enlarged the illustrative figures upon the black board. Geological Section.—January 27th.—Mr. T. H. Waller was re-elected Secretary of the Section, and the Presidency was offered to Mr. Saml. Allport, F.G.S., who, however, was not present, and has since declined to accept the office.—Mr T. H. Waller exhibited specimens of *Eozoon canadense*. Annual General Meeting.—February 3rd.—The report and balance sheet for 1879 were received and adopted. The report stated that the work of the Society during the past year had been of a satisfactory character, and the number of members had increased; the Treasurer had a balance in hand of £33 10s. 7½d., and over £700 had been expended on the Library and apparatus since the establishment of the Society. The following were elected officers for the current year:—President, Wm. Southall, F.L.S., F.R.M.S.; Vice-Presidents, E. W. Badger and J. Levick; Treasurer, Chas. Pumphrey; Librarian, J. E. Bagnall; Curators, W. B. Grove and R. M. Lloyd; Secretaries, J. Morley and H. E. Forrest. Biological Section.—February 10th.—Mr. A. W. Wills was unanimously elected Chairman, and Mr. J. F. Goode Secretary of the Section.—Mr. Allport announced that he had been appointed to form a Natural History Museum at Sir Josiah Mason's College and would be glad if any of the members would assist him with specimens.—Mr. Thos. Bolton exhibited a beautiful collection of Sea-weeds, from Torquay, mounted by a lady, which elicited universal admiration.—Mr. J. E. Bagnall exhibited a moss, *Bartramia pomiformis*, from near Erdington—local in Warwickshire.—Mr. J. F. Goode exhibited a worm of the genus Tubifex, from the surface of the mud in a ditch.—In the absence of Mr. Lawson Tait, Mr. H. E Forrest read a short paper by Dr. T. Spencer Cobbold, F.R.S., on *Strongylus nodularis*, a parasitic worm found by Mr. Tait, infesting the gizzard of a gosling. Specimens of the worm were exhibited.—Mr. W. R. Hughes made some remarks, and read some extracts from Dr. Cobbold's work on the Entozoa with reference to the subject.—Mr. E. W. Badger read a paper "On the Work of the Society," in the course of which he pointed out various methods whereby its usefulness and the number of working naturalists among its members might be increased.—An interesting discussion followed, in which several members joined. Microscopical General Meeting.—February 17th.—In recognition of the distinguished services which he has rendered to Biological Science, Professor T. H. Huxley, L.L.D., F.R.S., &c , was elected Honorary Vice-president of the Society.—Mr. J. E. Bagnall exhibited antheridia of Sphagnum dehiscing; antheridia and archegonia of *Mnium subglobosum; Pogonatum nanum*, and *Bryum roseum*, from Marston

Green; and other rare mosses.—Mr. T. Bolton exhibited *Zoothamnium dichotomum*, from one of the reserve tanks in the Aston Aquarium.—Mr. W. G. Blatch exhibited *Pœcilocampa populi*, December Moth, rare in the district, taken at Knowle, in December last.—Mr. H. W. Jones, F.C.S., F.R.M.S., read a paper on "Water Plants, and their Office in Nature," which will appear in a future number.

BIRMINGHAM AND MIDLAND INSTITUTE SCIENTIFIC SOCIETY, —January 28th. Mr. C. J. Woodward, B.Sc., read a paper on the Outline of the Kinetic Theory of Gases.—February 11th. Mr. A. E. Robinson, F.C.S. Alkaloids, their Sources and Reactions.

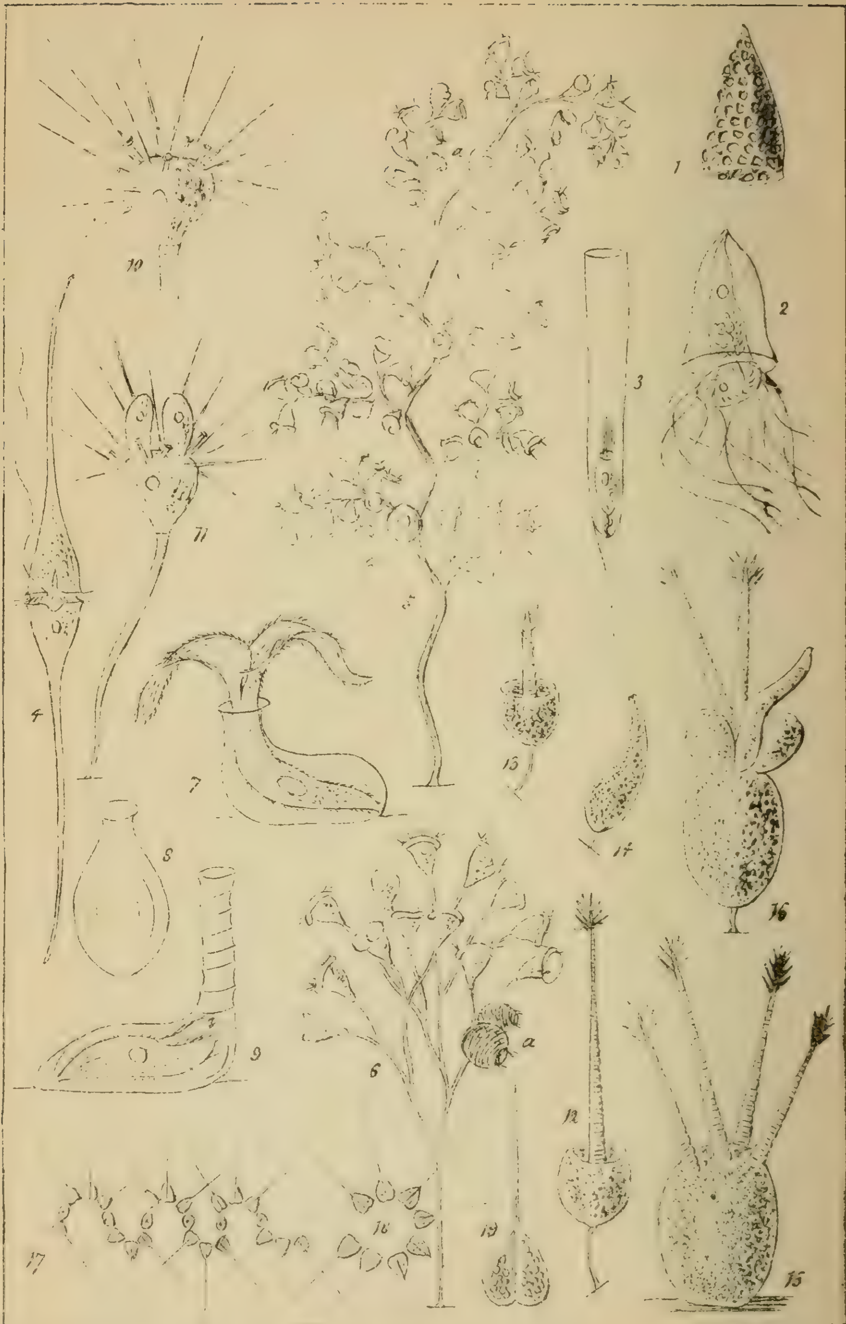
BIRMINGHAM PHILOSOPHICAL SOCIETY.—At a general meeting of the members of this Society, on February 12th, (Dr. Darwin's 71st birthday,) on the motion of the Rev. H. W. Watson, M.A., (Vicar of Berkswell,) seconded by the Rev. H. W. Crosskey, Dr. Darwin was elected an honorary member; and, on the motion of the President (Dr. Heslop,) seconded by Mr. Lawson Tait, the following address was unanimously adopted:—"To Charles Darwin, M.A., LL.D., F.R.S., &c. The President, Council, and Members of the Birmingham Philosophical Society, assembled on this, the 12th day of February, 1880, your 71st birthday, respectfully and unanimously offer to you the first Honorary Membership which the Society has conferred. They desire also to present their hearty congratulations, and to express their earnest hope that you may long be spared to continue those researches which have so widely extended the boundaries of human knowledge, and so profoundly influenced modern scientific thought. Few men are permitted to form by their works Epochs in the history of the world; but the appearance of the "Origin of Species," followed as it has been by numerous other publications illustrating its doctrines and extending their application, has constituted an Epoch as important as any that has yet marked the intellectual development of our race. Those who may refuse their assent to the philosophical principles enunciated in your works must admit, equally with those who accept them, that there are few realms of thought into which their influence has not travelled; while there is no branch of natural history, and hardly a problem connected with the position of man himself upon the earth, which has not had new light cast upon it, by the investigations called forth by your genius. The Members of this Society are conscious that, in offering you this Honorary Membership, they are asking you to confer a distinction upon them; but they feel that such a tribute of respect as they now desire to pay may not inappropriately come from the town which is the centre of that district with which your family have so long, and with so much honour, been associated.—Signed on behalf of the Philosophical Society of Birmingham."

BURTON-ON-TRENT NATURAL HISTORY AND ARCHÆOLOGICAL SOCIETY.—January 20th. Mr. W. Molyneux, F.G.S., read a paper on "Bosworth Field." He said the battle of Bosworth Field was fought either on the 21st or 22nd August, 1845, the two combatants being members of the same family—Richard III. and Richmond, who afterwards became Henry VII. It was the concluding battle of the Wars of the Roses, which had raged for thirty years at a sacrifice of over 105,000 men. On that field perished the last, if not one of the greatest of the Plantagenet kings—a race of men who, during the long period of 330 years had carried the destinies of England in their hands, and by their high courage, their determination, and generosity had done much in the foundation of the institutions and in the maintenance of the glorious and remarkable history of the country. Mr. Molyneux then commented upon the fact that no authenticated particulars of the engagement were known, but he remarked that the battle stood out as an event of three plain and simple but momentous facts—the defeat of the king's troops, the death of one king, and the proclamation of another. The works of historians who lived immediately after the battle were alluded to; and Mr. Molyneux next proceeded to give what he believed to be a correct account of the battle. February 10th.—Mr. W. G. Blatch, of Birmingham, read a paper on "Entomological Work in Winter." He said the object he had in view in preparing his notes (which were originally contributed to the Birmingham society) was to try and explode the popular fallacy that insects could only be found in summer. The truth was there was no day in the year when insects could not be found by those who knew where to look for them, and were willing to sacrifice personal comfort to entomological enthusiasm. Myriads of insects of all orders passed the winter in a secluded state; in fact, paradoxical as it might appear to the uninitiated, the more severe and prolonged the winter the more likely were they to survive. Anyone could readily confirm this by becoming an observer of insect life for two or three seasons, and the time and labour thus bestowed would not be ill spent. He then took his hearers on an imaginary winter excursion in search of insects, and, supposing them to have arrived at a locality suited for their labours, he gave a list of the numerous insects which might be found in a dead reed, at the roots of trees, the bark of trees, the moss and lichens growing on the tree trunks, the decayed stumps of oak and birch trees, grass clumps on the margins of watercourses, fungi, the accumulated rubbish on the sides of hedges, coping of stone walls, the trunks of poplars, and the decaying stumps of hawthorns, haystacks, &c. A vote of thanks was passed to Mr. Blatch, and the Rev. W. Fowler, in moving it, pointed out that in the neighbourhood of Burton numerous insects might be found in the rubbish left in the fields after a flood.—Mr. H. T. Ford then read a short paper relating to the discovery of bitumen on Bearwood Hill, his observations being illustrated by diagrams contributed by Mr. Boden. Mr. Ford stated that the cutting through Bearwood Hill having recently been widened to improve the way from Burton to Winshill now displayed a most interesting section of the Keuper sandstones, part of the New Red formation. Near the middle of the cutting, and at the base of the section, there was a bed of very hard sandstone strongly impregnated with bitumen. In explanation of how this bitumen came there, he said it was usually laid down that such mineral oily matters were distilled by subterranean heat from deposits of coal or other vegetable matter, and in that case it might have exuded through a fault or fracture in the strata, which struck this deposit at a right angle. He also pointed out that there was a remarkable contrast in the sand and clay resting on the sandstone. One end of the section was a reddish brown, and the other blue and green, the change taking place without any break in the stratification. The blue stain was considered to be from carbonate of iron, and might have resulted from percolation of water from a small lake which must once have existed in Winshill hollow, its outlet being clearly traceable through a gully running north-west. The beds also contained the well-known ripple-marked water-stones, some specimens of which were exhibited, together with a drawing of the labyrinthodon, a toad of gigantic proportions, whose hand-like footprints were sometimes found on those waterstones.

NORTHAMPTON NATURAL HISTORY SOCIETY.—January 8th.—Botanical Section.—A communication was read from the President, Rev. M. J. Berkeley, in which he said he was not inclined to attribute the scarcity of fungi in 1879 to the long continued frost in the Spring; that he had found *Hygrophorus Wynniæ* in Wales in 1879; that during the early autumn he examined some true *Polyporus varius* from an apple tree, and noticed that the spores, when just arriving at their full development, were fringed with delicate threads like eyelashes. These under the microscope proved to be cylindrical bodies filled with globose sporidia. A paper by Mr. G. C. Druce, F.L.S., on "The Botany of Fruits" was then read, in which he described the present classification of fruits, and described some of their contrivances for becoming disseminated. December 20th.—Mr. R. G. Scriven read a paper on "Common Ferns," in which he described the different genera occuring in Britain, and gave some very useful hints on the cultivation of British Ferns. January 15th.—Rev. T. C. Beasley read a paper on "Weather Forecasts." January 29th.—Geological Section.—Mr. Eunson exhibited specimens from the Lias from Kingsthorpe, and gave an interesting paper on "The Study of Geology."

EXCHANGE.

Plate IV.



W. Saville-Kent del.

Marine Infusoria.

NOTES ON MARINE INFUSORIA.*

BY W. SAVILLE KENT, F.L.S., F.R.M.S., ETC.

Among the treasure trove amassed by the Birmingham Natural History Society during their last summer's enjoyable outing on the Cornish coast, and at the gathering of which said material, availing myself of the kind invitation of the President, Mr. Walter Graham, I was permitted to assist, a considerable number and variety of Marine Infusoria were obtained. While none of these are new to science, several of them possess a more than ordinary interest with relation in some cases to their individual plan of structure and affinities, and in others to their marked diversity from the Infusorial types more frequently encountered by non-migratory "Midland Naturalists." To some few of these minute organisms, the produce of one day's wielding of the dredge and towing net, (July 11th,) I here propose to direct attention, accompanying my remarks with delineations of the more important forms.

Out of the eight types in all it is here proposed to select, the majority, five in number, were found associated with the horny polypidoms of the Hydroid Zoophytes, Polyzoa, and other organic

References to Plate IV.

Fig. 1.—*Dictyocysta cassis*, empty silicious lorica, showing fenestrated pattern.

Fig. 2.—*Dictyocysta cassis*, animalcule with extended tentacula; the fenestræ of the lorica are not represented, in order to give a clear view of the occupant (after Hæckel.)

Fig. 3.—*Tintinnus subulatus.*

Fig. 4.—*Ceratium fusus.*

Fig. 5.—*Zoothamnium alternans*, showing at a, a, a, the larger and axillary reproductive zooids.

Fig. 6.—*Zoothamnium dichotomum*, showing at a, a, a, the larger transversely-striate reproductive Zooids.

Fig. 7.—*Folliculária ampulla*, animalcule extended and inhabiting a lorica, with a moderately-produced neck=*Lagotia viridis*, S. Wright.

Fig. 8.—*Follicularia ampulla*, empty lorica, with very short neck.

Fig. 9.—*Follicularia ampulla*, lorica, with greatly produced neck, exhibiting annular growth markings; *Lagotia producta*, S. Wright.

Fig. 10.—*Hemiophrya gemmipara*, with tentacles of two orders fully extended.

Fig. 11.—*Hemiophrya gemmipara*, with two anteriorly developed buds.

Fig. 12.—*Ophryodendron pedicillatum*, proboscidiform zooid, with characteristic organ extended.

Fig. 13.—*Ophryodendron pedicillatum*, with proboscis retracted.

Fig. 14.—*Ophryodendron pedicillatum*, vermiform zooid.

Fig. 15.—*Ophryodendron multicapitatum*, sessile zooid, with four proboscidiform appendages.

Fig. 16.—*Ophryodendron multicapitatum*, stalked zooid, with two proboscidiform organs, one immaturely developed vermiform zooid, and two supplementary spheroidal buds.

Fig. 17.—*Asterionella Bleakeleyii* (?) showing characteristic spiral disposition of the associated frustules.

Fig. 18.—*Asterionella Bleakeleyii* (?) a few detached frustules, exhibiting a substellate disposition.

Fig. 19.—*Asterionella Bleakeleyii*, single frustule.

* The full title of this paper is "Notes on Certain Marine Infusoria, obtained during the Summer Excursion (1879) to Falmouth of the Birmingham Natural History and Microscopical Society, communicated by W. Saville Kent, F.L.S., F.R.M.S., and Honorary Corresponding Member of the Birmingham Natural History and Microscopical Society." It was read before the Society January 20th 1880.

matter brought by the dredge from the sea-bottom. By the use of the towing-net, employed, however, on one occasion only, and when the elements were by no means propitious for such operations, the small minority, including, as it eventually proved, the most interesting capture of the series, was secured. The contents of the net, as emptied on board the steam-boat into the glass receivers, were by no means promising, consisting merely of a little flocculent matter, at first distributed indifferently through the mass of water, but which, after a short interval, collected at the surface in the form of a pale yellow unsubstantial scum. Specimens of this scum examined fresh, and permanently mounted, both on board and later on in the evening, on our return to Falmouth, demonstrated that almost its entire mass was composed of two minute pelagic diatomaceous types. One of these, (Plate IV., Figs. 17 to 19,) forming substellate or long spiral and corkscrew-like aggregations, each component frustule having a somewhat inflated triangular body, and a long median and spine-like apical prolongation, is apparently identical with, or closely allied to, *Asterionella Bleakeleyii*. In no account of the several species of this same genus, at this moment accessible, however, do I find any record of their formation of long symmetrically twisted spiral aggregations, which in the present case is so eminently characteristic of the fully developed and perfect organism. The second, but less dominant diatomaceous type, accords essentially with the figures and descriptions given of *Rhizosolenia setigera*, consisting of perfectly straight, attenuate cylindrical frustules, chiefly remarkable for their finely produced and needle-like axial terminations. In some of the larger frustules a single or double spiral pattern was faintly discernible.

A more leisurely examination of the mounted slides of these diatomaceous skimmings has led to the detection among the same of the three infusorial forms placed first on this list. All these are, like the diatoms, essentially pelagic in their habits, and, possessing in each case an indurated lorica or carapace, adapt themselves readily for permanent preservation.

1.—*Dictyocysta cassis*, Hkl., (Plate IV., Figs. 1 and 2.)—Of this type, the most interesting capture on my list, unfortunately only the empty test or lorica has been preserved. The form and structure of this skeletal element are, however, so definite and characteristic as to leave no doubt whatever regarding the nature and relations of its former occupant. The lorica, which resembles in shape a conical cap or helmet, is of silicious consistence, perforated throughout with closely-set, irregular, polygonal foramina, and, in the absence of the knowledge that has recently come to hand, would be regarded as the silicious test of one of the simpler pelagic Radiolaria, and be referred in that same group to Ehrenberg's Polycystine genus, *Dictyocysta*. Professor Hæckel, however, has lately shown in an account of some new pelagic Infusoria, published in the "Jenaische Zeitschrift," for the year 1873, that the original fabricators and inhabitants of these elegant helmet-shaped tests are not Radiolaria, but belong to the more highly organised group of the Ciliate

Infusoria, representing among the same a specially modified form of the Vorticellidæ and other familiar members of the section Peritricha. The test itself, except for its silicious consistence and cancellated structure, corresponds morphologically and physiologically with the horny or chitinous protective lorica of a *Cothurnia* or *Vaginicola*. It is a secretion or exudation of the external cuticula. The enclosed animalcule, however, as shown by Hæckel, exhibits a very wide divergence from the ordinary Peritrichous type. The body of the same is attached posteriorly to the proximal or hinder extremity of the cavity of the lorica, while the more expanded oral or distal region is projected, when the animalcule is extended, beyond its everted anterior margin so far that the *tout ensemble* may be compared to a minute bell, in which case the lorica represents the bell-body, and the posteriorly attached animalcule the clapper. It is in the projecting oral region of the animalcule that the essential points of modification are found to obtain. Here, in place of the customary simply circular or spiral wreath of cilia, the margins of the oral disc are produced into about twenty long tentacle-like organs, probably of a prehensile nature, which, as the animalcule swims mouth downwards through the water, impart to it the aspect of a minute jelly fish or medusa. Inside the outer wreath of tentacles, which would appear to represent outgrowths or prolongations of the raised peristome-border of an ordinary *Vorticella*, is situated an inner circlet of stout vibratile cilia, which conducts to the oral aperture. This is apparently homologous with the adoral ciliary wreath of the same peritrichous type. *Dictyocysta cassis*, with which the minute silicious lorica taken in the towing-net on the Cornish coast entirely corresponds, was originally discovered by Professor Hæckel, in the neighbourhood of Messina, and its recent encounter in so much more northerly a latitude is of itself a feature of considerable interest. Three other species of *Dictyocysta*, all distinguished by various modifications of the form of the lorica, or in the pattern of its perforations, were obtained by Professor Hæckel from the same Mediterranean station, which would appear to lie within its most congenial and favoured area of geographical distribution. Two remaining species, upon which, in the year 1854, the genus was first founded by Ehrenberg, were encountered in deep Atlantic soundings, and no doubt originally lived, like Noctiluca and the Radiolaria, in the surface waters. Three infusorial types, having tentacle-like appendages, similar to those of *Dictyocysta*, but with loricæ formed of chitine, with an admixture of agglutinated sand grains and other foreign particles, have been described by Professor Hæckel, in the serial above quoted, in association with the new generic title of *Codonella*. The delineation here given of the animalcule of *Dictyocysta cassis* is reproduced from Hæckel's illustrations, that of the lorica being a sketch from the Falmouth specimen.

2.—*Tintinnus subulatus*, Müller, (Plate IV., Fig. 3.)—A single example of this type has been found mixed with the preserved diatomaceous skimmings. The lorica is of glass-like transparency, sub-cylindrical, and produced at the proximal or posterior extremity into an acute and often much attenuated spine-like point; it bears, in fact, no inconsiderable resemblance to the segment of a frustule of the diatom, *Rhizosolenia setigera*, with which it is so abundantly associated. The contained animalcule, resembling an elongate *Vorticella*, is fixed by a contractile pedicle to the bottom, or sometimes to one side of the lorica, and does not project beyond its anterior margin. The oral cilia, forming a spiral wreath at the distal extremity, are exceedingly long and powerful, and in its normally free-swimming state serve to propel the animalcule and its associated lorica backwards through the water with great rapidity. According to Claperède and Lachmann, the entire body in the representatives of this same genus is clothed throughout with fine vibratile cilia, and thus assimilates the typical characteristics of the section Heterotricha; the presence of these finer cilia, however, could not be detected in the spirit-preserved example recently examined.

3.—*Ceratium fusus*, Ehr., (Plate IV., Fig. 4.)—Several examples of this cilio-flagellate type have been found scattered through the prepared slides referred to, this species being remarkable among its associated family group of the Peridiniidæ on account of the production of the two segments of the carapace into single attenuate axial prolongations, the other representatives of the same genus, as *C. tripos* and *C. furca*, having usually two antero-lateral and not axially disposed processes. Although *Ceratium* is usually regarded as an essentially marine type, one form, *C. Kumaonense*, has been described by Mr. Carter (Ann. Nat. Hist., Vol. VII., 1871,) as occurring in prodigious numbers in the lakes of Kumaon, Hindostan, at an elevation of from 4,000ft. to 6,500ft. above the sea level, while the *Ceratium (Peridinium) longicorne* of Perty, (having, like *C. Kumaonense*, three anterior horn-like prolongations,) originally found in Switzerland, has been recently encountered in the neighbourhood of Birmingham, whence I have received specimens for identification from the hands of Mr. Levick. Among the Falmouth specimens of *Ceratium fusus*, one example in which the carapace had been crushed, and the enclosed yellowish and granular protoplasm extruded, exhibited a well marked oval nucleus-like body, while the aspect of the fractured edges of the carapace seemed entirely to support the suggestion recently made to me by Mr. Charles Stewart, F.L.S., and arrived at by his burning *C. tripos* on platinum over a spirit lamp without the destruction of the carapace, that this latter, in the case at least of the marine types, is probably of a silicious nature. The animalcule of *Ceratium* corresponds essentially with that of *Peridinium*, having a monadiform structure, and single long lash-like flagellum, which projects from a medially situated oval aperture; the carapace consists of an anterior and posterior valve, closely approximated, with an equatorial groove or channel between them upon which a circlet of fine vibratile cilia is developed, and upon the ventral face of which groove the oral aperture with its associated lash-like flagellum debouches. The fresh-water *Peridinium tabulatum* recently supplied to me from the neighbourhood of Birmingham through Mr. Thos. Bolton's excellent microscopic agency, is a form admirably adapted for the observation of this same fundamental type of structure, the carapace valves in this instance being moreover composed of elegantly reticulated polygonal facets that amply repay microscopic investigation.

(To be continued.)

THE CHANGES OF CLIMATE DURING GEOLOGICAL PERIODS.*

BY THE REV. J. WILSON COOMBS, B.A.

It has long been observed that the climate of the northern hemisphere must—at a former and comparatively recent period—have been considerably warmer than it is at present. The traces alike of the fauna and flora discovered in the rocks, as well as the bones of animals found in caves, and the fossil trees imbedded in the coal measures and elsewhere, furnish undoubted evidence that at one time the climate in this and other northern countries must have been nearly, if not wholly, tropical. For many years geologists were satisfied with the explanation that this reduction of temperature (which was supposed to have been continuous and unbroken) was to be attributed to the gradual cooling of the earth. But not to say that the effect of this upon climate is very much smaller than was formerly supposed, the abundant evidence which now exists of a much colder climate in former times than that which at present obtains has rendered this theory no longer tenable.

The knowledge of glacial action in Norway and Switzerland, resulting from the labours of Agassiz, Forbes, Tyndall, and others, has sufficed to prove that not only were existing glaciers at one time much more extensive than at present, but that in Alpine regions and elsewhere glaciers were at one time present where now not even the most attenuated ice-stream is to be seen. Moreover, the careful examination of the rock-basins which form so many of the lakes of Switzerland led to the conclusion that these must have been to a great extent hollowed out by the continuous action through long ages of glaciers, vastly larger than those which in regions more or less remote now supply the streams or rivers by which these lakes are fed. Along with these discoveries the fact was brought to light that there were abundant traces of ice-action in Britain and in other lands where glaciers have certainly never been present in historic times. Agassiz, Buckland, and others stated their belief to this effect, but these statements attracted at the time but little attention. Professor Ramsay discovered such traces in many parts of the Snowdon range, and he and others have found in the north of England and in Scotland all the signs which in Switzerland have been observed to indicate the presence of a glacier. "The Great Ice Age," by Mr. James Geikie, furnishes an exhaustive account of what has hitherto been brought to light by these investigations. Striated rocks, the roches moutonnées, glacial moraines, and boulder clay or till are found in many places and in great abundance, and, as in Switzerland, so also in Britain,

*Read before the Cheltenham Natural Science Society, December 18th, 1879.

boulders of granite and other rocks have been conveyed by the agency of ice many miles from their natural source.*

As far back as 1819 Dr. Buckland observed that on the Cotswold Hills there were found pebbles of hard red chalk, which must have come from the Wolds of Yorkshire and Lincolnshire ; and Mr. Lucy, who has directed attention to the fact that these hills are sprinkled over with boulders from Charnwood Forest, states that on visiting the latter place he found that many of the stones contained in it had come from Yorkshire.

The inlets of the sea so common in Norway and there known as fiords, and on the West Coast of Scotland where they are called lochs, are found only near mountains, and where there are the unmistakable evidences of glacial action, and in every instance the deepest part of the loch is found to be at the head, and striæ are observed in the rocks at the sides often high above the sea level ; so that there is every reason to believe that they, like the lakes of Switzerland, have been hollowed out by the action of ice. A general consensus of evidence goes to prove that at one time the whole of Scotland, with the exception of a few of the highest peaks, was locked in a great ice-sheet, coming down, in all probability, from Scandinavia, and extending far out to sea, overspreading all the islands, and connecting itself in one unbroken mass with the almost equally extensive ice-sheet that covered Ireland.

But not only is there this ample proof of the existence of a great ice-age in Britain and other parts of Europe, and in North America, but there is evidence, which though of necessity much scantier is yet sufficient, of other glacial epochs long antecedent, with intermediate warmer periods. Intercalated beds are found between the till or boulder clay. In some cases from 20ft. to 30ft. of sand and gravel and peaty matter, containing the remains of the elk, horse, reindeer, and mammoth, have been found between layers of the till, and in some instances four distinct formations of till have been found, separated from each other by beds of sand from 2ft. to 20ft. in thickness. At the last meeting of the British Association, palæolithic implements, pronounced by Sir John Lubbock and others to be undoubtedly of human origin, were exhibited, which were found beneath the chalky boulder clay in various parts of East Anglia, proving the existence of man in these districts previous to the glacial periods. In one case there was first sandy soil 2ft., then chalky boulder clay 6ft., gravel 4ft., loamy clay 4ft., boulder clay 6ft., chalk, and this spot yielded great numbers of flakes and many implements. Other evidence of the existence of man in the pre-glacial age is given in Heer's "Primeval World of Switzerland."

The Forest Bed of Cromer furnishes evidence of distinct formations

* Boulder Clay or Till.—This is a tough, clayey deposit, fine in texture, tenacious, and often of a stone-like hardness. It is always full of rocks and stones, which are usually covered with striæ, often crossing each other in various directions. It is found chiefly in low lying districts, sometimes as much as 100 feet deep, and, occasionally it is found as high as 2,000 feet above the sea in hollows on hill sides. The rock surfaces on which this rests are worn smooth, and when the rock is hard greatly grooved and striated. The constituents of the till all correspond with the character of the rocks of the district. It is often found underneath moraines, but never above them.

of till. It has been traced for more than forty miles along the coast, and consists of stumps of trees standing erect. Above these we have a fluvio-marine series, the flora and fauna of which belong to a warm interglacial period. Above this comes the Norwich boulder till, containing blocks 6ft. or 8ft. in diameter, many of which must have come from Scandinavia. Then, in succession, (1) beds of sand and gravel; (2) a drift yielding shells indicating a mild climate; (3) the upper boulder clay; (4) freshwater beds, containing seeds, bones, &c., indicating a mild and temperate condition of climate.

Professor Geikie observed a section of a cliff in the South of Scotland which stood thus:—1, vegetable soil; 2, boulder clay 30ft. to 40ft.; 3, yellowish gravelly sand; 4, peaty silt and clay; 5, fine ferruginous sand; 6, coarse shingle 2ft. to 3ft.; 7, coarse stiff boulder clay 15ft. to 20ft.

In one instance, at Dürnten, on the lake of Zurich, a coal seam 12ft. thick, which would require from six to ten thousand years for its formation, is found lying on boulder clay. Overlying this coal is another mass of drift and clay, 30ft. in thickness, with rounded blocks, and on the top of this upper drift lie long angular erratics, which evidently have been transported on the back of glaciers. Indeed the formation of coal beds can be explained on the supposition of interglacial periods, as it can be on no other. An interglacial climate is the one best suited for the growth of the coal plants. The coal period indicates the existence of a moist, equable, and temperate climate, such as will be shown must have been the character of our climate between these glacial epochs. At the same time, we have in the cold periods of such an epoch the condition most favourable for the preservation of those plants, for then they would be submerged and covered over by a thick deposit of sand, mud, and clay. In South Africa there is evidence not only of a glacial condition during the Pliocene period, but also of a warmer climate than now prevails in that region. Recent glaciation extends over a large portion of Natal and other parts.

It is not to be wondered at that the evidence of glacial action in very remote times should be very scanty. Indeed, remembering what must be the effects of the warm periods succeeding, it is, perhaps, remarkable that we have any evidence left of the preceding cold ones. It is evident that cold periods are best marked in temperate regions, and warm ones in Arctic; and in many Arctic localities the remains of a luxuriant flora of the Miocene period have been often found in great abundance. Remains of mammalia are found in the icy alluvial deposits of North Siberia, and unfossilized trees—conifers and others—in the Arctic lands of North America. Coal beds of the carboniferous age are extensively developed in Arctic regions, proving that a mild and temperate condition of climate must in some part of the carboniferous age have prevailed up to the very pole. Masses of Silurian limestones are also found in the Arctic regions, spread over a wide surface containing encrinites, corals, and mollusca, and other fossil remains.

In the Eocene period, when palms and turtles and crocodiles inhabited England, we find travelled blocks and other indications of ice-action. Near the lake of Thun, one of the granite blocks of this formation is nearly 100ft. square. It is red, and of a kind not now to be met with *in situ* anywhere in the Alps. Similar erratics of the same age have been found in the Carpathians and in the Apennines.

In the lower Permian conglomerates of the West of England there are unmistakable signs of ice-action. These contain angular fragments of various rocks, striated or polished, which can often be traced to Welsh rocks, from twenty to thirty miles distant. Evidence of a similar kind—more or less full—has been furnished of glaciation, and of warm periods in each of the other geological epochs. There is, therefore, abundant proof of many distinct alternations in past ages, of arctic and temperate climates.

How can we account for these alternations? It seems natural to conclude that the main reason for them must be sought in the changes which have taken place in the relation of the earth to the sun. These changes, however, have been asserted by eminent astronomers to be inadequate to account for these effects. This is quite correct, so far as the *direct* influence of solar heat is concerned, but the indirect influence of greater or less amount of that heat is much more efficient than the direct. Physical as well as astronomical calculations are needful, in order to estimate the changes which are thus wrought. The direct results of the precession of the equinoxes, and of the eccentricity of the earth's orbit, are greater than have usually been admitted by astronomers. Calculations, extending over long periods, of the variations of eccentricity have been made by Leverrier and others, one of whom, Mr. James Croll, of the Geological Survey of Scotland, has published an elaborate work on the subject of this paper, entitled "Climate and Time, in their Geological Relations." This book is my authority for many of the following statements.

(*To be continued.*)

THE CRYPTOGAMIC FLORA OF WARWICKSHIRE.

BY JAMES E. BAGNALL.

(*Continued from page 12.*)

SECTION II.—AMPHOCARPI.

FISSIDENTACEÆ.

399.—*Fissidens bryoides* Hedw. Marly and sandy banks, frequent. Sutton Park! Knowle! Acocks Green! &c. February.

400.—*F. exilis* Hedw. On rabbit heaps and clayey soils in woods, and on banks in Lias soils, rather rare. Bearley! Haywoods! Canal bank near Acocks Green! Lane near Yarningale Common! February.

401.—*F. incurvus* Schwg. Clayey banks, local. *F. viridulus, e. incurvus* Wils. Bearley, on banks near the village, Solihull! Canal bank near Solihull and Olton! Temple Grafton! Lane near Yarningale Common! March.

403.—*F. tamarindifolius* Brid. Marly banks, rare. Near Princethorpe! Drayton bushes! near Binton Bridges! March.

404.—*F. pusillus* Wils. Damp sandy banks, rare. Near Bacons End, Castle Bromwich! lane near Yarningale Common! March.

Var. Lylei Wils, *M.SS.* Very rare; abundant on the bank of a drain near Counden, on the way for Allesley! on Lias banks, Birdingbury Wharf! April.

405.—*F. crassipes* Wils. *F. viridulus, c. major* Wils., very rare. Sparingly by the water wheel, Guy's Cliff! April.

406.—*F. inconstans* Schpr. On Lias banks, very rare. Specimens found growing with F. incurvus near Binton Bridges are apparently identical with specimens received from H. Boswell, Esq. February.

409.—*F. adiantoides* Hedw. Marshes, rare in fruit. Sutton Park, by Windley and Long Moor Mill Pool in fruit! Ballards Green, near Arley Wood! recorded by Purton from a strawberry bed near Studley Castle. October.

410.—*F. taxifolius* L. Clay banks, somewhat local. Canal bank, Olton! Haywoods! Baddesley Clinton! Canal bank, Rowington! near Hartshill in several places! Ufton Wood, near Southam! Pool Hollies, Sutton Park! November.

SECTION III.—CLADOCARPI.

RIPARIACEÆ.

414.—*Cinclidotus fontinaloides* Hedw. *Trichostomum fontinaloides* Purt. "Mill walls, banks of rivers, rare. On a stone cistern at a watering place at Binton," (Purt, vol. ii., p. 527.) "On mill wheels at Bidford Grange, in full fruit, Bree," (Purt, vol. iii., p. 387.) The cistern at Binton I find is now altered into a modern drinking fountain. I saw no trace of the moss; the second locality I have not yet visited.

415.—*Fontinalis antipyretica* L. Streams and pools, attached to wood, rare. In river near Holywell! in small pool near Stratford-upon-Avon Road to Alcester!

CRYPHÆACEÆ.

418.—*Hedwigia ciliata* Dicks. On sandstone, very rare. Arbury (T. Kirk)! I have seen authentic specimens collected by Mr. Kirk from this locality, but have not found it myself.

420.—*Cryphæa heteromalla* Hedw. *Neckera heteromalla* Purt. On trees, local. "In a thicket at Alcester mill, near Allesley'" Purt, Bree. On elms near Stratford-upon-Avon! on elms, Wolstone Heath, near Dunchurch! near Sherbourne! Bridle Road from Drayton Bassett to Chadshunt! on ash and elm trees between Offchurch and Birdingbury! frequent in this locality. April.

SECTION IV.—PLEUROCARPI.

LEUCODONTACEÆ.

422.—*Leucodon sciuroides* L. On trees, local in North, frequent in South Warwick. Drayton bushes! Chadshunt! Chesterton! Harbury! Oakley! Exhall! Solihull! Rowington! Stratford-upon-Avon! Copt Heath! always barren.

NECKERACEÆ.

428.—*Neckera complanata* L. On trees, &c., frequent. Solihull! Shustoke! Maxtoke! Oakley Wood! &c. Not found in fruit.

429.—*Homalia trichomanoides* Schreb. *Omalia* Wils., Hobk. *Hypnum trichomanoides* Purt. "Allesley." On banks and trees, local. School Rough! Marston Green! Solihull on way for Bentley Heath! near Wroxall Abbey! November.

[*Hookeria lucens* Dill. Should be sought on moist banks in woods. Found by the late Mr. Westcott at Moseley, near Birmingham!]

LESKEACEÆ.

437.—*Leskea polycarpa* Ehrh. *Hypnum medium* Purt. "On tiles, Allesley, (Bree.") On trees, especially on the roots near water, local. Forge Mills, on alder roots! Bridle road from Drayton Bassett to Chadshunt! on poplar and alder roots, stream near Holywell! May.

440.—*Anomodon viticulosus* L. On tree roots. On ash trees, near Sherbourn! lane from Kingswood to Wroxall Abbey! Holywell!

446.—*Thuidium tamariscinum* Hedw. *Hypnum tamariscinum* Wils., Hobk. Marly banks and woods, frequent. Sutton Park! Canal bank near Rowington! Olton! &c. November.

HYPNACEÆ.

453.—*Thamnium alopecurum* L. *Isothecium* Wils. *Hypnum* Hobk., Purt. "Oversley." Banks, woods, and coppices. Rowington, in fruit! Drayton bushes, in fruit! Maxtoke Churchyard! Wootton Wawen! Yarningale! November.

454.—*Climacium dendroides* L. *Hypnum dendroides* Purt. Bogs and marshes, local. Canal bank near Holywell! Lane from Four Ashes to Box Trees, Shirley! Sutton Park! Allesley (T. Kirk)! "Cold Comfort," (Purton.)

456.—*Isothecium myurum* Poll. *Hypnum curvatum* Purt. "Allesley (Bree.") On trees, local. Plants brook! Haywoods! Holywell! Bearley Bushes! In fruit Chesterton Wood! November.

459.—*Homalothecium sericeum* L. *Leskea sericea* Hedw., Wils., Hobk. Walls, trees, thatch, &c., frequent. Sutton Park! Acocks Green! Olton! &c. November—March.

460.—*Camptothecium lutescens* Huds. *Hypnum lutescens* Huds., Wils., Hobk., Purt. "Cleve Bank opposite Salford." On banks in a marly or lias soil, local. Bearley Canal bank! near Ufton Village! Oversley Woods! not found fruiting.

462.—*Scleropodium cæspitosum* Wils. *Hypnum cæspitosum* Wils., Hobk., Berk. Tree roots near water, local. Forge Mills, near station! abundant on banks of Alne, near Aston Cantlow! borders of pool by Middleton Park! on alders near Marl Cliff! near Holywell on footbridge! near Curdworth bridge!

466.—*Brachythecium glareosum* B. and S. *Hypnum glareosum* Br., Wils., Berk., Hobk. Marly banks, local. High bank, Stratford Road, near Henley-in-Arden! marly banks near Rose Hall, Oversley! near the Bird in Hand, Henley!

468.—*B. albicans* Neck. *Hypnum albicans* Neck., Wils., Berk., Hobk. Grassy places, local. Near Upper Witton Reservoir! Sutton Park by Keeper's Pool, sparingly! Very abundant on the borders of a pine wood, Coleshill Heath!

469.—*B. velutinum* L. *Hypnum velutinum* Dill., Wils., Berk., Hobk. Banks, woods, fields, &c., common. Sutton Park! Solihull, Acocks Green! &c. November.

473.—*B. rutabulum* L. *Hypnum rutabulum* Wils., Berk., Hobk. Banks, woods, fields, &c., common. Sutton Park! Acocks Green! Solihull! &c.

A very robust form is also frequent on damp marly banks and in drains, abundant above Blackroot Pool, Sutton Park, Olton Canal bank, and other localities. November.

475.—*B. rivulare* B. and S. *Hypnum rivulare* Br., Wils., Berk., Hobk. In drains, rare. In a drain, canal bank near Holywell! November.

476.—*B. populeum* Hedw. *Hypnum populeum* Wils., Berk., Hobk. Walls, sandstone rocks, trees, rare. Tythall Lane, near Solihull! Olton Canal bank! November.

477.—*B. plumosum* Swartz. *Hypnum plumosum* Sw., Wils., Berk., Hobk. On sandstone rocks, &c., very rare. On stone coping of canal bridge, near Olton !

478.—*Eurhynchium myosuroides* L. *Isothecium myosuroides* Brid., Wils. *Hypnum myosuroides* Brid., Berk , Hobk. On trunks of trees, rocks, &c., rather local. On ash trees, near Sherbourne ! Bearley Bushes, on young trees ! Haywoods ! Chesterton Wood ! November.

482.—*E. striatum* Schreb. *Hypnum striatum* Schreb., Wils., Berk., Hobk. Woods and shady banks, local. Solihull ! abundant in Drayton Bushes ! Snitterfield and Bearley Bushes ! Chesterton Wood in fruit ! Shirley ! November.

484.—*E. piliferum* Schreb. *Hypnum piliferum* Schreb, Wils., Berk., Hobk. Shady marly banks, very local. Olton Canal bank ! Canal bank near tunnel under Shrewley Heath, abundant !

485.—*E. speciosum* Brid. *Hypnum speciosum* Brid., Wils., Berk., Hobk. On roots of trees near water, very rare. Coppice by Windley Pool, Sutton Park, in fine fruit, 1870 ! January.

487.—*E. Swartzii* Turn. *Hypnum Swartzii* Turn., Wils., Berk., Hobk. Damp banks in a marly or calcareous soil, local. Sutton Park ! Coppice near New Park ! Drayton Bushes ! In a drain, lane from Middleton to Kingsbury ! Abundant on lias bank near Kineton ! November.

488.—*E. prælongum* Dill. *Hypnum prælongum* L., Wils., Hobk., Berk. Shady banks, woods, &c., frequent. Sutton Park ! Acocks Green ! Water Orton ! &c. November.

489.—*E. pumilum* Wils. *Hypnum pumilum* Wils., Berk., Hobk. Shady and marly banks, local. Bank near Middleton ! Olton Canal bank ! In fruit, near Solihull, on the way for Bentley Heath, abundant ! November.

490.—*E. Teesdalii* Sm. *Hypnum Teesdalii* Sm., Wils., Berk., Hobk. Very rare. " In a moist shady place, between Oversley Green and the Mill, upon the upper bank," Purton. I have not succeeded in finding this moss in the place indicated, and am unable to refer to Purton's specimen.

(To be continued.)

ENTOMOLOGICAL RAMBLES IN THE MIDLANDS.

III.—OLTON, SOLIHULL, AND KNOWLE.

BY W. G. BLATCH.

The month of April, with its mingling of cloud and sunshine, warmth and cold, wet and dry, typifies to some extent the state of an Entomologist's mind at this interesting season of the year. Hope and foreboding, ardour and indifference, regret and resolve, alternately occupy his thoughts, according to the point of view from which he looks forward to the coming season, or reviews the results of his labours during the past. Hopefulness, however, is his prevailing mood, and, as surely as the sunshine of summer dispels wintry gloom, this perennial quality asserts its dominion over every dismal feeling. A few genial flashes of sunshine, the bright young green of the budding hedgerows, the gradual resurrection of insect life, have an irresistible influence—awakening the dormant enthusiasm of even those most addicted to slumber. As surely as the sap rises in the trees, causing them to put forth their leaves and blossoms, so the mystic mercury rises in the soul of the entomologist and forces him into activity. He watches with peculiar interest the developing spring, and longs for an opportunity to revisit some of his favourite haunts, to see what insects are out, and what new facts and phases he may be able to observe.

In consonance with this feeling, let us avail ourselves of the first suitable opportunity to go forth on an April expedition, in search of insects, and thus resume our "Entomological Rambles in the Midlands."

Nor need we wander far afield. Within ten miles of Birmingham there is ample scope for our entomological acumen, sharpened though it be to its keenest edge by surrounding conditions. Leaving the "big" localities—the "Forests" and the "Chases"—until the season is more advanced, we will pay a visit to less pretentious, though not less beautiful or interesting parts. Indeed, the district we propose to visit inspires considerable interest in both the Naturalist and the Archæologist, and, although now bereft of many of its ancient characteristics, bears sufficient traces of having once been—in fact, as it is by tradition—the "Forest of Arden."

The distance to be traversed would not be too much for good walkers, but it will save time, at least, if we take advantage of the facilities for reaching our ground afforded by the Great Western Railway. Leaving the train at Olton, we cannot help looking longingly at the Canal Reservoir, and thinking of the probability of some rare *Bembidia* and *Sten* being found upon its banks; of uncommon bees and moths swarming about the sallows, now in bloom, that margin it round; and of hosts of *Hydropori* and *Corixæ* living unknown and undisturbed in its watery expanse: but as it is "forbidden ground" we pass on, the only gratification derived from its contemplation being "pleasures of the imagination."

Proceeding past the new church and the college, we pass into a field-walk on the left which takes us in the direction of Solihull. On the oaks in the lane we have just left the Lepidopterists of our party found some interesting moths, including the handsome *Amphydastis prodromaria*, *Phigalia pilosaria*, *Hybernia leucophearia*, and *Larentia multistrigata*. That queer object which a keen-eyed member of the party has detected on an oak trunk is the female *P. pilosaria*: it is wingless and, like the male, mouthless, and looks like anything but a moth. At the margin of the wood skirted by the field-path we find, feeding on dandelion, *larvæ* of the Golden Swift moth, *Hepialus hectus*, which, in the perfect state, abounds here in June.

Upon reaching the road, we turn to the left towards Cut-throat Coppice, a startlingly horrible name truly, but the only thing at all unpleasant about the locality is its name. In the hollow, growing beside the brooklet, are some alders upon which we are lucky enough to find two *larvæ* of the large Emerald moth, *Geometra papilionaria*, and amongst the dead stalks of last year's plants a few *pupæ* of the very local and beautiful Royal Mantle moth, *Anticlea sinuata.* From the hawthorn hedges are beaten several *larvæ* of the curious little moth, *Cilix spinula.* A number of sallows are in bloom on the waste ground a little further on, about which various bees and other insects are flying and buzzing in lively style, and upon which, at night, most of the spring moths—including nearly all the *Tæniocampæ* (*T. gracilis* amongst the number) may be taken.

By beating the underwood in Cut-throat Coppice we start the somewhat rare moth, *Phorodesma bajularia*—the "Blotched Emerald"—so called from the colour of the wings, which are green with a conspicuous creamy and red blotch in each anal angle. On a lilac tree at the door of a cottage close by we find a freshly-emerged specimen of the delicately-coloured Lilac Beauty moth, *Pericallia syringaria*, and on the opening buds of birch growing outside the wood a number of *larvæ* of the very handsome *Tryphæna fimbria* are feeding, a good supply of which we duly secure. This *larva*, in its earlier stages, feeds, chiefly at night, on low growing plants—such as the primrose—but as soon as the tender shoots of the birch and sallow begin to unfold it ascends these trees and feeds upon the buds. It may frequently be found by day, although early evening is much the best time to search for it.

Sitting on a post, apparently asleep, in tint and outline very much like a small patch of lichen, and, moreover, closely simulating the colour of the wood, is a specimen of the charming little Long-horn beetle, *Pogonocherus hispidus.* This specimen is most unlikely to be the only one in the immediate neighbourhood, and the hint afforded by its presence is not to be neglected; hence, knowing the creature's predilections, we beat over an inverted umbrella some dry sticks placed in a hedge close by to stop a gap, with the result that three more *hispidus* and one *P. dentatus*, a closely allied but smaller species, are secured. In a piece of oak bark which we strip from a decaying tree are a colony of *Octotemnus glabriculus*, two species of Rhizophagus, *Homalium planum* and *H. florale*; whilst in a fungus growing outside near the base are two beetles that, except in habitat, widely differ from each other, their names being *Cis boleti* and *Mycetophagus quadripustulatus.*

By digging at the roots of a solitary oak, growing in the middle of a field opposite the coppice, we obtain three *pupæ* of *Amphydasis betularia*, commonly known by the undignified appellation of "Pepper Moth," and one *A. prodromaria.* From under moss-covered bark of poplar, two cocoons of *Acronycta megacephala* are brought to light, together with some half dozen specimens of *Erirhinus vorax*, one of the Rhynchophorous or snout-bearing beetles. Whilst removing these, we observe on the trunk of the tree, at its base, scores of the pretty yellow-legged weevil, *Apion fagi*, and capture two examples of *A. difforme*, both males, as indicated by the peculiar enlargement of the basal joint of the anterior tarsi. By shaking over our sheet of paper some of the moss loosened in our search after *pupæ* we obtain specimens of *Encephalus complicans*, *Megacronus* *analis*, *Syntomium æneum*, *Phlœobium clypeatum*, and of the minute and curious *Bythinus bulbifer.*

We now shape our course towards the pleasant township of Solihull, whence, after paying our respects to the grand old Church, (and perhaps also taking a little refreshment at the "George,") descending the hill on the right, past the Rectory, and passing through the wicket on the left, we make the best of our way to Blythe Bridge, the walk taking about twenty minutes. Arrived at the Bridge, we go the length of one field down the river (*sic*) Blythe, working our water nets as we advance. The water is low and clear, and, consequently, exactly suitable for our purpose. Three or four species of *Corixa* (an extensive genus of the order *Heteroptera*) are extremely abundant, as also are several kinds of water beetles. Of the latter the more interesting captures are *Brychius elevatus*, *Agabus didymus*, *A. nebulosus*, *A. maculatus*, *Elmis æneus*, *E. Volkmari*, and *Limnius tuberculatus.* In the weedy pond on our right, near the footbridge, we find the skeleton-like *Hydrometra stagnorum*, the vicious-looking water scorpion, *Nepa cinerea*, and, very abundantly, the typical *Notonecta*, as well as a fair sprinkling of the prettily maculated variety. Several of the larger water beetles also oc cur, amongst them being, of course, the giant *Dytiscus marginalis* and its inseparable companion and imitator, *Acilius sulcatus.* Our dredging operations bring to light a vast number and variety of *larvæ*—Stoneflies, (Caddis,) Mayflies, dragonflies, gnats, bugs, and beetles. By taking these home and carefully tending them, we may, in due time, be gratified by seeing a few, at least, assume their winged state, when we can either let them exercise their newly acquired powers in the free air, or immortalise them by making cabinet specimens of them. One other insect must be mentioned as having been fished up from the muddy bottom of this prolific pond, viz., the extremely curious and uncommon *Ranatra linearis.* On a willow, near the bridge, as we return, one of our party finds a newly-emerged Puss moth, *Dicranura vinula*, worth noting as an unusually early specimen. The eggs of this moth are very pretty, being hemispherical in form, red, with a yellowish centre; they are laid singly on the superior surface of willow and poplar leaves, and so closely resemble the tiny red galls, common on the foliage of those trees, as to be distinguishable only by a practised eye. May is the month in which to look for them, although they may sometimes be found as early as April and as late as June. During one very favourable season I recollect having *larvæ* of this species full fed and "spun up" in their cocoons as early as Midsummer-day—the usual time being August and September. The caterpillar is a very remarkable animal, and has attracted the notice of observers of all kinds. Readers of the amiable "Isaac Walton" will remember a characteristic description of it in his "Complete Angler." Under the flood refuse here (not "blood" refuse, as once printed by mistake) occur lots of interesting beetles—*Bembidium rufescens*, *Lesteva longælitrata*, and *Philonthus nigritulus*, being, perhaps, the best of the more conspicuous species. This, by the bye, is the only locality I know of in this district for the first-named beetle.

Ascending the brook—I beg pardon, the "river"—our attention is attracted by two interesting plants—*Geum rivale* and the columbine, *Aquilegia vulgaris*—the latter being particularly ornamental when in bloom, occurring as it does all along the Blythe, especially in the vicinity of woods. In one of the meadows here, feeding on sorrel, we find the yellowish, hairy *larvæ* of the Green Forester, *Procris statices*, the moth being abundant, some seasons, during the month of June. In the same field, on bird's-foot trefoil, *Lotus corniculatus*, are *larvæ* of the Six-spotted Burnet moth, *Zygæna filipendulæ*, resembling in some respects those of the "Forester."

On the young alders that margin the stream, *larvæ* of the Miller moth, *Acronycta leporina*, may be found freely in August and September. This is one of the queerest of caterpillars. It always rests in a more or less curved position, is pale green, clothed with long white silky hairs, which are parted along the dorsal line, like the hair of a lady's head, only that on one side it is brushed forward, and on the other backward, producing a very droll appearance—suggestive of the idea that the two sides had quarrelled, and had decided to go different ways

Both the coppices here—"Shelley" and "Sanderfield," would be worth working, but as they are strictly "preserved," we keep on the outside. But though forbidden to enter, we may surely venture to look over the fence, in doing which we are gladdened by the sight of a perfect carpet of Lily of the Valley, *Convallaria majalis*. Venturing to gather a few of the dead leaves lying just within an enclosed belt, near Sanderfield Coppice, we obtain therefrom the minute *Orthoperus atomus*, and several specimens of a shell that will be very acceptable to our conchological friends, viz., *Helix aculeata;* also, a few *H. pygmæa*, the smallest *Helix*, as we are told.

Near this spot may be found the caterpillars of a very pretty little geometer, which, later on, flits about the alders on warm evenings; it is known as the "Bordered Beauty," in science *Epione apiciaria*. Whilst searching for these we discover two more *larvæ* of our handsome friend the large Emerald, *G. papilionaria*—these are rather smaller than those taken earlier in the day, but still we shall hope to rear them into "first-rate specimens." A few "March Daggers," *Diurnea fagella*, are yet to be seen resting on the trees, but the younger members of the party pass them by with contempt, not only because the moth is so extremely common, but "because it is not in Newman." It may be as well to say now that by "sugaring" here in June legions of beautiful moths can be obtained, including such general favourites as *Thyatira batis*, *T. derasa*, *Tryphæna interjecta*, *T. janthina*, *T. fimbria*, *Aplecta herbida*, and others—"too numerous to mention."

Under bark, on a post forming part of a field fence, we capture a single specimen of the rather rare *Coryphium angusticolle*, a beetle of the Brachelytrous section, closely allied to *Homalium*.

The field we are now about to pass through, on our way to Four Ashes and Knowle, is extremely fertile in flowers and insects, and a whole afternoon might be profitably spent in it by both Botanist and Entomologist. We must now, however, push forward, or we shall not complete our walk before night overtakes the lingering day. Near the road at Four Ashes are a number of birches of unusual growth, bearing upon their branches enormous examples of the fibrous excrescence peculiar to this tree. On the surface of the ground beneath these, amongst the dead leaves, we obtain the cocoons of two of the "Prominents," *Notodonta dictæa* and *N. dictæoides*, both of which feed, in the larval stage, on birch. From a poplar tree close by we take some cocoons of the Puss moth, and one of the Kittens, *Dicranura bifida;* there are plenty of empty cocoons of the latter, and some one pertinently enquires how it is "that their outline cannot easily be detected until the moths have escaped?"

Turning into a sort of alley beside the White Lion Inn, we soon find ourselves in a field where, next to grasses, the prevailing plants seem to be yellow rattle, *Rhinanthus crista-galli*, and the earth-nut, *Bunium flexuosum.* I never found anything entomological on the former, but the latter is the food plant of the Chimney-sweep moth, *Tanagra chærophyllata*, great numbers of which may be taken now either by searching or sweeping; the latter being by far the quicker method. It is a linear, green larva, almost white on the back. It rolls in a ring, and simulates death when disturbed. In the middle of the next field stands a solitary oak tree, which I have never visited without finding upon it a moth of one kind or another. To-day there are two species on its trunk—the desirable *Amphydasis prodromaria* and *Anisopteryx æscularia.* Underneath its spreading branches hyacinths, *Scilla nutans*, grow very thickly, many white ones (the number increasing year by year) intermixed with the blue.

Crossing into the next meadow, we continue a very pleasant walk, but find nothing new, with the exception of one larva of the Ruby Tiger moth, *Arctia fuliginosa*, and a pair of Muslin moths, *Arctia mendica.* On the railway banks, which we have now reached, the common broom, *Sarothamnus scoparius*, grows luxuriantly, by beating which *larvæ* of two pretty moths are obtained, viz., *Chesias spartiata* and *Pseudoterpna cytisaria.* A month later would be better for collecting these, if we could be sure of finding them. As, however, we are not certain about finding them at a future time, we take now what suffices us, at the same time quoting as an excuse for bagging them so young the pithy couplet—

> "Who putteth off until the morrow,
> Soweth gold and reapeth sorrow."

Turning now into a small meadow resplendent with Lent lilies—

> "Daffodils that come before the swallow dares,"

we soon reach the locality for *Trachys troglodytes*, one of the most brilliant and rare of our native beetles of the "skip-jack" tribe. His wing cases are highly polished, bright green suffused with purplish and golden reflections, and he is, as you will confess, should we be fortunate enough to find a specimen, one of nature's gems. Ah! there is one sitting unsuspectingly on a leaf of devil's bit scabious, and positively gleaming in the sun's rays; but, wary to a degree, he has discerned our intrusive presence and disappeared amongst the thick turf. After a long search (in prosecuting which we discover some young plants of the Moonwort, *Botrychium lunaria*, just peeping through the soil) we capture our prize and place him, as becomes his rarity, in a small bottle by himself. With this red-letter capture I think we may fairly terminate this day's ramble, especially as we are so near to Knowle station, with a train due in less than ten minutes. We have, however, only got through about half our programme—the original intention having been to extend our explorations to Hampton-in-Arden and Coleshill—I fancy, however, that those places will be quite sufficient in themselves for another half-day's excursion, and so we contentedly resign ourselves to circumstances and the railway train, hoping soon to meet again and complete our little tour.

METEOROLOGY OF THE MIDLANDS.

THE WEATHER OF FEBRUARY, 1880.

BY W. JEROME HARRISON, F.G.S.

The long cold and dry period which began in October ended about the 4th of February; from this date to the end of the month showers fell almost daily, although no single fall was of very great amount. The total rainfall of February is somewhat above the average, and there were slight floods from the 16th to the 18th. Rather strong S.-W. winds prevailed, with a low and fluctuating barometer. Temperature was decidedly above the average; the first week was foggy, but there was on the whole a fair amount of sunshine. Storms of thunder and hail, but of no great intensity, occurred on the 8th, 20th, and 27th. Altogether the month may be characterised as mild, moist, and windy, leading us to hope for a bright and warm summer.

* * * As a regular reader of and contributor to the "Midland Naturalist," I should like to make two suggestions to those who contribute Natural History notes :—1st, It would add much to the interest of the notes if they referred to wild flowers only; because however interesting a garden may be to the owner, it does not interest those who only read of it; in addition to which the flowers in a garden, however roughly kept, are grown under much more favourable conditions than wild flowers. 2nd, the value of the notes would be increased if, in addition to the name and date of flowering, the situation, soil, and aspect of the place of growth were also given, and arranged in a tabular form.—OBSERVER.

STATION.	OBSERVER.	RAINFALL. Total for M. In.	Greatest fall in 24 hours. In.	Date.	No. of rainy d.	TEMPERATURE. Greatest ht. Deg	Date.	Great'st cold Deg	Date.
GLOUCESTERSHIRE.									
Cheltenham	R. Tyrer, Esq.	4·83	·95	18	23	54·0	19	26·0	1
Stroud	S. J. Coley, Esq	4·85	1·06	19	22	57·0	29	27·0	1 & 25
SHROPSHIRE.									
Haughton Hall, Shifnal	Rev. J. Brooke	2·12	·55	16	22	53·0	19	26·0	25
Woolstaston	Rev. E. D. Carr	2·.2	·44	16	23	53·0	4	30·0	9
Leaton Vicarage, Shr'wsbury	Rev. E. V. Pigott	2·25	·52	16	22	53·2	18 & 29	26·0	25
More Rectory, Bishop's Csatle	Rev. A. Male	3·41	·67	16	23	52·0	3	25·0	25
Bishop's Castle	E. Griffiths, Esq.	3·19	·58	16	23	52·0	19 & 29	27·0	25
Cardington	Rev. Wm. Elliott	2·02	·45	16	18				
Adderley Rectory	Rev. A. Corbett	2·45							
Stokesay	Rev. J. D. La Touche	2·74	·63	16	21	5[illegible]·8	18	26·1	9
HEREFORDSHIRE.									
Stoke Bliss	Rev. G. E. Alexander	3·38	·57	16	21	52·0	26 & 29	30·0	1 & 24
WORCESTERSHIRE.									
Orleton, Tenbury	T. H. Davis, Esq.	4·05	·71	16	22	55·5	4	26·7	25
West Malvern	A. H. Hartland, Esq.	4·19	·71	18	23	51·0	4 & 18	30·5	4 & 24
Pedmore	E. B. Marten, Esq.	3·24	·63	16	22	52·0	12, 18,28	26·0	24
Longlands, Stourbridge	J Jeffries, Esq	3·12	·65	16	20	53·0	28 & 29	27·0	24
Dennis, Stourbridge	Mr. C. Webb	2·96	·60	16	19	54·0	18	27·0	24
Evesham	T. J. Slatter, Esq	2·87	·66	16	21	55·7	19	26·2	1
STAFFORDSHIRE.									
Dudley	Mr. J. Fisher	2·50	·65	16	16				
Sedgley	Mr. C. Beale	2·27	·59	16	21	50·0	29	31·0	24
Kinver	Rev. W. H. Bolton	2·96	·66	16	21	53·0	29	27·0	24
Walsall	Mr. N. E. Best	2·78	·53	16	22				
Grammar School, Burton	C. U. Tripp, Esq.	2·07	·49	16	23	55·0	29	27·0	1
Weston-under-Lyziard R'tory	Hon.and Rev.J. Bridgeman	2·21	·61	16	26	54·0	19	26·0	23
Wrottesley	E. Simpson, Esq.	2·31	·65	16	21	52·5	20	28·5	13
Heath House, Cheadle	J. C. Philips, Esq	2·76	·61	16	21	52·0	18	30·0	5 & 13
Alstonfield Vicarage	Rev. W. H. Purchas	4·07	·76	16		49·0	29	21·0	1
Farley, near Cheadle	C L Wragge, Esq.	2·54	·60	17	20	51·6	19	29·5	22
Oakamoor	E. Kettle, Esq	2·75	·58	16	20	52·8	29	23·9	2
WARWICKSHIRE.									
Coundon, Coventry	Lieu.-Col. R. Caldicott	3·25	·73	16	21	53·0	19 & 29	29·0	1, 4, 5
Bickenhill Vicarage	J. Ward, Esq	3·36	·55	18	17	49·0		35·0	
St. Mary's College, Oscott	Rev. S. J Whitty	2·48	·51	16	23	54·4	20	30·9	25
Henley-in-Arden	T. H. G. Newton, Esq	3·49	·51	18	21	54·0	19 & 29	23·0	1
Rugby School	Rev. T. N. Hutchinson	2·75	·80	16	20	8[illegible]·0	28	29·0	25
Snitterfield, Stratf'd-on-Avon.	J. Goodacre, Esq.	2·74	·69	16	21	54·0	19	25·9	4
DERBYSHIRE.									
Stoney Middleton	Rev U. Smith	2·69	·82	15	13	50·0	1, 3, 29	25·0	7 & 8
Fernslope, Belper	J. G. Jackson, Esq	2·18	·55	16	19	52·0	19	28·0	9 & 12
Willesley Gardens, Cromford	J. Tissington, Esq	3·02	·76	16	12				
Spondon	J. T. Barber, Esq	2·05	·56	16	16	53·5	20	27·8	
Duffield	W. Bland, Esq	2·05	·45	16	22				
NOTTINGHAMSHIRE.									
Tuxford	J. N. Dufty, Esq.	1·80				52·0	29	29·0	4, 8, 11, (13
Hodsock Priory, Worksop	H. Mellish, Esq.	1·89	·73	16	20	55·7	20	27·0	11
Park Hill, Nottingham	H. F. Johnson, Esq	2·13	71	16	16	52·7	20 & 29	30·1	1
LEICESTERSHIRE.									
Loughborough	W. Berridge, Esq	2·28	·78	16	19	55·1	1	24·4	1
Ashby Magna	Rev. E. Willes	2·81	·87	16	21	61·0	18	27·0	23 & 25
Kibworth	T Macaulay, Esq	2·80	·74	16	20			25·0	11
Town Museum, Leicester	W. J. Harrison, Esq.	2·35	·88	16	18	56·8	18	25·9	1
Syston	J. Hames, jun., Esq	2·25	·76	16	25	50·0	19 & 29	27·0	1
Waltham-le-Wold	E. Ball, Esq.	1·80	·40	16	16	50·0	19	29·0	2
Coston Rectory, Melton	Rev. A. M. Rendell	1·81	·59	16	20	53·9	19	24·5	1
Dalby Hall	Mr. G. Jones	2·00	·70	16	18	52·0	19	26·0	25
NORTHAMPTONSHIRE.									
Towcester Brewery	J. Webb, Esq	2·61	·66	18	17				
Castle Ashby	R. G. Scriven, Esq.	2·28	·59	16 & 18	13	54·0	29	31·0	1
Kettering	J. Wallis, Esq.	2·89	·96	18	18	54·0	20	29·0	1 & 2
Althorpe	G. S. Groom, Esq	2·70	·96	18	16	53·0	19 & 29	24·0	1
Pitsford	C. A. Markham, Esq.	2·75	·87	18		58·0	17	16·0	
RUTLAND.									
West Deyne, Uppingham	Rev. G. H. Mullins	1·75	·61	16	20	52·8	19	30·7	5
Northfields, Stamford	W. Hayes, Esq	1·93	·70	18	13	49·0	7	28·0	7
Ventnor Hospital	W. T. Ryder, Esq	3·04	·63	18	11	52·8	26	32·4	4
Altarnun Vicarage	Rev. J. Power, M.A	6·29	1·05	16	20	59·0	20 & 21	24·0	25
Oxford	E. J. Stone, Esq	2·38	·60	16	22	54·9	20	25·0	1

NATURAL HISTORY NOTES BY OBSERVERS.—*Burton-on-Trent.*—1st, Rooks actively engaged at repairing old nests, (Newton Solney;) 19th, Black Currant lf.; 28th, Common Elder lf. The following flowered on dates given:—13th, Blue Azalea (Bretby;) 20th, Snowdrop; 25th, Red Mezereon; 29th, Yellow Primrose and Yellow Crocus; March 4th, very large flights of Plovers at Branstone; there were none to be seen in January. Their return, according to local tradition, shows winter to be "clean gone." *Altarnun.*—Snowdrops in bloom generally during first week; Yellow Primrose on 23rd, both very late for Cornwall. *Oakamoor, near Cheadle.*—Snowdrops out on 27th. *Stroud.*—6th, Catkins of Hazel, low and damp, loamy, south-west; 21st, Snowdrop, low and damp, loamy, south; 24th, Pistil of Hazel, low and damp, loamy, south-west; Ivy-leaved Veronica, Mouse-ear Chickweed, hillside, heavy and damp south-west; 26th, Primrose, hilltop, heavy loam, south-west; Dog's Mercury, hillside, heavy land, south-west; 28th, Coltsfoot, Ground Ivy, hillside, loamy, south-west. *Nottingham.*—Primrose first flowered 21st January, Snowdrops first flowered 14th February; Willow Catkins seen on February 20th. *Uppingham.*—*Turdus musicus* singing January 28th, *Alauda arvensis* began singing January 31st, *Fringilla cœlebs* singing February 1st, *Motacilla Yarrellii* first seen February 21st, *Coccothraustes chloris* singing on February 21st, *Galanthus nivalis* in flower February 18th, *Draba verna* in flower February 22nd, *Corylus avellana* in flower February 25th; Frogs—spring croaking commenced February 21st. *Farley, near Cheadle.*—4th, Honeysuckle bursting into leaf; 7th, *Turdus musicus* surely singing, heard for first time this year; 10th, pair of Gold-finches seen; signs now of activity among the feathered tribe; *Fringilla cœlebs* in song; 21st, *Turdus musicus*, *Turdus merula*, *Turdus viscivorus*, and *Sturnus vulgaris* becoming more abundant. *Shifnal.*—Snowdrops spring on 5th, Aconites on 10th, and full out on 25th; Rooks carry sticks on 21st. *More Rectory.*—The Common Thrush was in song throughout the whole of the month, and the Blackbird since the 20th, in the evening. *Waltham.*—Snowdrop open on 7th, in sheltered spots; Aconite on 13th, Primrose (coloured) 19th, in gardens. *Spondon.*—Crocus in bloom in warm situations in the last week; in exposed parts only just peeping above the ground.

Correspondence.

Leafing of the Oak and Ash.—Observers will oblige by communicating the exact dates of the first appearance of leaves on oaks and ash trees respectively.—Eds. M. N.

Plants in Flower.—Lesser Celandine, (*Ranunculus Ficaria,*) in flower at Bretby on 6th March; *Viola odorata*, in flower in a garden 13th March.—J. E. N., Burton-on-Trent.

Floral Notes for February.—*Ulex gallii* in flower February 8th; *Ranunculus Ficaria* in flower February 8th.—H. W. Trott, Wimborne, Dorset.

Plants in Flower.—I first observed the Daisy, February 21st; Dog's Mercury and Hazel, 22nd; Primrose, Snowdrop, and Sweet Violet, 26th.—A. Davis, jun., Great Marlow, Bucks.

Plants in Flower.—February 21st, Hellebore, *(Helleborus fetidus,)* Boxley Hills; Hazel, (*Corylus Avellana,*) Boxley Hills; Coltsfoot, *(Tussilago Farfara,)* Snodland Marsh. February 28th.—Lesser Celandine, *(Ranunculus Ficaria,)* Boxley; Chickweed, *(Stellaria media,)* Boxley Hills.—J. Thornhill, Maidstone.

Spring Flowers.—The following species were gathered February 29th, between Leicester and Charnwood Forest:—Sweet Violet (buds), Dog's Mercury (buds,) Little Celandine (buds,) Snowdrop, Daisy, Coltsfoot, Speedwell, Hazel. March 14th:—Primrose, and *Chrysosplenium alternifolium.*—G. Robson.

Natural History Notes.—*Viola odorata*, March 7th; *Ranunculus Ficaria*, March 13th; *Salix caprea*, (female,) March 13th; *Tussilago Farfara*, March 20th. I found a Thrush's nest, with three eggs in it, to-day, March 20th. The hedges (thorn) are beginning to show a bit of green, but the cold nights are keeping them back as yet.—H. F. Johnson, Nottingham.

Early Flowers.—February 25th I found Hazel, both male and female flowers, and on the 26th the Barren Strawberry *(Potentilla Fragariastrum,)* and the perennial Dog's Mercury; March 3rd, a Dandelion; March 8th, Lesser Celandine *(Ranunculus Ficaria)* and Coltsfoot; March 13th, Wood Anemone; March 15th, Willow; March 21st, Moschatel, (not quite out;) and March 24th, Wood Sorrel and Green Hellebore.—O. M. F., Frankton, Salop.

Another Boulder.—I noted, a few days since, a fine erratic block lying in a field between the villages of Ratby and Glenfield, and about four miles west of Leicester. It rests upon a thin stratum of drift containing quartzite pebbles, under which the red marls of the Keuper are seen in a brook-course close by. The boulder measures 3½ by 3 by 2 feet, and consequently weighs about 1½ tons. It is of Mountsorrel granite, somewhat rounded, and contains several dark patches or inclusions, some of which look much like the volcanic ashes of Charnwood Forest, caught up by the granite when it invaded the sedimentary rocks. Such "inclusions" are very common in the Mountsorrel rock; the majority of them, however, are found, when examined microscopically, to be only granite of a finer grain than the mass, the crystals being smaller. The boulder lies six miles S.S.W. of its original home, the hummock of igneous rock which forms Mountsorrel and Buddon Wood. It is only one mile due south of the syenite of Groby. Its height above sea level (by Aneroid) is about 270 feet.—W. J. H.

Botanical Notes from South Beds.—*Primula vulgaris.*—These flowers were cut off by the frosts at the end of January, and re-appeared at the end of February. *Mercurialis perennis.*—Many staminate plants showed their spikes of unopened flowers on February 29th, but no pistillate ones were observed. *Corylus Avellana.*—Blossoming freely on February 22nd. *Tussilago Farfara.*—Many plants in blossom on railway banks, with southern aspect, on March 3rd. *Lamium purpureum.*—First blossom noticed on March 10th, on a bank with a south-west aspect. *Viola odorata.*—Earliest observed blossoms in the open country on March 10th. *Salix caprea.*—In full blossom by March 13th. *Adoxa moschatellina.*—Foliage and inflorescence about three inches high, but flowers unopened March 13th. *Anemone nemorosa.*—In blossom in a sheltered wood March 13th. *Helleborus viridis.*—First foliage showed above ground on February 11th. *Ranunculus Ficaria*, *Caltha palustris*, and *Petasites vulgaris*, in full blossom March 13th, in a boggy meadow, under trees.—J. Saunders, Luton.

A Method of Testing the Definition of Object Glasses.—When the Rev. W. H. Dallinger visited Birmingham to lecture on his important researches into the minutest forms of life, he favoured me with some information on his methods of manipulating the very high powers he used in these researches. In the course of conversation, in reply to my enquiry whether or not he considered that the indications of a power so high as the 1-72nd could be relied on, he stated he could place as much reliance on it as on one of 1in. focus; and explained, he never used any power which he had not tested on an object, which he could verify with the naked eye. To do this, he takes any clearly defined object, such as a watch dial, and places it in the position which the mirror usually occupies. This he strongly illuminates; then, by using as a condenser the power in his possession next lower to that he wishes to test, an image is formed, at the level of the stage, of the selected object, but extremely minute. Upon this reduced image he brings to bear the object glass he is testing. This enlarges the image, and enables him to compare it in all its details with the test object, which is of a size he can measure with his naked eye. If the result is satisfactory, he can use the objective, thus tested on the known, with confidence upon the unknown. I applied this test most easily to several powers, of which the highest was a Ross 1-12th, with satisfactory results. A 1-5th of Swift's, very moderate in price, compared very favourably with some much more expensive powers. The object used was a piece of printed paper, cut round so as to lie flat on the face of the mirror.—Edmund Tonks.

Subterranean Fungi, &c.—A wish is expressed in the February number of the "Midland Naturalist" for information respecting the subterranean and light-avoiding Cryptogamic plants, occurring in the Midland District. Though I have not made the subject a special study, I may mention instances of the occurrence of such plants. *Rhizomorpha medullaris* exists creeping down to a great extent on the walls of a covered well, near my residence. I have also seen the same curious plant descending on the walls of a friend's wine cellar. This plant was fully described and figured many years since in the Linnean Transactions. A plant, possibly an Alga, but with crowded branches, only an inch or two long, and a line wide, compressed, of an orange colour, and more divided below, occurs dependent from the woodwork covering wells, and also from the roofs of vaults. *Racodium cellare*, or mouseskin byssus is, of course, a common find in our cellars; and I have had it sent to me from the cellar of one of our Universities, noted, however, for better productions. A friend tells me that he found immense masses of a similar plant, composed of a white or reddish thready structure, in a mine on the Great Orme's Head. The Dry-rot (*Merulius*) is, unfortunately, too well known. It has, to my knowledge, destroyed the wooden flooring beneath the pews of a large church, and also the staircase in a friend's mansion. Subterranean fungi also occur very frequently in coal mines. I noticed some timber that was phosphorescent owing to the presence of the *hymenium* of a fungus; and the same appearance occurs in hot weather at the decayed foot of posts, &c.—R. G., Stoke-upon-Trent.

Natural History Notes.—The winter has been felt very severely at Oscott, more so than for many years. The hard frosts have killed many of the evergreen shrubs in the plantations. The Arbutus, Laurestine, Portugal Laurel, and Bay, have nearly all succumbed to the severity of the season; and even the common Laurel, generally so very hardy, has suffered considerably. The spring, too, is unusually late, much later here than in the neighbourhood. The following are the observations recorded by the Oscott Natural History Society:—February 22nd.—Snowdrop, Daisy, and Chickweed in flower. 27th.—Redwings flocking together, starting northwards; Skylark, Chaffinch, and Song Thrush singing. 28th.—*Daphne Mezereon* in flower. 29th.—Coltsfoot and Hellebore in flower. March 2nd.—Ants working. 3rd.—Elder tree in leaf. 5th.—Several Ladybirds seen. 6th.—Crocus in flower, and House Flies seen. 7th.—Hawthorn in leaf in sheltered places. 10th.—Groundsel and Polyanthus in flower; Cockchafer and Wasp seen. 11th.—*Bertius aquifolia* and Yew in flower. 12th.—*Ranunculus Lenormandi*. 14th.—*Cerastium viscosum* and *Scleranthus annuus* in flower. 17th.—Horse Chestnut in leaf. 21st.—*Luzula campestris*, Dogtooth Violet, and Jonquil in flower. We have not recorded the Primrose in flower here as yet, nor has the Honey Bee been seen. There are no signs of *Veronica hederifolia*, though it is not unusual to see this plant in flower all the winter through. In Worcestershire, on the 9th inst., we found Primrose, Sweet Violet, Dog's Mercury, and *Veronica agrestis*. On February 1st, *Ranunculus acris* was found in flower at Stonor Park, Henley-upon-Thames. On February 13th, a fine specimen of the Clouded-yellow Butterfly, *Colias Edusa*, was caught at Oscott, in a room where, I suppose, it had been hibernating, brought into activity once again by the warm sun.—J. Caswell, Oscott.

Observations on the Flowering of Plants, from January 1st to March 15th, 1880, with the dates when observed last year :—

	1880.	1879.
Groundsel *(Senecio vulgaris)* in flower by	Jan. 1st.	Jan. 1st.
Primula vulgaris, *Viola odorata* and *tricolor*, in flower in the garden by	„ 1st.	
Veronica agrestis seen in flower..	„ 6th.	Mar. 3rd.
Chickweed *(Stellaria media)*	„ 7th.	Jan. 1st.
Shepherd's Purse *(Capsella bursa-pastoris)*	„ 7th.	Mar. 11th.
Whitlow Grass *(Draba verna)* in flower by	„ 8th.	„ 1st.
Winter Aconite *(Eranthis hyemalis)* first seen in flower in the garden	Feb. 13th.	Feb. 9th.
Daisy *(Bellis perennis)* in flower by	„ 13th.	Mar. 18th.
First Snowdrop expanded in the garden	„ 17th.	Feb. 8th.
Filbert *(Corylus sativa)* first seen in flower	„ 17th.	„ 8th.
Polyanthus *(Primula polyanthus)*	„ 19th.	
Hazel *(Corylus Avellana)* in flower by	„ 20th.	„ 16th.
Spurge Laurel *(Daphne Laureola)*	„ 21st.	Mar. 7th.
Winter Aconite in flower in plantations by	„ 21st.	Feb. 21st.
Yew Trees *(Taxus baccata)* in flower by..	„ 29th.	Mar. 8th.
Coltsfoot *(Tussilago Farfara)* first seen in flower ..	Mar. 1st.	„ 7th.
Crocus	„ 4th.	„ 5th.
Red Dead Nettle *(Lamium purpureum)* in flower by	„ 4th.	Feb. 21st.
Wych Elm *(Ulmus montana)*	„ 4th.	Mar. 19th.
Alder (*Alnus glutinosa*) in flower by	„ 5th.	„ 19th.
Celandine (*Ranunculus Ficaria*)	„ 5th.	„ 19th.
Violets (*Viola odorata*) *flore purpureo*	„ 8th.	„ 8th.
„ *Flore albo*		„ 19th.
Common Elm (*Ulmus campestris*) in flower by ..	„ 8th.	„ 19th.
Mercury (*Mercurialis perennis*) male flowers	„ 9th.	„ 28th.
Primrose (*Primula vulgaris*) in flower	„ 12th.	„ 15th.
Sallow (*Salix caprea*) in flower by	„ 12th.	„ 25th.
Mercurialis perennis, female flowers	„ 15th.	
Lungwort (*Pulmonaria officinalis*)	„ 15th.	April 8th.

R. R., Castle Ashby.

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—February 25th.—The annual conversazione was held in the Town Hall, and passed off with great success. The display of microscopes was, perhaps, the finest ever seen in this town, comprising over one hundred instruments, which were arranged systematically, according to the class of object shown in each. These occupied the floor of the hall, and were the main feature of the exhibition. The galleries were crowded by a splendid collection of specimens in every branch of Zoology, Botany, Geology, Art, and Archæology, which it would take far more space than is here available to enumerate. Nearly 700 persons attended the gathering, and, judging from the numerous expressions of approval and pleasure to be heard on every hand, we may safely add that they all thoroughly enjoyed themselves. General Meeting.—March 2nd.—Mr. A. W. Wills exhibited two diatoms, *Asterionella Bleakeleyii*, from Falmouth; and *A. formosa*, from Sutton Park.—Mr. J. E. Bagnall exhibited *Fissidens exilis*, a rare moss; and Antheridium of *Diplophyllum albicans*, both from Solihull.—Mr. W. P. Marshall read Dr. Marshall's paper, (printed on page 49, *et seq.*,) giving the results of Professor A. Weismann's researches into the habits and life-history of *Leptodora hyalina*. Illustrations were given of three stages in the development of the nauplius or larva, and some large diagrams of nearly allied forms, connecting it with the other Cladocera, were shown by Mr. Marshall.—Biological Section.—March 9th.—Mr. J. E. Bagnall exhibited and described, on behalf of the Rev. W. H. Painter, a fine collection of plants from Anglesea.—Mr. T. Bolton exhibited pro-embryo of *Chara fragilis*, grown from spores.—Mr. Levick exhibited, under the microscopes, the rotifer *Notommata Brachionus*, males and females, the latter making webs to which they attach themselves. He also exhibited *Anuræa curvicornis* and *Polyarthra platyptera*.—The first part of a valuable paper, by Mr. W. Phillips, F.L.S., of Shrewsbury, "On the Study of the Lichens," was read by Mr. J. E. Bagnall, and illustrated by a large number of typical specimens and drawings. The concluding portion of the paper, which is looked forward to with much interest, will be read on the 30th instant. A vote of thanks was passed to Mr. Phillips for his communication.—General Meeting.—March 16th.—Mr. W. G. Blatch exhibited *Pogonocherus hispidus*, one of the Longicorn beetles, found at Sare Hole, Moseley, on the 14th inst., which is remarkably early for its appearance.—Mr. T. Bolton exhibited Wenham's immersion illuminator.—Mr. J. Levick exhibited a curious Infusorian *Dinobryon sertularia*, and *Volvox globator*.—Mr. W. B. Grove, B.A., read a most interesting paper on "Some Phenomena of Ice," illustrated by drawings and by thin slabs of ice in the oxy-hydrogen microscope; the paper will be printed in a future number.

BIRMINGHAM AND MIDLAND INSTITUTE SCIENTIFIC SOCIETY.—February 14th.—The members made an excursion to the site of the New Lunatic Asylum, at Rubery, where, during the excavations for the foundations, the coal measures have been exposed. A seam of coal, nearly two feet thick, was examined by the party. February 26th.—Fifty-eight members and friends went to Aston Lower Grounds. Mr. W. R. Morris explained the Gramme Machines, and showed various experiments with the Electric Light. Mr. H. W. Jones, F.C.S., conducted the members through the Aquarium, describing the various forms of animal life in the tanks, &c. March 10th.—Mr. J. H. Baxter read a paper on "What can be done with a cheap Microscope," and exhibited a large collection of slides, which were well shown under microscopes not costing more than 10s. 6d. each. March 17th.—Mr. R. Waite gave a very interesting description of Stonehenge and Salisbury Plain.

BURTON-ON-TRENT NATURAL HISTORY AND ARCHÆOLOGICAL SOCIETY.—March 2nd, Mr. Robert Thornewill read a second paper on "The History of Burton Abbey." In his first paper, March 1878, Mr. Thornewill gave a sketch of the history of the abbey from its foundation by Wulfric Spot in 1004 to the death of Abbot Nicholas in 1197. The present was a *resumé* of the history of the abbey during the 13th and 14th centuries. William Melbourne, a monk of Reading, succeeded Nicholas in the abbacy; during his rule—on the 31st of March and the 1st of April, 1200—King John was a guest at the abbey. In this abbot's time occurred the first uncovering of the remains of Burton Church—probably the Saxon church partly replaced in 1114 by the Norman work at the west end by Abbot Nigel. Melbourne was also a great benefactor to the town. They were told he built the town "extending from the great bridge at Burton as far as the new bridge in the direction of Horninglow;" and he procured from King John a charter for the Thursday market and the fair now known as "Burton Winter Fair." Abbot

Melbourne died in the year 1214, and was succeeded by Roger Norman, who only ruled for two years. Nicholas Wallingford, prior of Burton, was the next abbot, and he died in 1222, after six years' rule. He was succeeded by Richard de Insula or Ely, who built the chapel of St. Edmund and endowed it. He procured from Henry III. a confirmation of the charter given by King John, and also a charter for a market and fair for Abbot's Bromley. Having been translated to the abbacy of St. Edmund's, Richard was succeeded in 1229 by Lawrence, a monk and cook at Burton, who presided over the abbey for thirty years, during which time some notable events occurred. On the 2nd of October, 1254, the town was destroyed by fire, and a little more than a month later the Trent overflowed its banks. and there was a "terrific flood." In July, 1255, there was a "fearful hailstorm," which was followed by a "marvellous tempest." Abbot Lawrence gave liberally to the monastery, and began to build the Lady Chapel of the grand old church. In his time there were thirty monks in the abbey. Lawrence died in 1260, and was succeeded by the prior of Burton, John de Stafford, a native of Stretton, and a great scholar. For the good of the souls of his father and mother he built a bridge at Egginton, which is called Monk's Bridge to this day. In his time the Lady Chapel was completed by Prior Michael. After being abbot twenty years, John de Stafford retired on account of old age and died in 1280, a few weeks after his retirement. He was succeeded by Prior Thomas Packington, who ruled twenty-six years. During his time there was a terrible famine, and to relieve the distress he employed the people to make Cat Street, now called Station Street. The building of the chancel or the upper church, or choir, was also began and completed. John Fisher, of Stapenhill, a monk of Burton, was next appointed, and in turn he was succeeded by William Bromley, who had formerly been cellarer of the monastery. During his time—in the year 1322—the battle of Burton Bridge was fought between the forces of the Earl of Lancaster, owner of Tutbury Castle, and Edward II. This event caused the monks so much suffering that the King, to compensate them, gave them the advowsons of Hanbury and Tatenhill, which had previously belonged to the Earl of Lancaster. On the death of Bromley in 1329 a dispute arose as to his successor, one party favouring the appointment of Roger de Bybington, a monk, of Burton, and another that of Robert Longdon, formerly of Burton, and then prior of Tutbury. The dispute was finally referred to the Bishop of Coventry and Lichfield, who chose Robert Longdon. He was twelve years abbot, and built the Chapel of the Confessors with its spiral columns and ornamental capitals. Longdon died in 1340, and was succeeded by Robert Birkhull, monk and cellarer of Burton, who died in 1348. John Ibstoke, monk and almoner of Burton, then ruled as abbot for eighteen years, and was succeeded by Thomas Southam, monk and chaplain to the late abbot, who retired on the 1st of November, 1400, after being in office thirty-three years.—Mr. Thornewill was heartily thanked for his paper. A number of excellent drawings of portions of the old abbey were exhibited.

NORTHAMPTONSHIRE NATURAL HISTORY SOCIETY. — February 17th. General Monthly Meeting. Mr. B. Thompson, F.C.S., read a paper on "Polarisation of Light," illustrated by various kinds of Polariscopes. March 4th.—Entomological Section. The President, Sir Herewald Wake, Bart., read a paper on "Wasps," in which he detailed his observations on the way in which larvæ are fed; and a plan for systematic work for the ensuing year was adopted.

NOTTINGHAM LITERARY AND PHILOSOPHICAL SOCIETY.—The following lectures have been delivered this season:—January 29th, G. H. Wallis, Esq., on "The Potter's Wheel;" February 5th, J. B. Hutchinson, Esq., on "The Present Agricultural Depression, and Its Probable Consequences;" February 12th, G. B. Kidd, Esq., LL.D., on "Philosophy in the Middle Ages—Schools and Schoolmen;" February 17th, Dean Stanley, on "The Relations of Theology, Science, and Literature;" February 26th, H. Y. Stanger, Esq., B.A., on "Utilitarianism;" March 4th, Rev. J. F. McCallan, M.A., on "Intermediate Education;" March 11th, H. C. Sorby, LL.D., F.R.S., on "The Structure and Origin of Limestones;" February 17th, J. J. Harris Teall, Esq., M.A., F.G.S., on "The Structure of Molecules."

MIDLAND UNION OF NATURAL HISTORY SOCIETIES.

NORTHAMPTON MEETING, JUNE, 1880.

BOTANICAL EXCURSION.

BY R. G. SCRIVEN,

A MEMBER OF THE NORTHAMPTON NATURAL HISTORY SOCIETY.

As the excursions from Northampton at the approaching meeting of the Midland Union will probably be over ground which is new to most of the members present, I have been invited by the Editors of this Journal to contribute a few notes to introduce to them the general features of interest which we propose to bring before them, and to assist them in making their choice as to which of the excursions they will join for the day. There will be two excursions on the second day of the meeting, one being principally Botanical and the other Geological in its object. The Geological excursion will, I understand, form the subject of a paper to be contributed by another of our members, and I shall, therefore, confine myself to describing the course proposed to be taken by the Botanical excursion. Starting from Northampton at nine A.M. in carriages provided for the day, the members will take the road leading down the Nene valley for about four miles, when they will cross the river at Billing Bridge, from which point on their right they will see Clifford Hill, a small Roman earthwork, probably thrown up to defend the passage of the river. The Nene valley, here, as along the whole of its course, is a wide alluvial flat of rich water meadows, subject to frequent flooding, and covered in spring time with masses of the Marsh marigold and the Cuckoo flower, (*Cardamine pratensis*,) while by the banks of the sluggish river grow the Iris and the Bulrush, and the long spikes of the Purple Loose-strife (*Lythrum salicaria*,) the "long purples" of Ophelia. From Billing Bridge the route will be by Cogenhoe, which stands on a steep hill on the right bank of the Nene, and by Whiston, where there is a small Perpendicular church of great beauty, which may be worth a flying visit, to Castle Ashby, the seat of the Marquis of Northampton. Some time will be spent here in viewing the mansion and grounds, which are well worthy of inspection. From Castle Ashby the party will proceed through Yardley Hastings to the Chase Park Farm, where luncheon will be provided, and the remainder of the available time will be spent in botanising in the adjoining woods. Yardley Chase is one of a series of ancient forests, extending along the southern border of the county of Northampton, on the high ground forming the watershed between the Nene and the Ouse, which runs through the neighbouring counties of Buckinghamshire and Bedfordshire. Salcy Forest is the next adjoining to it, beyond which is the old Royal Forest of Whittlebury. The soil is barren, being composed of the glacial drift which here overlies the oolite to the depth of a hundred feet, the limestones cropping out from under it in each of the adjoining valleys. It is a hard clay, filled with chalkstones. The soil is, however, admirably suited to the growth of oak timber, which, in consequence of its slow growth, is remarkably hard and durable, and oak trees of great size are met with throughout this tract of forest land, two of which, called Gog and Magog, stand close to the Chase Park Farm. Nor is the soil, though poor, destitute of botanical interest, nay, perhaps, from that very reason its flora may be more abundant. It is a well ascertained fact that a rich soil and high cultivation are unfavourable to a great variety in the flora, and I remember seeing a remarkable instance of this in Mr. Lawes' experimental plots at Rothamsted, where the unmanured plot bore a small crop containing a great number of different species, while in the highly manured portions, though the crop was increased ten-fold, the number of species had sunk to some half dozen. These woods contain most of the plants commonly met with in similar woodland districts, together with a few plants now strictly indigenous to the chalk formation such as *Chlora perfoliata*, which I have found in a few places; and in the adjoining fields *Linaria spuria* and *Elatine*, and *Lithospermum officinale* and *arvense*. One curious plant, which is not found except in similar situations, the herb Paris, *P. quadrifolia*, is tolerably abundant, while near it, in a part of the Chase which will be visited by the members of the excursion, is the only locality I know in this district for the common garlic, *Allium ursinum*. The Orchidaceæ are fairly represented, among the more common being the Butterfly orchis, *Habenaria bifolia*, *Orchis Morio*, *mascula*, and *maculata*, and *Listera ovata*. The common wild Hyacinth, *Agraphis nutans*, and the Wood Anemone cover large tracts of ground, as does also the common *Mercurialis perennis*. The wild Honeysuckle and the *Clematis vitalba* are abundant, though the latter is rather local. Of Ferns the number is very limited, comprising only the male fern, *Aspidium Filix-mas*, the Crested Fern, *A. cristatum*, the Lady Fern, *Asplenium Filix-fœmina*, the Hart's Tongue, the Common Polypody, and the Bracken. A great number of interesting plants are also found in the open ridings and grassy glades in the Chase, among the more prominent of which are the Eyebright *Euphrasia officinalis*, the pretty little Centaury *Erythræa centaurium*, *Polygala vulgaris* in three colours, the Woodsorrel *Oxalis Acetosella*, two or three varieties of *Hypericum*, *Carex*, and *Equisetum*. Of course, in the limited space allowed me it would be impossible to give anything like a complete list of the plants to be found in so large an area, and I have, therefore, only given a few of the more common, hoping in this way to give some indication as to the general character of the flora of the locality.

The excursionists will leave the Deer Park about four o'clock in the afternoon, and will proceed direct to Northampton by the road leading through Denton and Brafield. The Leopard's Bane, *Doronicum pardalianches*, grows in a hedge bank by the roadside, just outside the village of Denton, probably escaped from some garden.

It is most likely that this excursion will be chosen by many of the students of Entomology, and I should like, therefore, to have added a few notes for their benefit. I have been unable, however, to get any assistance in this matter, and my own knowledge is limited to a few of the more striking of the Lepidoptera.

The Purple Emperor is fairly abundant, and though the date of the excursion is too early for the mature insect, I have known several instances of its having been secured in the larval state about that time. The Purple Hairstreak is also pretty common, and the Marbled White is in some seasons abundant. Among the rarer varieties which may be met with at the time of the excursion, are the small Fritillary, *Melitœa selene*, and the Skipper, *Thymele alveolus*.

CURIOUS INSTANCES OF PARASITISM IN THE TOAD.

BY T. SPENCER COBBOLD, M.D., F.R.S., PRESIDENT OF THE QUEKETT MICROSCOPICAL SOCIETY.

Just forty years ago I remember, as a lad, to have been painfully struck with the distress of a toad, as shown by its outstretched fore limbs firmly planted in the soil, and by an otherwise peculiar attitude. The victim was in a plantation of my father's rectory grounds, Wortham, Suffolk. Noticing the constant outward and inward movement of several parasites which occupied the cavity of the nose, my chief thought was how I could best put the unfortunate batrachian out of its misery. I killed the toad; but the parasites were neither removed nor preserved. It was, in fact, my earliest observation in helminthology. From that time onward the circumstance continually recurred to me as one worthy of scientific notice; but as, until recently, I had received no confirmation of the correctness of the observation, the matter was allowed to pass. During my prolonged absence from town last autumn, a letter arrived from Dr. C. A. McMunn, of Clarence House, Waterloo Road, near Wolverhampton, describing something very similar. Writing on the 6th of August, 1879, Dr. McMunn records the following incident:—"As I was returning home from the country yesterday I noticed a toad slowly crawling across the road, and on taking it up I found two holes in the front of its head, evidently the nostrils, very much increased in size. They were filled with moving bodies. To-day the animal died. The two holes have coalesced into one, and the cavity formed by this coalescence is filled with the same parasites I saw yesterday. I enclose the toad, as I know you are interested in such matters."

For the reasons above particularised, it was not until the expiration of three months that I had opportunity to read Dr. McMunn's letter and to open the paper-box containing the toad. After explaining this by

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* Communicated to the meeting of the Entomological Club held at Dr. E. H. Vinen's house, Bayswater, on the 17th of March, 1880.

letter, my correspondent was kind enough to furnish me with some additional particulars. Writing at the close of the year, he observes:—"On examining the toad more carefully, I found each nostril filled with whitish small worm-like bodies, which would amount, I should say, to fifty or more in each nostril. They kept appearing at the outside of the nostrils, and then receding, these movements being probably due to the respiratory efforts of the toad. They also had a rolling motion, individually. After some hours the septum between the nostrils was quite eaten away, and a large hole appeared in the animal's head, the toad being then quite dead." Dr. McMunn did not observe any rings or hooks, but in a postscript he expresses the opinion that the parasites represented "the larvæ of some insect."

I must here mention that the envelope and box had arrived in a torn state. When I examined the contents of the box, there was nothing but the skeleton of the toad, the remains of numerous pupæ, from which the perfect insects had escaped, and the wool and notepaper in which the toad was packed. The surface of the writing paper was plainly marked with impressions of the smooth-skinned pupæ. These are distinctly ringed, and when magnified about 40 diameters show a large number of minute spines. From a sketch supplied by Dr. McMunn, the living larvæ would appear to have been fully a quarter of an inch in length. I found that one of the dried, shrivelled, and empty pupæ skins measured exactly one-fifth of an inch in length. The remains of a rather small beetle that had evidently gained access to the box were found lodged in the skeleton. This had certainly nothing to do with the parasitism, about which not a shadow of doubt could exist. In determining the species, I stood in need of the assistance of learned Entomologists; and it was this which induced me to submit the facts and specimens to the notice of the club.

Appendix.—During the discussion which followed the reading of this short paper, (in which discussion Messrs. Sheppard, Lowne, Dallas, Pascoe, and the Rev. G. Henslow took part,) Mr. Robert McLachlan, F.R.S., drew attention to recent notices in the "Zoological Record" for 1877-78, and he stated that not improbably the larvæ in question would be found to belong to the genus *Batrachomyia* of MacLeay. In the reports in question I find that reference is made by Mr. E. C. Rye to a note by Herr Boie, on the larvæ of a Dipteron attacking the soft parts of the mouths of toads in Bohemia. M. Girard also gives "instances of Batrachians attacked in a similar manner." Mr. Rye quotes also the opinion of MM. Colin de Plancy and E. Taton, that "the flies (*Batrachomyia*) attack only sores already existing." It appears that M. Moniez had previously referred some dipterous insects, possessing these habits, to the genus *Lucilia*, one species of which (*L. hominivorax*) proves, as everybody knows, so terrible to the convicts at Cayenne. The new fly, *L. bufonivora*, Mon., lays its eggs "in the eyes of frogs, and the larvæ eat into the living batrachian." Mons. Lelièvre refers it to *L. regalis* or *L. illustris*, Meig., but the opinion is disputed by

M. Girard. It is also stated that "larvæ of this species have been discovered in the head of a toad, near Maurenne;" and also, in another instance, near Paris. From these observations it appears that the instances of dipterous parasitism in the nasal chambers of toads, as recently witnessed by Dr. McMunn, and by myself some forty years back, are perfectly genuine.

NOTES ON MARINE INFUSORIA.

BY W. SAVILLE KENT, F.L.S., F.R.M.S., ETC.

(Continued from page 76.)

4.—*Zoothamnium alternans*, C. and L., (Plate IV., Fig. 5.)—This very beautiful type, identical with the *Zoothamnium plumosum* of Dr. Strethill Wright, the *Z. spirale* of P. H. Gosse, ("Tenby," Plate IV., Fig. b,) and, possibly, the *Zoothamnium niveum* of C. G. Ehrenberg, (in which case this last-named specific title must take precedence of the others,) was obtained in considerable abundance attached to *Sertulariæ* and other Hydroid Zoophytes brought up with the dredge, from various depths. Some of these colonies were remarkable for their size and luxuriance of growth, those obtained from deeper water, fifty fathoms, being most notable in this respect. Compared with the more familiar fresh-water species, *Zoothamnium arbuscula*, (sometimes found in sea-water,) *Z. alternans* may be immediately distinguished by the mode in which the secondary branches are disposed with relation to the main or axial stem of the compound colony. In the present instance, these secondary branches are given off alternately, sometimes from opposite sides, and sometimes in a spiral manner, producing, in this latter instance, an exceedingly elegant, tall, plumose colonial stock, or "Zoodendrium," which may be indefinitely prolonged. Not unfrequently, and more especially in examples obtained near the shore line, the height of the entire colony does not much exceed the breadth, and, the branches originating at regular intervals on opposite sides of the main stem, the zoodendrium, as a whole, presents a flabelliform or espalier-like contour. In *Zoothamnium arbuscula*, on the other hand, all the secondary branches diverge radially or close to one another from the apex or distal termination of the main, or axial stem, which latter, being once produced, does not increase in length.

5.—*Zoothamnium dichotomum*, St. W., (Plate IV., Fig. 6.)—One or two colonies of a type that, so far as it is possible to predicate, appears to be identical with the form very briefly described in "Pritchard's Infusoria" under the above title, were obtained from the lower depth of fifty fathoms. The zoodendrium, in this instance, is built up by the more or less regular dichotomous division of a somewhat slender primary, or axial stem, the ultimate divisions, or pedicles, which support the associated zooids being of considerable length. In no other species of

Zoothamnium, as yet described, does the supporting stem exhibit such a well-marked dichotomous plan of growth. The *Z. Cienkowskii*, of Wrzesniowski, and *Z. elegans* of De Udekim, present the nearest approach to the same, but in both of these there exists a considerable distinction in the proportionate length and thickness of the axial stem and supporting pedicles. In every instance, two or three larger reproductive zooids (Plate IV., Fig. 6*a*) were found attached towards the bases of the main branches, which were conspicuously distinct from the ordinary or alimentary zooids by their ovate instead of campanulate contour, and the coarse transverse striation of their cuticula. Dr. Strethill Wright's original comparison of the contour of the zooids of this species to that of the fruit of the Wild Rose *(Rosa canina)* would appear to apply only to these more conspicuous reproductive units.

6.—*Follicularia ampulla*, Mull. sp., (Plate IV., Figs. 7 to 9.)—Among the shell *débris* brought up from a depth of fifty fathoms, the valve of a *Pecten* was encountered, whose inner surface was thickly sprinkled with what appeared to the unassisted vision as mere dark-greenish specks. Examined with the microscope, it was found that each of these latter represented an animalcule of bottle-green colour, contained in a decumbent flask-shaped lorica, permeated with a fainter shade of the same tint, and corresponding with the type originally described by O. F. Muller in the year 1786, under the title of *Vorticella ampulla*. Although recognised by Lamarck in the year 1816 as the type of a new genus, upon which he conferred the title of *Follicularia*, it is only within a comparatively recent date that this same animalcule has been almost simultaneously rediscovered and renamed; Dr. Strethill Wright, on the one hand, and MM. Claperède and Lachmann on the other, encountering and conferring upon it the respective titles of *Lagotia* and *Freia*. The Genevan Naturalists possess, by an interval of two years, the prior claim, and their title of *Freia* is most generally adopted. There can be no doubt, however, that both these names must give place to the still older one that originated with Lamarck. To the titles of *Freia* and *Lagotia* alike several presumed distinct and well substantiated specific varieties have been relegated. Instances referable to the first-named category are afforded by the several types described by Dr. Strethill Wright under the respective names of *Lagotia viridis*, *L. hyalina*, *L. atropurpurea*, and *L. producta*, all of which, however, are shown by Stein in his Monograph of the Heterotricha to pass, by almost imperceptible gradations, into one another. Stein's decision in this connection has been amply borne out by an examination of the Falmouth examples, among which, on the same Pecten shell, both the simpler ovate and comparatively neckless, and the long annulated necked types were encountered, with every intermediate variation. Morphologically the animalcule of Follicularia may be compared to a Stentor, having its characteristic trumpet-shaped oral region produced into two lateral ear-like lobes, round which, as in the sub-circular disc of Stentor, the strong rhythmically vibratile adoral cilia are produced, and bring food material to the oral aperture, situated at the base of these two lobes. Although the representatives of the genus Follicularia are almost exclusively marine, I have for some time been familiar with a fresh-water type, discovered in the neighbourhood of Stourbridge, by Mr. Thomas Bolton, upon which I have conferred the title of *Follicularia (Freia) Boltonii.*

7.—*Hemiophrya (Podophrya) gemmipara*, Hertwig, (Plate IV., Figs. 10 and 11.)—This and the type next referred to belongs to that remarkable group of the infusoria known by the title of the Suctoria or Tentaculifera, typified by the genus *Acineta*, and distinguished by the possession of tubular tentacle-like appendages, each of which usually terminates in a sucker-like and slightly expanded disc. With these suctorial organs other animalcules are seized, and their protoplasmic contents sucked out and transferred to their own bodies. Many of these Acinetidæ during a considerable part of their existence lead an endoparasitic life within the body substance of larger Ciliate Infusoria, such as Vorticella and Paramecium, a circumstance which led Stein to infer that the Acinetidæ were not independent organisms, but developmental phases of their selected hosts. This hypothesis, however, is now entirely abandoned, and *Acineta* and its allies recognised as representing an entirely independent, extensive, and highly interesting Protozoic group. *Hemiophrya gemmipara* was first described by Dr. Hertwig in the year 1875, "Morphologisches Jahrbuch," Band I.,) as a species of *Podophrya*, and has been adopted as the type of an independent genus by myself, ("Manual of the Infusoria," now going to press,) with reference to the peculiar character of the tentacular appendages first pointed out by its discoverer, and frequently confirmed by my own personal observation. These appendages are, in fact, of two sorts, consisting partly of the ordinary tubular and suctorial organs, and partly of non-tubular ones, which are simply prehensile, thus resembling pseudopodia, and which, extending peripherally to a considerable distance, seize and bring food material within reach of the suckers. The specific name of *gemmipara* has been conferred by Hertwig on this type with relation to its conspicuous, gemmiparous mode of reproduction. Large bud-like processes, varying from one or two to as many as six or eight in number, are developed at the distal extremity of the body; within each of these a diverticulum of the branching endoplast or nucleus is produced, and the entire bud or buds are ultimately constricted off and set free in the form of free-swimming ciliated embryos. Examples of this interesting type were encountered in the polypidoms of *Bugula*, *Crisia*, and other Polyzoa obtained from various depths, and with the aid of osmic acid specimens were successfully mounted exhibiting the tentacles in a condition of full expansion, as also with the characteristic embryos attached.

8.—*Ophryodendron pedicellatum*, Hincks, (Plate IV., Figs. 12 to 14.)—This singular form, figured and described at length by the Rev. Thomas Hincks in the "Quarterly Journal of Microscopical Science" for January, 1873, and obtained by him at Ilfracombe, North Devon, was sparingly encountered, and on one occasion only, attached to a species of *Plumularia*, brought up with the deeper dredgings. In their normal condition the animalcules of this species are separable into zooids of two denominations. Both are seated on short pedicles, and possess, in the one instance, a simple vermiform contour, with a more attenuated distal termination, and in the other have a cup-shaped basal region or body-mass, from the centre of which is produced an attenuate highly extensile and retractile proboscidiform organ, the apex of the same supporting a fascicle of minute tentacle-like processes, which, when the proboscis is exerted, are maintained in a state of active motion. Among the examples obtained at Falmouth, proboscidiform zooids were alone encountered, and the illustration of the vermiform zooid here given is reproduced from Mr. Hincks's figures. In two other species of this remarkable genus, obtained and examined by myself in the Channel Islands, *O. sertulariæ*, St. W., and *O. multicapitatum*, S. K., both proboscidiform and vermiform zooids occurred in abundance, and are temporarily united in the same animalcule. The last-named type, *Ophryodendron multicapitatum*, n. sp., is especially noteworthy, inasmuch as a single zooid may possess as many as three or even four proboscidiform appendages.* Although the various species of *Ophryodendron* are usually assigned to the section of the Tentaculifera, the singular proboscis-like organs being presumed to represent a modification of the tentacula of the ordinary Acinetæ, the true significance and morphological position of these very remarkable beings has yet to be elucidated. So far as speculation is assisted by the facts of embryological development, the evidence is certainly in favour of their Acinete affinities, the internally produced embryos in the case of *Ophryodendron abietinum* being shown by Claperède and Lachmann to accord essentially with those of many normal representatives of the genera *Acineta* and *Podophrya*, and to exhibit in common with the same an Hypotrichous plan of ciliation.

SEEDS AND THEIR GERMINATION DYNAMICALLY CONSIDERED.

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

The normal life-history of a phanerogamous plant is the history of the development of a seed, through the phases of stem, leaf, and flower, returning finally to the seed again. The seed which terminates that epoch always differs from the seed which began it, since it must inevitably bear in its constitution some record of the active life of the plant. When in its turn it develops into active life again, the new life-history will be differentiated from the previous one by whatever of its own special experiences it left behind it in that minute storehouse of energy.

* A delineation of this remarkable species is added for the purpose of comparison. See Plate IV., Figs. 15 and 16.

If the species be an advancing one, the record written in the seed will show some infinitesimal step forward in that advance, or if the species be dying out it will bear some trace of retrogression.

A ripe seed is, to all appearance, as quiescent and lifeless as a stone. This appearance, however, does not represent the truth. It is plain that some continuous action goes on in the substance of the seed, and that this action exhausts itself in process of time, for if the seed be kept dry beyond a certain period it perishes.

Much has been written upon the chemical and morphological changes which take place during the germination of seed and the growth of the plant, but very little upon the relation of these changes to the physical or vital energy which is the cause of them. What is the dynamical meaning of "growth?" Of the differentiation of leaf from stem, of flower from leaf, of seed from flower? When is a seed properly "ripe?" and what is its molecular condition when germination begins? We can follow the transformations of energy in the inorganic world from chemical affinity into heat, from heat into mechanical work, from work into light or electricity, and from these into heat once more; can we not trace a similar dynamical cycle in the changes of the living plant?

Theoretically a body in motion might, under certain conditions, continue to move in a straight line with uniform velocity for ever. Practically, however, this does not happen. All moving bodies encounter resistance, and all velocities are perpetually changing. The result is that all motions assume the character of the wave; that is to say, they have two points of minimum velocity or intensity, and an intermediate point at which the velocity or intensity is at its maximum. There are two principal forms of wave-motion, the undulatory and the concentric. A living organism is the expression of a more or less complex concentric wave of motion.

In the dry, ripe seed, which lies for months or years without visible motion, without sensible change of weight or temperature, the energy which constitutes its life probably exists as atomic motion only, and is concealed from our human senses because the movements of atoms within the limits of their respective molecules do not affect the ether in any way of which we are able to take cognisance. The seed is ripe when this atomic motion has reached its maximum, and from that moment it begins to be reconverted into molecular motion, and dissipated by radiation.

This conversion may be very slow, but it must terminate within a definite time; and, if the whole atomic energy is converted and dissipated before the necessary conditions of germination are provided, the seed perishes, and its molecules having lost the amount of energy required for independent existence as an organic unit, are taken up by surrounding attractions and dispersed. But if, on the contrary, a supply of energy is furnished to the seed externally before the exhaustion of its internal store; if heat is communicated to it, and such material as it can chemically assimilate—which in its earliest stages is mostly water—then begins the process of germination or vegetable growth, which consists of a constant aggregation of matter and concentration of energy. From this point of view it would seem that germination must be most vigorous, if the necessary conditions are supplied soon after the seed becomes truly ripe, which, in a general way, accords with actual experience, although the moment of true ripeness cannot be accurately ascertained.

The aggregation of matter brings under the concentric influence of the organic wave a stream of molecules having diverse characters and capacities, which combine in the most complex manner, but always with a tendency to sort themselves according to certain definite affinities, rhythmic as well as chemical. The original wave generated by the conversion of the atomic energy in the seed is simple, and its field of action small; but, as growth proceeds, the original wave, still maintaining its primary influence, becomes complicated with secondary waves, and these with others, in receding ranks. Every branch of the main stem expresses the divergence of a subsidiary wave, as does also every twig, and every leaf, and every hair, while all are controlled by the general direction and character of the primary.

In every wave of every rank the same process is carried on, the aggregation of matter, the concentration of energy, and the sorting of molecules according to their rhythmic affinities. The process only terminates when the maximum concentration of molecular energy is reached in the blossom. After this comes the inevitable re-action. Growth ceases, heat is radiated instead of being employed, energy is dissipated, and the plant dies, either entirely when that organic wave is broken up altogether, or partially when it passes into a season of rest or leaves behind it seeds in which some of the molecular motion instead of being communicated to the ether has passed into atomic motion and so become insensible.

The production of seed is not an essential part of the life-history of any individual plant, nor is it of any benefit to the individual. The climax of the organic wave is reached in the blossom not in the seed, which is the anti-climax; and if the blossom should be unfruitful either from failure of fertilisation or from being double, so that no reproductive organs are produced, the life of that individual plant is in no way less perfect or complete. It is to the species that the seed is valuable. If a plant leaves seeds behind it a specific wave is generated which has most of the characters of the individual wave on an extended scale. The succession of generations is to the species what the succession of annual seasons is to the perennial plant. The vital energy of an individual perennial plant increases from year to year up to a certain limit. That limit may be contracted or enlarged by adverse or propitious seasons to some extent but not very far. On the average a tree of any particular species will live a certain number of years and no longer. It reaches at last a year of maximum energy, and from that point it declines. Its vigour wanes, the dissipation of energy is more rapid than the supply, and death ensues. So with the species. Each generation adds something to the energy of the specific wave until a maximum is reached, re-action sets in, and ultimate extinction follows. In like manner the generic wave includes within its larger grasp a number of specific waves, and is itself included in one of the great ordinal waves, these being but phases of that vast concentrating impulse which originated organic life, and is carrying it forward through ages of progress to a climax yet far distant.

THE CHANGES OF CLIMATE DURING GEOLOGICAL PERIODS.

BY THE REV. J. WILSON COOMBS, B.A.

(Continued from page 80.)

At present, the distance of the earth from the sun during winter, when nearest to the sun, is nearly 90,000,000 miles. But when the eccentricity is at its superior limit, the distance is 98½ million miles. Now, the northern hemisphere is nearest the sun in winter. This makes the winter both milder and shorter than it would otherwise be. But about every 10,500 years this state of things is reversed. If, according to the precession of the equinoxes, winter in our northern hemisphere should happen when the earth is in the aphelion of its orbit, at the time when the orbit is at its greatest eccentricity, it would be 8½ million miles further from the sun than it is at present, and the winter would be thirty-six days longer than the summer. Then, as the quantity of heat received from the sun is in inverse proportion to the square of its distance, the heat of the sun would be one-fifth less during the winter season, and one-fifth more during the summer. But, if winter should, at this time of extreme eccentricity, happen when the earth is in the perihelion of its orbit, the earth would then be more than 14,000,000 miles nearer the sun in winter than in summer. In this case, while the one hemisphere would be enduring the greatest extremes of summer heat and winter cold, the other would be enjoying a perpetual summer. The eccentricity is at present diminishing, and will continue to do so during about 24,000 years. It has been small for the last 60,000 years, and no considerable change of climate has occurred during that time.

There was a period of high eccentricity of 200,000 years, commencing about 2½ million years ago, to which, probably, the glacial epoch of the Eocene age may be referred. A second period in which the eccentricity was very high (still higher than the preceding) may be taken as commencing 850,000 years ago. It extended over a period of nearly 300,000 years, and to it may be referred the glacial epoch of the Miocene age. A third period began about 240,000 years ago, and extended over 160,000 years, *i.e.* to about 80,000 years ago. To this may be referred the last glacial epoch—the time of the till and boulder clays. At the time of greatest eccentricity during the first (Eocene) epoch, the excess of winter over summer was 33·6 days, the mid-winter intensity of the sun's heat (1,000) = 841. The number of degrees by which the midwinter temperature was lowered = 44·3. Midwinter temperature of Great Britain — 5·3. In the second (Miocene), these figures were 34·7; 837; 45·3; — 6·3; and in the third (Glacial), 26·7; 864; 37·7; and 1·3 respectively. It must be borne in mind that change of climate is not caused by difference in the mean annual amount of heat received from the sun, but by the increase or decrease in the difference between summer and winter temperature. Astronomically, the summers at those periods were as much warmer than they are at present, as the winters were then colder than now. Physically, however, they were in reality much colder, notwithstanding the great increase in the intensity of the sun's heat resulting from the diminished distance of the sun. In the circumstances under consideration the winters would not only be much colder than now, but they would be considerably longer. The moisture of the air would be all precipitated in the form of snow, and the presence of so much snow would lower the summer temperature, and prevent, to a large extent, the melting of the ice. This lowering of the summer temperature by a great accumulation of snow and ice would be produced—first, by means of direct radiation; second, by the reflection by the snow of the rays of the sun; third, by chilling the air and condensing the vapour into thick fogs. It will readily be seen, therefore, that the greater heat of a comparatively short summer will by no means compensate for the greater cold of the longer winter. Cover India with an ice sheet, and its summers would be colder than those of England.

But there is another agency brought into operation by the foregoing condition of things, far more powerful than those hitherto noticed, viz., the deflection of ocean currents. It has, I think, been proved that the winds are the impelling cause of currents, and that the direction of the current depends on the direction of the prevailing winds of the globe, and on the conformation of land and sea. The ocean alone can convey the equatorial heat to distant shores, and the heat thus conveyed is distributed over the land by aërial currents. Trade winds owe their existence to the great difference between the temperature of the equator and the poles. This difference is now greatest between the South Pole and the Equator. Therefore, the south-eastern trades are stronger than the north-eastern. But if the northern hemisphere were the cold one, as was the case at the period of the glacial epoch, the north-east trade winds on it would far exceed in strength the south-east trade winds of the southern hemisphere. The effect of this would undoubtedly be that the great equatorial currents would be shifted southwards.

The shifting of the equatorial current of the Atlantic only a few degrees to the south of its present position would turn the entire current away from the Gulf of Mexico into the Southern Ocean, and the Gulf Stream would consequently be stopped. This, combined with other causes, would place Europe under glacial conditions. The Gulf Stream (I quote from Mr. Croll) heats our island indirectly, by heating the winds which blow over it to our shores. They are heated in two ways—

first, by radiation from the water; and, second, by contact with the water. The south-west winds, to which we owe our heat, derive their temperature from the south-east portion, which flows away in the direction of the Azores. The north-east portion of the stream, which flows past our shores up into the Arctic seas, protects us from the ice of Greenland by warming the north-west winds which come to us thence. The strong under-current of air from the north implies an equally strong upper-current to the north. This would carry northwards the aqueous vapour formed at the Equator, which would be deposited in the form of snow, an enormous quantity of which would fall in the northern regions.

These various agencies re-act on one another, and so as to strengthen each other. The accumulation of snow and ice tends to cool the air, and produce fogs. This diminishes the melting power of the sun, and increases the accumulation, the rate of which continually increases. As the snow and ice accumulate on the one hemisphere, they diminish on the other. This tends to increase the strength of the trade winds on the cold hemisphere, and to weaken those on the other. The effect of this is to impel the warm wind of the tropics more to the warm hemisphere than to the cold. As the snow and ice accumulate, the ocean currents decrease; and, on the other hand, as the ocean currents diminish, snow and ice accumulate, the two effects mutually strengthening each other. As the eccentricity increases century by century, the temperate regions become more and more covered with snow and ice, and this state of things goes on increasing until the solstice point arrives at the aphelion. Then, a contrary process commences, which continues for ten or twelve thousand years, until the winter solstice reaches the perihelion. The transference of the ice from one hemisphere to the other continues as long as the eccentricity remains at a high value.

To meet a possible objection, it may be stated that this theory not only comports with the fact that the mean temperature of the whole earth is somewhat greater when it is in aphelion than in perihelion, but requires it. It is greater, because then the sun is over the hemisphere which is comparatively free from ice, while in perihelion it is over the hemisphere nearly covered with snow and ice, and the heat is spent in melting these.

The argument, then, is this: There is ample evidence to prove changes in the earth's relation to the sun, which, to some extent directly, by increasing or decreasing the summer and winter temperature, and to a much larger extent indirectly, by altering the direction of the winds and currents, would effect, at longer or shorter intervals, alterations of climate, inducing, in succession, periods of great cold and of great heat in the two hemispheres alternately. Corresponding with these changes of eccentricity, there is very ample evidence of the existence of a glacial age in the northern hemisphere, and of a temperate or subtropical age in the southern, while there is scantier, but still sufficient evidence of interglacial periods—alternating with temperate and tropical ones—the dates of which, as far as these can be estimated, are in accord with the known dates of these astronomical changes.

SUMMER BIRDS OF PASSAGE.

The following list of migratory birds noticed by me in this neighbourhood is sent for publication, in the hope that it may induce other observers to communicate similar lists. My observations have extended over the last eight years. The dates given are the earliest and latest the birds have been seen by me during that time:—

	Appears.	Last seen.
Chiffchaff (*Phyllopneusta loquax*)	March 18	September 21
Yellow Wagtail (*Motacilla Rayi*)	March 28	September 23
Wryneck (*Yunx torquilla*)	March 20	June
Sand Martin (*Hirundo riparia*)	March 30	November 22
Tree Pipit (*Anthus arboreus*)	April 3	
Martin (*Hirundo urbica*)	April 5	October 19
Willow Wren (*Phyllopneusta trochilus*)	April 9	September 15
Whinchat (*Saxicola rubetra*)	April 10	December 28
Cuckoo (*Cuculus canorus*)	April 15	August 30
Wood Wren (*Phyllopneusta sibilatrix*)	April 15	September 6
Swallow (*Hirundo rustica*)	April 19	November 24
Wheatear (*Saxicola œnanthe*)	April 18	October 20
Blackcap (*Sylvia atricapilla*)	April 20	
Whitethroat (*Sylvia cinerea*)	April 21	September 6
Lesser Whitethroat (*Sylvia garrula*)	April 21	
Grasshopper Warbler (*Salicaria locustella*)	April 22	
Landrail (*Crex pratensis*)	April 25	November 4
Redstart (*Sylvia phœnicurus*)	April 29	September 6
Sedge Warbler (*Salicaria phragmitis*)	May 5	September 2
Swift (*Cypselus murarius*)	May 12	September 25
Common Flycatcher (*Muscicapa grisola*)	May 20	July 21
Turtle Dove (*Columba Turtur*)	May 22	September 6

In addition to the birds mentioned above, I have noticed a few specimens of the Nightingale, (*Philomela luscinia*,) Reed Warbler, (*Salicaria arundinacea*,) Stonechat, (*Saxicola rubicola*,) Red-backed Shrike, or Butcher Bird, (*Lanius collurio*,) Goat Sucker or Fern Owl, (*Caprimulgus europæus*) and the Common Sandpiper, (*Tringoides hypoleucos*,) but I think these birds had arrived some weeks before the time when I observed them.

John Hazard, Nottingham.

METEOROLOGY OF THE MIDLANDS.

THE WEATHER OF MARCH, 1880.

BY W. JEROME HARRISON, F.G.S.

At the commencement of the month we had three or four rainy days, with south-westerly gales, and a low barometer. The wind then shifted to the north-east, and, with the exception of a slight fall on the 9th, there was no more rain until the last day of the month, (31st.) This long period of dry weather was accompanied by much sunshine, the fogs which prevailed in the early morning being soon dissipated, and altogether nothing could be more favourable for agricultural operations generally. The cold easterly winds and frosty nights somewhat retarded the progress of vegetation, and, on the whole, the season cannot be described as an early one, although it compares favourably with the spring of 1879. Thunderstorms are reported from Spondon on the 3rd, and Northampton on the 9th; solar halo at Oxford on the 29th; and aurora at Waltham on the 11th.

STATION.	OBSERVER.	RAINFALL. Total for M. In.	Greatest fall in 24 hours. In.	Greatest fall in 24 hours. Date.	No. of rainy d.	TEMPERATURE. Greatest ht. Deg	Greatest ht. Date.	Great'st cold Deg	Great'st cold Date.
GLOUCESTERSHIRE.									
Cheltenham	R. Tyrer, Esq.	1·20	·48	31	6	62·2	25	23·3	2[illegible]
Stroud	S. J Coley, Esq.	1·05	·70	3	8	59·0	31	26·0	25
SHROPSHIRE.									
Haughton Hall, Shifnal	Rev. J. Brooke	1·11	·32	2	10	58·0	5	26·0	20 & 29
Woolstaston	Rev. E. D. Carr	1·53	·73	2	13	61·0	29 & 30	25·0	21
Leaton Vicarage, Shr'wsbury	Rev. E. V. Pigott	·88	·39	2	9	6[illegible]·6	29	23·4	20
More Rectory, Bishop's Castle	Rev. A. Male	1·78	·65	2	12	59·0	30	24·0	19 20, 24
Larden Hall	Miss F. R. Boughton	1·56	·60	2	10				
Adderley Rectory	Rev. A. Corbett	1·40	·37	1	11				
HEREFORDSHIRE.									
Stoke Bliss	Rev. G. E. Alexander	1·34	·65	31	8	59·0	25	29·0	19
WORCESTERSHIRE.									
Orleton, Tenbury	T. H. Davis, Esq	1·52	·60	31	9	64·5	29	25·8	29
West Malvern	A. H. Hartland, Esq.	1·03	·45	3	8	62·0	25	28·0	23
Pedmore	E. B. Marten, Esq.	1·31	·67	31	7	63·0	25 & 30	24·0	23 & 28
Longlands, Stourbridge	J Jeffries, Esq	1·21	·68	31	5	59·0	5, 25, 30	27·0	28
Dennis, Stourbridge	Mr. C Webb	1·12	·58	31	7	63·0	29	26·5	28
Evesham	T. J Slatter, Esq	1·22	·41	31	9	60·0	5 & 25	27·0	24
STAFFORDSHIRE.									
Dudley	Mr. J. Fisher	·95	·55	31	3	58·0	30	30·0	19 & 26
Kinver	Rev. W. H. Bolton	1·27	·63	31	6	58·0	5 & 30	26·0	28
Walsall	Mr N. E. Best	1·19	·54	31	5	59·0	5 & 7	27·0	23
Grammar School, Burton	C. U Tripp, Esq.	1·25	·53	31	8	66·0	29	27·[illegible]	20 & 29
Weston-under-Lyziard R'tory	Hon. and Rev. J Bridgeman	1·22	·33	1	8	59·0	30	2[illegible]·0	24
Wrottesley	E. Simpson, Esq.	·81	·33	31	4	59·8	30	26·0	20
Heath House, Cheadle	J. C. Philips, Esq.	2·27	·96	31	8	5[illegible]·0	29	24·0	20
Alstonfield Vicarage	Rev. W. H. Purchas	2·62	·99	31	7	61·2	29	20·0	20
Farley, near Cheadle	C L Wragge Esq.	2·2[illegible]	1·01	31	8	58·0	29	27·0	20
Oakamoor	E. Kettle, Esq.	2·49	1·06	31	7	59·6	29	23·0	20
WARWICKSHIRE.									
Coventry	J. Gulson, Esq.	1·68	·83	31	6	59·0	30	25·0	20 & 29
Coundon, Coventry	Lieu.-Col. R. Caldicott	1·72	·92	31	6	[illegible]9·0	5	28·0	19
Bickenhill Vicarage	J. Ward, Esq.	1·60	·90	3	5	5[illegible]·0		27·0	
St. Mary's College, Oscott	Rev. S. J Whitty	1·02	·60	31	6	62·1	29	26·[illegible]	20
Henley-in-Arden	T H. G Newton, Esq.	1·70	·62	31	6	65·0	25	25·0	29
Rugby School	Rev. T. N. Hutchinson	1·6[illegible]	·79	30	6	65·2	29	24·0	20
Snitterfield, Stratf'd-on-Avon.	J. Goodacre, Esq.	1·44	·50	31	6	60·2	25	23·9	22 & 28
DERBYSHIRE.									
Stoney Middleton	Rev. U. Smith	3·07	1·25	1	8	58·0	2[illegible] & 29	28·0	24
Fernslope, Belper	J. G. Jackson, Esq.	2·67	·90	31	8	58·0	29	29·0	20 & 24
Linacre Reservoir	C. E. Jones, Esq.	1·88	·8[illegible]	2	8				
Spondon	J. T. Barber, Esq.	2·02	·69	31	7	56·8	25	28·5	
Duffield	W. Bland, Esq.	2·26	1·11	2	9				
NOTTINGHAMSHIRE.									
Hodsock Priory, Worksop	H Mellish, Esq.	2·[illegible]2	·73	2	9	59·9	5	28·8	19 & 21
Park Hill, Nottingham	H. F. Johnson, Esq.	2·25	·85	2	5	58·0	29		
LEICESTERSHIRE.									
Loughborough	W. Berridge, Esq.	1·79	·88	31	6	62·0	29	26·0	20
Ashby Magna	Rev. E. Willes	1·50	·69	31	6	69·0	29	23·0	24
Kibworth	T Macaulay, Esq.	1·90	·83	31	8			29·0	19 & 23
Belmont Villas, Leicester	H. Billson, Esq.	1·47	·66	30	5	60·8	30	26·0	20
Town Museum, Leicester	W. J. Harrison, Esq.	1·42	·64	31	7	61·2	29	21·8	20
Syston	J. Heames, jun., Esq	1·42	·68	31	6	65·0	26	29·0	29
Walthsm-le-Wold	E. Ball, Esq.	1·82	·75	31	6	56·0	5	25·0	19
Coston Rectory, Melton	Rev. A. M. Rendell	1·57	·66	31	7	59·5	29	25·8	29
Dalby Hall	Mr G. Jones	1·41	·79	31	5	66·0	29	24·0	24
Market Harborough	S. W. Cox. Esq.	1·83	·81	31	6	60·0	29 & 30	24·0	24
NORTHAMPTONSHIRE.									
Towcester Brewery	J. Webb, Esq.	1·69	·48	3	6				
Castle Ashby	R. G. Scriven, Esq.	1·44	·37	31	6	58·0	25	29·0	11
Kettering	J. Wallis, Esq.	1·47	·62	31	9	59·0	7	30·0	21 & 24
Althorpe	G. S. Groom, Esq.	1·22	·42	31	5	57·0	5	25·0	28
Pitsford	C A Markham, Esq.	1·38	·41	31	9	66·0	25 & 29	17·0	5
RUTLAND.									
Northfields, Stamford	W. T. Ryder, Esq.	·85	·29	31	4	60·0	6	27·0	[illegible]0
Altarnun Vicarage	Rev. J. Power, M.A.	2·[illegible]0	·80	3	13	65·0	31	23·0	23 & 24
Oxford	E. J. Stone, Esq.	1·4[illegible]	·50	2	5	62·2	25	26·9	19

Natural History Notes by Observers.—*Cheltenham.*—March 6th, *Viola canina* in flower; 8th, frogspawn deposited; 9th, Apricot in bloom, (wall S.W.;) 10th, Peach blossom and Nectarine ditto; 13th, *Bombus terrestris* flying; 14th, Gooseberry in fair leaf; 17th; Currant ditto; 18th, Walnut budding, Robins pairing; 19th, Bats (large and small) flying seven p.m., (calm and cloudless;) 21st, *Apis mellifica* on flowers, *Salix* (palm willow) in full flower; 28th, *Vanessa urticæ* on Peach blossom; 29th, *Pieris rapæ* or *napi* flying. *Shifnal.*—Gooseberry buds burst on 3rd; Willows blossom on 23rd; Lesser Celandine flowers, Hawthorn bursts, and Coltsfoot flowers on 28th; yellow-tipped humble bee out 8th; Stock Dove heard on 14th; Chiffchaff on 26th; and first white Butterfly on 30th. *More Rectory.*—Blackbird, Thrush, Skylark, and Hedge Sparrow have been in full song throughout month. *Coventry.*—Chiffchaff and Wryneck heard on 14th. This is at least a week or ten days before their usual time of arrival. *Burton-on-Trent.*—White Hawthorn lf. on 19th; 27th, Swallows reported at Bretby; 28th, Wasp in open air; *T. instabilis* emerged from pupa March 27th; *T. stabilis* emerged from pupa April 3rd; Wood Anemone *(Anemone nemorosa)* Bretby, March 29th; four Swallows seen, Newton, near Burton-on-Trent, 27th; Larvæ of *N. xanthographa* 19th. *Waltham.*—Snowdrop in bloom on March 7th; Aconite on 13th; *Draba muralis*, 14th; *Viola odorata*, 21st; *Anemone nemorosa*, 27th. *Stratford-on-Avon.*—Saw "Common Cabbage" Butterfly on March 25th; and "Small Tortoise-shell" April 3rd. *Stroud.*—April 3rd, Celandine *(Ranunculus Ficaria)*; 10th, *Viola odorata*, Cinquefoil, *Viola canina*; 14th, *Saxifraga oppositifolia*; 18th, Daffodil, *Anemone nemorosa*, Wood Sorrel; 23rd, *Caltha Palustris*; 25th, *Adoxa moschatellina*, *Saxifraga alternifolia*, *Carex præcox*; 27th, *Lamium album*, *Viola hirta*, Common Bugle, *Ranunculus bulbosus*.

Reviews.

The Physical Geology and Geography of Great Britain. By A. C. Ramsay, LL.D., F.R.S., &c. Fifth Edition. 639 pp., 114 woodcuts, and coloured map. Price 15s. E. Stanford, publisher.

This is a new edition of Professor Ramsay's well-known book. It has been doubled in size (and price,) mainly by the incorporation of an account of the British Formations, originally written for Black's Cyclopædia. Much of the matter is new and valuable, and could only have been written by one who has such extensive facilities for observation as the Director-General of the British Geological Survey. The account of the British Miocene strata is very useful, and in his description of each epoch the author gives most interesting notes on the Physical Geography of the time. The following paragraph is well worthy of note by those geologists whose peace of mind is seriously disturbed if they find a fossil but a few feet out of the "zone" which it is considered to characterise:—

"It would be a great comfort to a proportion of the geological population, if the different formations were as clearly distinguishable on the ground as they often are on a map, by different colours, aided by numbers or letters, for the use of the colour-blind. If to this, in the economy of Nature, it had so happened that no species had been permitted to stray from its own formation into the next in succession, the benefit would have been much enhanced, for to those with keen eyes for form, the finding of any single fossil would be sufficient to mark the place in the geological scale of any given formation. Then we should have a perfect and orderly symmetrical accuracy of detail, so that he who runs may read. But it so happens that this is not the case, for Nature loves variety, and performs her functions in various ways, and thus it happens that in certain cases the dividing lines between two formations, if we follow them far enough, are sometimes difficult to determine."

The Author has also incorporated in this edition some of the illustrations and the main points of the matter of his charming little book on the "Glaciers of North Wales." Of other new plates, the most useful are those of the characteristic fossils of the British strata, arranged by Mr. Etheridge, and drawn by Mr. Sharman.

W. J. H.

Cassell's Natural History. Edited by P. Martin Duncan, M.B., (Lond.,) F.R.S., F.G.S., &c., Vol. I., small 4to. Cassell, Petter, and Galpin, London, Paris, and New York.

Few publishers in these times have done more to advance the cause of popular education and recreation than the Messrs. Cassell, and the important work of which the above is a splendid instalment bids fair, when completed, to be one of the most valuable contributions of its kind. The Naturalists under whose care it has been produced are all men of established reputation, and while the subject has been treated popularly it has not in any way suffered scientifically. The volume before us is devoted to the higher vertebrates, "Apes and Monkeys" being done by the accomplished editor, "Lemurs" by the same, in conjunction with Dr. Murie, F.L.S., F.G.S., &c., and "Chiroptera and Insectivora" by Mr. W. S. Dallas, F.L.S. Adopting a principle similar to that laid down by Mr. Herbert Spencer, in his famous Essay on Education, that "as grammar was made after language, so ought it to be taught after language; an inference which all who recognize the relationship between the evolution of the race and that of the individual will see to be unavoidable," the editor, in his preface, thus describes the method pursued:—"The plan of this work is not to open with a classification of animals, the majority of whose names and shapes are entirely unknown to the reader, but to describe the shape, nature, and habits of groups of creatures, and then, when they have become familiar, to arrange and classify them. For the same reason an introduction, dealing with the nature and importance of natural history studies, with the abstract ideas of classification, and with the explanation of the necessity of dividing the animal kingdom according to the principles of comparative anatomy, is not given until the work is tolerably advanced; but an arrangement has been made so that this important part can be subsequently introduced in its usual place. The facts of the Natural History of Animals and their explanations will thus be placed prominently, and will precede the classification."

The volume is beautifully printed and copiously and graphically illustrated, and will be alike acceptable to the young Naturalist and the more advanced student in Biology. We congratulate all concerned in its production, and shall look forward with pleasure to the issue of future divisions of this charming addition to the study of living animals.

W. R. H.

The Geology of parts of Nottinghamshire and Derbyshire. By W. Talbot Aveline, F.G.S. Twenty-two pages, price 6d.

Although described as a second edition, the present issue is practically a reprint of the memoir published in 1861, soon after the ground was surveyed, the alterations being merely verbal. The district described comprises an area of about 164 square miles, by far the larger portion of which is in that part of Nottinghamshire that formed the heart of the ancient forest of Sherwood, the north-west corner being in Derbyshire The chief town included by the map is Mansfield, and it is round this place that the more interesting geological features of the district cluster. The formations represented are the Coal Measures—one or two very small tongues of the Derbyshire coal-field; the Permian Lower and Upper Magnesian Limestone, with the intervening marls and sandstones forming the Middle Division; and the Lower Mottled Sandstone, Bunter Pebble Beds, "Waterstones," and Upper Keuper Marl, of the Trias. The Bunter Pebble Beds, which form the ground known as the "forest lands"—the soil being gravelly and poor for agricultural purposes—cover a broad area running up the middle of the district, and rise going west till they attain an elevation at a point on Coxmoor of 634 feet above the sea—the highest ground in the district. The Permian rocks form a broad band along the west; while on the east, the Keuper sweeps up rapidly into a bold swelling escarpment. The Permian being the most important as well as the most interesting of the formations in the district, the greater part of the memoir is devoted to a detailed description of the lithological features, the fossils, and the remarkable local variations of the Magnesian Limestone as traceable in the large quarries around Mansfield. The bottom beds of the Magnesian Limestone, which are exposed in the quarries on the south side of the town, consist of a white calcareous sandstone, which makes an excellent building stone, and is also much used for paving, for cisterns, &c. Another variety, the red dolomitic sandstone, is described in a passage quoted from Sedgwick as about fifty feet thick, and of a "dull red colour, and might, without close examination, be mistaken for New Red Sandstone." The red sandstone is surmounted by a band of clay, above which come some striped slaty ferruginous beds, which gradually pass into a coarse yellow Magnesian Limestone. Professor Sedgwick thus continues :—" This red dolomitic sandstone rises and falls in long sweeping undulations, and may be traced to a quarry on the side of the Chesterfield Road, where it preserves nearly the same colours and external characters, and is worked for the same purposes. In the whole range of the Magnesian Limestone I know of no deposit which can be compared with that which is here described; and it is more remarkable, as it is found in the heart of the formation, and nearly in a line with the finest specimens of crystalline dolomite." Mr. Aveline believes, though he could get no certain proof, that these beds are the same (altered in colour by an excess of iron and slightly varying in structure) as the white sandstone of Mansfield. It is this continual change of character, the various kinds of limestone being found to extend over very limited areas, that constitutes the most remarkable circumstance connected wtih the Magnesian Limestone of this district. Although the ravine called Creswell Crags is described, we miss any reference, except in a foot-note, to the recent remarkable discovery in the caves there, by the Rev. J. M. Mello, of a valuable collection of mammalian and of pre-historic human remains. In other respects the memoir is admirably written, and is of far greater importance than might be inferred from the number of pages it contains.

J. S.

On the Manufacture of Gun-flints, the Methods of Excavating for Flint, the Age of Palæolithic Man, and the Connection between Neolithic Art and the Gun-flint Trade. (Geological Survey Memoir.) By SYDNEY B. J. SKERTCHLY, F.G.S. 80 pp., 71 woodcuts. Price 17s. 6d.

THIS is a very valuable and interesting account of an industry which will probably soon become extinct. Gun-flints are now only made (in the British Isles) at Brandon, a small town in Suffolk, on the Little Ouse, about six miles west of Thetford. There are now engaged in the trade thirty-six men and boys. The manufactured flints are chiefly purchased by Birmingham and Sheffield merchants for export to Africa, &c., although for horse pistols and large duck guns they are still used in this country. The exact date of the introduction of flint for fire-arms is unknown, and it seems to have been preceded for this purpose by pyrites, for we find that "in 1586 Julius, Duke of Brunswick, had pyrites collected for his fire-arms, near Seefen, and even worked it into shape himself." Gun-flints were superseded in England by percussion caps about the year 1835, and so complete was the change that flint-locks ceased to be manufactured for home use soon afterwards. By experiment Mr. Skertchly found that a flint was used up after about thirty shots.

The flints used by the Brandon knappers are extracted from the Upper Chalk of Lingheath, about a mile distant from the town. The digging or "getting" of the flint is quite a distinct branch from that of its manufacture. In Grimes's Graves, about three miles north-east of Brandon, it seems probable that we have old pits excavated by Neolithic flint-workers, and Mr. Skertchly believes that the manufacture of flint has been carried on continuously in this district since that period.

When the flint has been raised to the surface it is broken up into pieces of a convenient size by means of a "quartering hammer;" from these masses long narrow double-backed flakes are struck with another "flaking" hammer. The lump remaining, from which no more flakes can be struck, is termed a "core," and is used for building. From 7,000 to 12,000 flakes can be struck by one man in a day.

Next the flakes have to be cut up into gun-flints; this is called knapping. The knapper sits in front of a round block of wood, into which is driven a short iron "stake." Resting the flake on the stake at a certain angle, he lightly strikes it with his knapping hammer, making three to five flints from each flake, and about 3,000 per day. With the thoroughness which distinguishes the work of the officers of the Survey, Mr. Skertchly himself donned the leather apron, and became an expert "flaker" and "knapper," so that we may fairly admit his claim (see preface) "to have produced a work as free as possible from all errors of description." His remarks on the fracture of flint, and on the impossibility of the argument that the Palæolithic flint implements might have been produced by natural means, are both original and conclusive. Finally, Mr. Skertchly gives us a glimpse into the nature of the important evidence which he has obtained, proving the pre-glacial existence of man. In beds of loam, sand, and gravel (Brandon Beds he terms them) which clearly *underlie the Great Chalky Boulder Clay* at Botany Bay, near Brandon, at Mildenhall Brickyard, High Lodge, Mildenhall, Bury St. Edmunds, West Stow, and Culford, Mr. Skertchly has found many flint implements which are clear proof of the existence of the human race in this district before the maximum period of cold. Professor Ramsay has examined the evidence, and writes: "That man lived in this district in inter-glacial times I have no doubt, and I also believe it to be most probable that he even inhabited our region in pre-glacial times, and, perhaps, never fairly left it, but only retired south during the general increase of cold and the gradual advance of the glaciers, and still survived in what is now the south of England." This should lend a new interest to the work which our Union has taken up—the examination of the drift deposits of the Midlands.

W. J. H.

Correspondence.

Skeleton Leaves.—Information as to the best means of preparing and bleaching skeleton leaves will much oblige.—J. W. Bodger, Peterborough.

Hen's Egg.—This morning I had the opportunity of examining an egg, laid by a Spangled Hamburg hen, measuring an inch long and three-quarters in diameter.—H. Stone, Handsworth.

MOLES.—I have noticed in many parts of the country during the past winter and spring an unusual number of mole-hills. In some grass fields they were so numerous as nearly to cover the herbage. I should be glad if some naturalist, familiar with the habits of the mole would, if possible, explain why these little creatures have been so unusually busy of late in throwing up their hills?—ENQUIRER.

METEOR.—Many readers of the "Midland Naturalist" must have seen and noticed a most magnificent meteor that I and several others who were with me on Easter Monday last saw when near St. Alban's, Herts. It was exceedingly bright, and of a bluish and red colour, lighting up the road brilliantly. It seemed to shoot from north to south, was large, and seemed to have a luminous tail, and was visible for quite three seconds, I should think. If some astronomical reader will kindly give an account of it, I and others will be obliged.—F. W. H.

EARLY WILD FLOWERS.—March 6th, Wild Laurel, *Daphne laureola*; 7th, Lesser Celandine and Coltsfoot; 9th, Elm; 17th, *Viola odorata*, Violet; 28th, Dandelion; 30th, *Anemone nemorosa*. April 7th, Ground Ivy, *Glechoma hederacea*; 8th, White Dead Nettle; Cowslip, *Primula veris*; 11th, Larch.—A.E.I., Hatton Rectory, Lincolnshire.

FLORAL NOTES.—Dates of flowering, &c., at Nottingham:—April 3rd, *Primula veris*, Cowslip, *Viola canina*, Plum Blossom (west aspect;) 12th, *Caltha palustris*, Cherry Blossom (west aspect;) 13th, Pear Blossom (west aspect;) 17th, *Lamium album*, *L. purpureum*, *Nepeta Glechoma*, Blackthorn, *P. communis*, *Alliaria officinalis*, Hedge-sparrow's eggs, Blackbird's eggs, *Veronica agrestis*. The Sycamores began to show foliage at the beginning of the month.—H. F. JOHNSON, Nottingham.

FLORAL NOTES.—March 1st, Hazelnut in flower. 5th, Daisy; first Crocus out in garden. 6th, Daisies; Marsh Marigold; staminate flowers of Larch. 7th, Dog's Mercury, only one plant really out; Coltsfoot fully out. 8th, Elm fully out; Larch pistillate flowers; Chickweed; Shepherd's Purse; and a blue and white Veronica. 18th, *Adoxa moschatellina*, *Viola odorata*; Lesser Celandine. 20th, Red Dead Nettle. 21st, *Potentilla fragariastrum*.—A. S. L., Stapenhill, Burton-on-Trent.

FLORAL NOTES.—Dates of flowering near Wimborne, Dorset:—March 1st, *Viola odorata;* 3rd, *Primula vulgaris;* 7th, *Anemone nemorosa;* 15th, *Lamium purpureum;* 17th, *Viola sylvatica;* 19th, *Veronica Chamædrys*, *Adoxa moschatellina*, *Mercurialis perennis* (male,) *Stellaria media*, *Tussilago Farfara*, *Bellis perennis;* 20th, *Caltha palustris*, *Veronica hederifolia*, *Lychnis diurna*, *Taraxacum officinale*, *Myosotis arvensis*, *Euphorbia helioscopia;* 21st, *Lamium album;* 25th, *Leucojum æstivum*; 10th, *Salix* (species doubtful probably *caprea*,) male flower. The whole month, with the exception of about seven days (*e.g.*, 15th, 16th, 22nd, and 23rd,) was decidedly warm; very little rain or wind, considering the month.—H. W. TROTT, Wimborne.

FLORAL NOTES.—*Arum maculatum* and *Chelidonium majus* in leaf at Duddington; *Bellis perennis* in flower at Wakerley on February 17th and on the 18th, *Vicia sepium* (?) in hedge-row facing east, near Sudbury, between two and three feet high, growing luxuriantly, with immature seed vessels, but no flowers, it appeared to have blossomed in the winter; part of the plant I have preserved, the other I left, hoping to see more of it in May. March 8th, *Ulmus campestris* in full flower at Huntingdon, and *Ranunculus Ficaria* at Brampton; between the two places, in sheltered spots; Hawthorn in full leaf; *Ranunculus Ficaria* in flower at Frampton, near Boston; 9th, *Viola odorata* in flower at Milton; 19th, *Nepeta Glechoma* in full flower at Fletton, cluster cups abundant on *Ranunculus Ficaria* leaves; 29th, cluster cups on *Ranunculus bulbosus* at Frampton; April 2nd, *Cheiranthus cheiri* on Cathedral walls, *Tussilago Farfara*, *Lamium album*, *L. purpureum*, *Nepeta Glechoma* in full flower at Peterborough; 9th, *Caltha palustris* and *Cardamine pratensis* in flower at Thorney, *Tussilago Farfara* in flower and leaf, *Narcissus pseudonarcissus* in flower in abundance near Croyland; 12th, *Alliaria officinalis* in flower at Horsey, *Matricaria inodora*, *Cardamine hirsuta* in flower near Stanground, and fruiting stems of *Equisetum arvense* near Whittlesea.—J. W. Bodger, Peterborough.

Botanical Notes.—February 17th, Snowdrops plentiful in Foremark Wood. March 5th, a few flowers of *Viola odorata* on Askew Hill; Coltsfoot *Tussilago Farfara*, in full bloom in several places; Ground Ivy, *Nepeta Glechoma*, many patches in flower; Marsh Marigold, *Caltha palustris*, one or two flowers in an osier bed; the Daisy, sparingly, on a bank facing the south. March 17th, Lesser Celandine, *Ranunculus Ficaria*, in a small plantation; Dog's Mercury, *M. perennis*, in bud. March 25th, *Draba verna* in flower near Ticknall; Wood Anemone and Primrose in flower at Bretby Wood. April 5th, *Saxifraga tridactylites* in flower on an old wall; and White Dead Nettle, *Lamium album*, on hedge banks. April 12th, *Cardamine hirsuta* in flower; and *C. pratensis* not quite out, but showing clearly the lilac colour of the petals.—J. H., Repton.

Botanical Notes from South Beds:—

Name.	Date.	Aspect	Situation, &c.
Anemone pulsatilla	March 27th	S.E.	Chiltern Hills on chalk
Primula veris	,,	,,	,, ,,
Carex præcox	,,	,,	,, ,,
Adoxa moschatellina	March 20th	S.	At the edge of a wood.
Viola canina	March 18th	,,	,, ,,
Cardamine pratensis	April 7th	,,	Moist meadows.
Ranunculus auricomus	,,	S.W.	Hedge bank.
,, bulbosus	April 10th	,,	Railway bank.
Lamium galeobdolon	,,	,,	Hedge bank.
Cardamine hirsuta	March 23rd	,,	River bank.
Cerastium semidecandrum	April 2nd	,,	Hedge bank.
Eriophorum polystachyon	April 18th	open	Marsh.
Luzula campestris	,,	,,	Moist meadow; proterogynous — the stigmas had ripened and the anthers were developed.
Myosotis arvensis	,,	,,	Fallow field.
Paris quadrifolia	April 17th	S.	In an old clay pit in a wood.
Prunus spinosa	April 18th	N.E.	Hedge.
Cardamine hirsuta, 1878	March 1st	,,	On an old wall with N.E. aspect. In 1880 the plants are dwarfed; in 1878 they were vigorous.
,, ,, 1879	April 15th	,,	
,, ,, 1880	April 5th	,,	
Equisetum arvense	April 19th	open	Moist meadow.

J. Saunders, Luton.

Notes from Oscott College.—The cold of the last fortnight has somewhat checked the opening buds, and it will be some time before the trees are fully out. The Larch, Chestnut, and Lime show signs of returning summer; but the Beech, Oak, and Ash are very backward, and it will be some weeks before they are fully out. The following are the notes recorded for the month:—March 21st, Thrush's nest with eggs, Humble Bee seen, Daffodil and Jonquil in flower; 23rd, Honey and Sand Bees seen, Willow and Furze in flower; 26th, Shepherd's Purse in flower, *Vanessa urticæ* seen; 29th, Dandelion, Strawberry-leaved Cinquefoil, White and Purple Dead-Nettle, Musk Ivy, Lesser Celandine, Marsh Marigold, Whitlow Grass, Golden Saxifrage, Ivy-leaved Veronica and Osier in flower, Chiff-chaff singing; 30th, several Vanessa, common White, and Brimstone Butterflies seen; April 5th, Pansy and Lady's Mantle in flower, Swallow first seen; 8th, two Swifts seen; 18th, Sand Martins seen; 20th, Garden Warbler seen and heard singing, House Martin seen, Cuckoo heard; 24th, *Cerastium arvense* and *Prunus avium* in flower.—J. Caswell.

Phenological and General Observations, taken in the vicinity of Farley, near Cheadle, Staffordshire, during March, 1880:—*Fringilla cælebs* in full song early in month. 11th, Cry of *Vanellus cristatus* heard; bird evidently seeking nesting-ground. 13th, Daisy in bloom; wild rose, elder, and wild gooseberry bursting into young leaf. 17th, Nest of *Turdus musicus* found ready for eggs. 18th, *Corvus frugilegus* building. 20th, Nest of *Turdus musicus*, above referred to, contained three eggs, first found this season, as far as I know. 2nd, First lambs seen. 19th, *Strix aluco* on nest, but no eggs; eggs taken from this same nest March 20th last year; Currant fruit tree bursting into young leaf. 21st, *Narcissus pseudonarcissus* in full bud, and Lilac bursting into young leaf; *Potentilla fragariastrum* now in flower; *Corylus Avellana* bursting; and *Ranunculus Ficaria* first seen in flower on bank facing south; *Mercurialis perennis* only *just* and slightly in bloom; plants of fine growth and leafage, but flowering considered very backward. 23rd, *Ribes Grossularia* in full young leaf. 24th, *Tussilago Farfara* now in flower generally; said to have been seen first 7th inst. 25th, *Turdus musicus* just commenced to sit; *Luzula pilosa* in bud in Churnet valley. 26th, *Cardamine hirsuta* in flower; also *Veronica polita* on wall facing S.S.W., and open position. 28th, *Ribes Grossularia* in flower; also *Adoxa moschatellina;* and *Narcissus* (under cultivation.) 29th, Examples of fertile *Salix caprea* in full flower. 30th, Horse Chestnut and Larch in full young leaf. Catkins of *Corylus Avellana* said to have been seen first 15th inst. 31st, Flowers of *Oxalis acetosella* first seen.—Clemt. L. Wragge, F.R.G.S., F.M.S.

Chiff-chaff.—Mr. J. S. Hedderley, of Bulcote, near Nottingham, one of our best ornithologists, informs us that he heard the Chiff-chaff so early as the 13th of March this year.—L. Lee, Nottingham.

Ornithological Notes from Leicestershire.—A rough-legged Buzzard was shot in this county near Ashby-de-la-Zouch in February. On March 10th, I saw a male Goosander on Saddington Reservoir. The bird remained for several days. On March 19th, the ever-welcome note of the Chiffchaff, first arrival of summer migrants, was heard. This is the earliest record of the arrival of this bird that I have, the average date of its appearance being 25th, but, as the bird was seen as well as heard, there can be no doubt about it. On 25th March, I noticed the Wheatear; this also is the earliest record I have. On 30th, I heard the Blackcap, of all our warblers pre-eminently the sweetest. April 6th, the Willow Wren appeared. April 13th, the Wryneck's note was heard. On

15th of this month I saw a tolerably large flock of Fieldfares outward bound. This is not an unusually late date. At the time of writing, none of the *Hirundinidæ* have put in an appearance, nor has the Cuckoo or the Nightingale been heard, but doubtless they will all be noted in a few more days.—Thomas Macaulay, M.R.C.S.L., Kibworth, April 16th, 1880.

Ornithological Notes.—I have at present only four summer migrants to record as having arrived here. Chiff-chaff, March 30th; Yellow Wagtail, on the 5th; Willow Wren, on the 17th; and Swallow, on the 21st inst. Young Rooks were calling from the nests on the 8th of this month, eight days earlier than last year. We have a few Wild Ducks staying to breed this season, but not so many as last year. On the 3rd instant, I was surprised to see a pair of Teal rise from an osier bed on the banks of one of our streams. I am sorry to have to record the occurrence of another Peregrine Falcon, which was killed at Marston St. Lawrence, on March 17th. A man had placed a stuffed Ring Dove on the ground as a decoy, and whilst waiting for pigeons, saw the Falcon strike the decoy, when he shot it. I had the pleasure of examining the bird, and found it to be a female, in good condition. It measured 3ft. 7¼in. in alar expanse. Some young Song Thrushes were hatched out here on the 12th instant.—O. V. Aplin, Bodicote, Oxon, April 22nd, 1880.

Subterranean Fungi.—In reference to a note on this subject, by R. G., page 93, I would suggest that careful search be made for the more developed and perfect state of the plant alluded to as *Rhizomorpha medullaris*, which is in fact only the mycelium of a fungus, and hence *Rhizomorpha* has long since been discarded as a genus. The distance to which the mycelium of some fungi will penetrate into wood and earth is very striking, as is also the power it exerts in forcing a passage for itself; and any fact bearing on this subject, when the species giving rise to it can be accurately determined, will be of much interest to mycologists. The mycelium alone affords but a very imperfect clue to a species, but if the fruit-bearing surface (the *hymenium*) of the plant can be found, the species may be determined. The plant R. G. alludes to as "possibly an Alga," of an orange colour, is probably *Ozonium auricomum*, Link., figured in Greville's "Scottish Cryptogamic Flora," plate 260, which is not uncommon on dead wood exposed to dripping water. The timber observed to be phosphorescent would most likely owe that quality, not to the presence of the *hymenium* of a fungus, but the *mycelium*. I am not aware that phosphorescence in wood has ever been traced to the presence of the hymenium of a fungus. Any observations on these points alluded to by your correspondent as occurring in the midland district, will be deserving of record in your valuable columns.—W. Phillips.

Gleanings.

Midland Union Meeting.—The arrangements for the Northampton Meeting, so far as settled, will be found on the second page of the cover of this month's magazine. Some interesting particulars of the Botanical Excursion will be found at page 97. Next month similar details of the Geological Excursion will be given. As early as possible the Hon. Secs. of the Union will send out the official programme for circulation among the members of all the Societies in the Union.

Professor Huxley, LL.D., F.R.S., has been unanimously elected an Honorary Vice-president of the Birmingham Natural History and Microscopical Society, in recognition of his distinguished services to Biological Science.

Geological Survey.—The corrected maps of the Nottingham district (Quarter-sheets 71 N.-E. and S.-E.) are now ready. In addition to corrections in the Triassic rocks, they contain the latest colliery information as to underground faults, the sites of bore-holes, &c. They are the work of Mr. W. T. Aveline, F.G.S.

Chalk Fossils.—In almost every collection of organic remains from the chalk may be seen "an elongated more or less undulating body, composed of the scales and bones of fishes confusedly mingled." Dr. Mantell considered this to be a long cylindrical fish, identical with the *Dercetis elongatus* of Agassiz, and this was generally accepted, though some collectors referred the remains to coprolites, and others to intestines of fishes. In the *Geological Magazine* for 1879, p. 145, Mr. W. Davies, of the British Museum, states his reasons for considering these curious bodies to be "the remains of membranous tubes of large soft-bodied Annelides, of solitary habits, that collected and agglutinated, either for protection or disguise, the scales and bones of fishes to the exterior surface of their tubes," just as some living annelides do; he names them *Terebella Lewesiensis.*

The Rocks of Brazil Wood, Charnwood Forest.—With reference to the remarkable exposure of the contact between granite and slate, discovered at this point by Messrs. Allport and Harrison, and first described in our pages (Vol. II., p. 243), a brisk controversyh as taken place in the *Geological Magazine* between Prof. Bonney and Mr. Allport, as to the correct name to be given to the altered rock; it has hitherto been called *gneiss*, and Prof. Bonney would retain this term for it, while his adversary designates it as a *micaceous schist*. The rock is mainly a compound of two micas, and as it has "neither the chemical composition, mineral constitution, internal structure, nor even the external appearance of gneiss," Mr. Allport's name would seem to be the better one.

Roman Oysters.—During the excavations for the new Corporation Baths, in Leicester, a few months ago, some strongly built walls and concrete floors, evidently of Roman work, were met with. *Underneath* the old masonry large numbers of oyster shells, many in very perfect preservation, were met with, and similar specimens with shells of the whelk have been found associated with Roman pottery in several parts of the old town. Considering the position of Leicester in the very centre of England, and the consequent expense of carriage, the discovery of these marine delicacies here would seem to afford another proof of the high estimation in which they were held by the early conquerors of our island.

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—Geological Section.—March 23rd.—The section resolved to visit the exposure of coal in the excavations at Rubery Hill, on Saturday, the 3rd of April.—Mr. J. Levick exhibited *Floscularia cornuta* and *Podophrya quadripartita*, two interesting infusoria. A reprint of a paper on the Precambrian Geology of Anglesey, by Dr. Callaway, of Wellington, was presented by the author.—Miss

Hadley exhibited some specimens from the sinking for coal at Hamstead.—Mr. Cotterell read an interesting paper on the mineralogy of Cornwall, and exhibited a large number of beautiful specimens.—On Easter Monday, March 29th, about forty members of the Society made a very pleasant excursion to Evesham, where they were met by Mr. T. J. Slatter and Mr. J. T. Burgess, under whose guidance they visited the banks of the river Avon, Wood Norton, the grounds of the Duc D'Aumale, and other places in the vicinity. On the roots of the willows, growing in the first mentioned locality, many interesting microscopic specimens were found. General Meeting.—March 30th.—Mr. W. Phillips, F.L.S., of Shrewsbury, was elected a corresponding member of the Society; and the concluding portions of his paper on the study of Lichens were read by Mr. Bagnall and Mr. Badger. The paper will be published in future numbers. —Mr. H. W. Jones exhibited a female Arctic Stone Crab, *Lithodes arctica*, from Aston Aquarium.—Mr. H. E. Forrest exhibited, on behalf of Mr. Doeg, of Evesham, a cluster of flies about three inches in diameter, which when first found was much larger. It was discovered at Blockley, near Evesham, in a hawthorn bush, about four feet from the ground, but the cause of its formation was unknown. Mr. Forrest suggested that they might have been drawn together by some attractive, but poisonous food, which had killed them on the spot. Mr. W. G. Blatch said that the hawthorn was covered with the web of the larva of one of the ermine moths, and thought that the cluster of flies was artificially produced by their getting entangled in the web.—General Meeting.—April 6th.—Mr. W. R. Hughes read a letter from Mr. H. J. Carter, F.R.S., promising to give the Society a report on the sponges dredged during the Falmouth expedition last year. Mr. Montagu Browne gave a short description of the whale now being exhibited in Birmingham. The species is the common Rorqual, and it measures nearly 70ft. in length. He also exhibited the stomach of an Owl, which had been shot on account of the destruction it was supposed to have wrought among some pigeons kept in a loft. When opened, however, it was found to contain, not feathers, but the skulls, &c., of several mice and rats, which were, no doubt, the perpetrators of the crimes for which the Owl had paid the penalty. Mr. W. Graham presented to the Society a new Microscope Lamp, by Parkes; and a cordial vote of thanks to the donor was passed unanimously. Mr. H. E. Forrest exhibited living specimens of the beautiful little Gonophores, or Medusiform larvæ of a species of Obelia, (plicata?) growing attached to the Arctic Crabs *(Lithodes arctica)* in the Aston Aquarium. They hatched out in a bottle after he had removed the colony from the Crab. Specimens of the polypidom of the same Obelia were exhibited by Mr. Bolton, with a Follicularia attached of a different species from that figured by Mr. Saville Kent opposite page 73. He also showed a very rich gathering of Rotifers, comprising several members of the genera Asplanchna, Anuræa, Brachionus, and Polyarthra. Mr. Forrest also exhibited spawn of the common Perch. The embryos were in active motion, and the albuminous sheath was full of curious radial markings. Mr. J. E. Bagnall exhibited *Pellia calycina*, *Riccardia multifida*, ditto *var. ambrosioides*, and *R. sinuata*, all new to Warwickshire; a very rare moss, *Mnium rostratum;* and a Confervoid Alga, *Vaucheria geminata*, showing formation of the spores. Mr. W. G. Blatch exhibited a beetle, *Coccinella ocellata*, new to the district, found at Coleshill. Mr. R. W. Chase read an interesting paper on "The Changes of Plumage in some of the British Birds," with special reference to the Plovers and Sandpipers, of which he showed many beautiful specimens in various states of plumage. After describing the changes which they undergo periodically, he said that many theories had been advanced to account for these changes, but none of them would stand thorough investigation. As a rule, birds assume their brightest coloured plumage at the commencement of the breeding season, and this disappears very rapidly, owing to the partial or entire moulting of these feathers. His own idea was that the brightness of the colours was owing to the fact that, at the season in question all the vital functions of the bird were performed more vigorously than at other times. The paper was listened to with great interest and attention, and at the conclusion elicited from Mr. Montagu Browne a promise that he would shortly give a paper in continuation of and answer to Mr. Chase's. Adjourned Annual General Meeting.—April 12th.—The retiring President, Mr. Walter Graham, delivered his address to the members of the Society. The Address was chiefly devoted to a review of our past and present knowledge of Archebiosis, or spontaneous generation, with particular allusion to the researches of Dallinger and Drysdale. It also gave several valuable suggestions for the future conduct of the Society. On the motion of Mr. Wills, seconded by Mr. Levick, a resolution was unanimously passed thanking Mr. Graham for his able address, and for the uniform kindness and ability with which he had discharged the duties of his office during the past year. Mr. Montagu Browne exhibited three young squirrels, just taken from the nest. This is very early in the year for them to be found.

BIRMINGHAM AND MIDLAND INSTITUTE SCIENTIFIC SOCIETY.—April 7th.—Mr. G. H. Twigg read a paper on "The Oolitic Formation on the Borders of Warwickshire." After noticing the character of the formation as a whole, he referred to some localities in detail, selecting principally those within easy distance from Birmingham, describing the fine exposures in the Lias to be seen at Wilmcote, Harbury, and Birdingbury, as well as those in the Inferior Oolite, at Leckhampton, and other localities in the Cotswolds, around Banbury and Northampton. The paper was illustrated by a variety of fossils, collected in the district referred to, and concluded by an allusion to the enormous denudation which must have resulted since the first deposit of the calcareous rocks of the formation, as rendered manifest by the outliers, of which Bredon Hill is a notable example. April 10th.—The members visited the new sinking at Hamstead. Upon arrival Mr. F. Meacham exhibited the various rocks passed through during the sinking for coal. Attention was then given to the spoil banks, and many specimens of carboniferous plants were obtained. The thick coal, of excellent quality, has since been found at a depth of 615 yards. This, it need scarcely be added, is a valuable find. April 14th.—Mr. W. P. Wynne read a paper on "Water Analysis," Drs. Frankland and Armstrong's process being described.

BURTON-ON-TRENT ARCHÆOLOGICAL AND NATURAL HISTORY SOCIETY.—March 30th.—The annual meeting was held in the Wesleyan School Room, Station Street. the Rev. C. F. Thornewill, V.P., presiding.—From the statement of accounts for the past year it appeared that the receipts had been £74 7s. 10d., and the disbursements nearly the same sum. The report was adopted, and the Committee's report was taken as read. PRIZES TO JUNIOR MEMBERS.—The Chairman said no mosses had been sent in; the only collections were moths and butterflies.—Mr. Baker was asked to examine these collections, and make a report on them, and he reported that there had been five collections sent in, and he had awarded the prizes as follows:—1st, 126 species, J. E. Nowers; 2nd, 86 species, Miss M. E. Day; 3rd, 64 species, Miss Gibbs. The election of Mr. W. Molyneux, F.G.S., to the office of President was carried unanimously. The following gentlemen were appointed Vice-Presidents for the year:—Mr. S. Evershed, Mr. J. C. Grinling, Mr. H. G. Tomlinson, Mr. Robert Thornewill, and the Rev. C. F. Thornewill. Mr. Partridge was re-elected Treasurer. Mr. T. C. Martin and Mr. C. U. Tripp were re-elected Secretaries. Mr. W. G. Blatch, of Birmingham, was elected an Honorary Member of the Society. The following excursions have been arranged:—Cannock and Stone; Breedon and Melbourne, leader, Mr. Ford; Dudley and Wren's Nest, leader, Mr. Molyneux; Chatsworth, leader, Mr. Boden; Morley, leader, Mr. R. Thornewill; Wirksworth, leader, Lott.

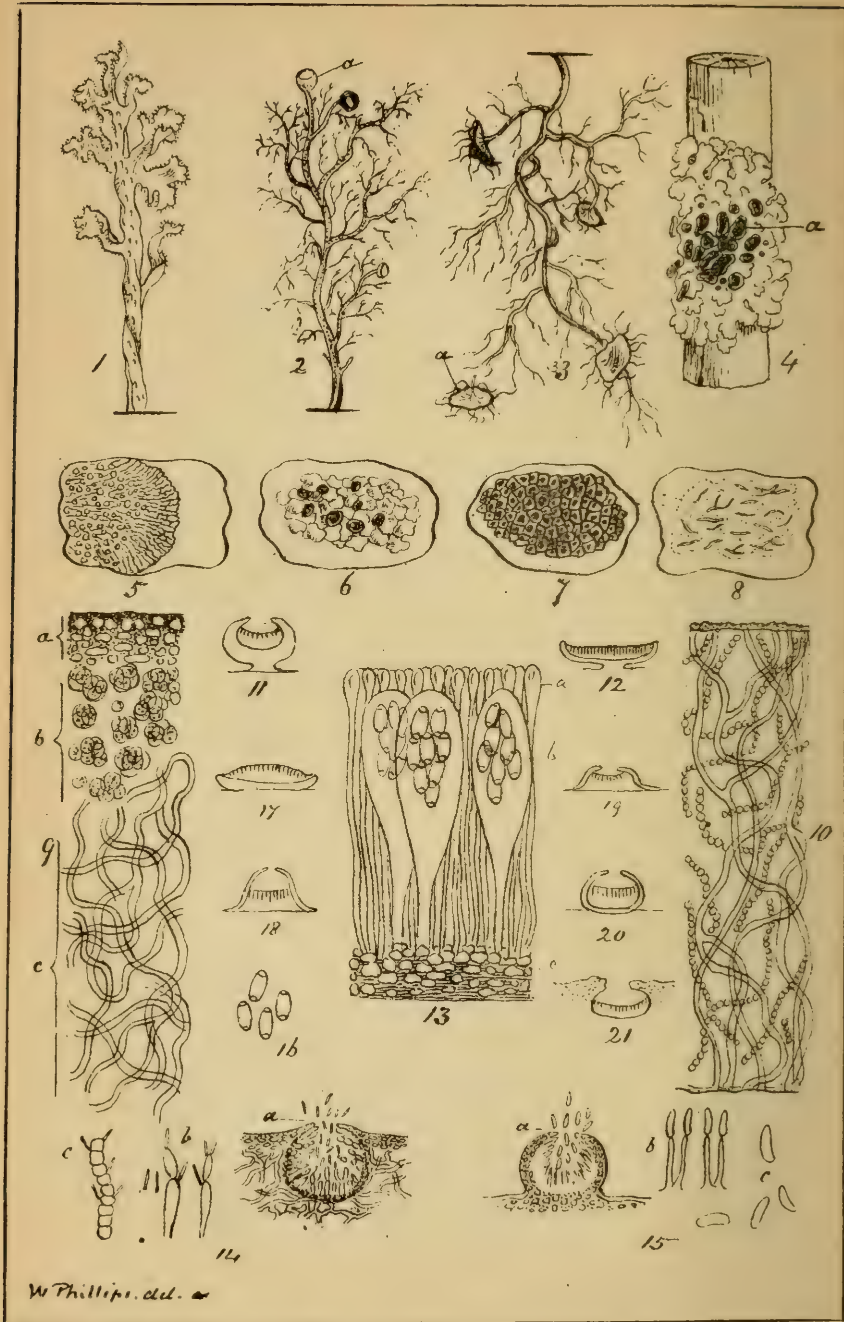
NORTHAMPTON NATURAL HISTORY SOCIETY.—March 18th.——ANNUAL MEETING.—The reports of the Treasurer and Committee were presented, both of which were eminently satisfactory. Four gentlemen were elected as members of the Society, and eleven others nominated. The officers and committee for the ensuing year were elected, Sir Herewald Wake, Bart., being chosen as one of the Vice-presidents, in the place of Rev. Wm. Thornton, F.G.S., resigned.

NOTTINGHAM LITERARY AND PHILOSOPHICAL SOCIETY.—The following meetings were held during April:—8th.—The Rev. C. Hargrove, M.A., lectured on "Coedman, the First English Poet." 15th.—Dr. Seaton gave a lecture on "Epidemics."—Erratum in the April number of "Midland Naturalist." Mr. Teall's lecture on "The Structure of Molecules" was delivered on the 17th March, and *not* on the 17th February.

PETERBOROUGH NATURAL HISTORY AND SCIENTIFIC SOCIETY. —A most pleasing incident in connection with this society deserves record. The Dowager Marchioness of Huntly recently invited the members to pay her a visit at Orton Hall. About fifty availed themselves of the invitation, and were received by the Marchioness, who had for the occasion converted the large dining room into a temporary museum of scientific objects, of which she possesses a valuable collection. After examining these, the party proceeded to the grounds, where they saw much to interest them. On returning to the dining room the Dowager Marchioness of Huntly said:—"I must thank you for having so kindly met me here to-day, especially at this busy time, and I take it not only as a compliment to myself, but as a proof of your interest in the future success of the Peterborough Natural History and Scientific Society. I have thought it would be a great pity that this society, begun originally under such good auspices, should fall to the ground, because I believe it is calculated to exercise a beneficial influence. Peterborough is now a rising place, with a largely increasing population, and we could wish that the young especially should be imbued with tastes which would lead them to healthy and improving pursuits. The business of the society will be discussed at a meeting which I hope will soon be convened, but I just wish to say that we are anxious to secure a room for the members, and to obtain books of reference, and cases in which specimens can be exhibited and preserved, and which may become the nucleus of a local museum. Mr. Peckover has sent me an account of the rise and progress of a similar institution at Wisbech, which began in a small way, but gradually received encouragement, and is now rich in grants of money, and contributions of objects of art and natural history. Mr. Peckover has done more. He has generously entrusted me with ten guineas for the purposes of the society. Canon Argles has given three guineas. I hope we may receive further donations, and if funds are still wanted, we might perhaps organise a local exhibition, and devote the proceeds to our undertaking. I understand that 150 pictures have been left to the city of Peterborough on the condition of finding a room in which to place them. This is a good beginning, and augurs well for our future prospects. I will just add that I propose offering to my young friends a book on Natural History, as a prize for the most complete list, with dried specimens if possible, of the plants growing on the fen lands, and the clay, geologically termed the Oxford clay of this county, with a view to ascertaining what families of plants are most likely to flourish on these soils. I would also recommend to our young people a collection of the land and freshwater shells of this neighbourhood, which are especially interesting. Also, that they should look out for the flint celts, the weapons and implements of the ancient inhabitants of the earth, which I believe are to be found in the gravel deposits, and of which you will see a specimen here." Addresses were also given by Mr. Skertchly, Mr. A. Tyler, the Dean of Peterborough, the Rev. Canon Argles, and Mr. Bentley. Subsequently the party adjourned to the drawing room, where "five o'clock tea" was served, and afterwards returned to Peterborough, having heartily enjoyed a most pleasant afternoon. A large number of new members have since joined the society.

WOOLHOPE NATURALISTS' FIELD CLUB.—The Annual Meeting was held at Hereford, on Thursday, April 15th. The financial statement for the year 1879 was read, the dates and places of the Field Meetings for the present year fixed, and the Meteorological Tables, with the Rainfall, and Register of Flood Water on the Wye for 1879 laid on the table. A report on the Herefordshire Pomona was read, together with the Financial Statement for Part II.; the first proofs of the ten plates prepared for Part III., giving oloured drawings of forty different varieties of fruit, were exhibited; and the usual annual grant for the production of Part IV., in 1881, asked for. The members dined together at the Mitre Hotel afterwards. The President subsequently delivered his Retiring Address, and a paper on "The Crab Apple, its Characteristics and Associations," by Edwin Lees, Esq., F.L.S., F.G.S., was read.

Plate V.



British Lichens.

BRITISH LICHENS: HINTS HOW TO STUDY THEM.*

BY W. PHILLIPS, F.L.S.

The group of plants classed as Lichens, though for the most part minute in stature, offer a highly interesting field of study to the lover of nature, and will well repay the labour bestowed upon them by presenting before the mind much beauty of form and curiosity of structure. To him who wants an inducement to seek the country lane, the wooded park, or the breezy hill side, no better one can be found than in the pursuit of these attractive little plants, which need no care in drying, and little space for storing. The thousands of species that lie scattered on the surface of old trees, the face of weathered rocks, and on heathy pastures, will supply an exhaustless source of pleasure to the man who is capable of appreciating the wisdom of the great Creator, displayed in the lower forms of vegetable life; nor is there that difficulty in their study which some people have imagined. As in other departments of botany, as indeed in every branch of human knowledge, there are certain initial difficulties—those which stand on the threshold of the subject—which give some trouble, but when these are surmounted the course becomes easy and

REFERENCES TO PLATE V.

Fig. 1.—*Cetraria Islandica*, a single frond, natural size.
Fig. 2.—*Sphærophoron coralloides*, natural size, *a, apothecium.*
Fig. 3.—*Usnea barbata*, natural size; *a, apothecium.*
Fig. 4.—*Physcia parietina*, natural size on wood; *a, apothecia.*
Fig. 5.—*Placodium callopismum*, a portion of a specimen, natural size.
Fig. 6.—*Squamaria crassa*, natural size.
Fig. 7.—*Lecidea geographica*, natural size.
Fig. 8.—*Graphis elegans*, natural size.
Fig. 9.—Perpendicular section of the thallus of *Physcia parietina*, much magnified; showing the three strata, *a* cortical layer, *b* gonidial layer, *c* medullary layer.
Fig 10.—Perpendicular section of the thallus of a *Leptogium*, much magnified; showing the intermixed hyphæ and gonidial necklaces.
Figs. 11 & 12.—Perpendicular sections of apothecia of *Physcia parietina*, very little magnified; the first a young, the second an older individual.
Fig. 13.—A perpendicular section of the same, more highly magnified; *a* asci with sporidia, *b* paraphyses, *c* hypothecium.
Fig. 14.—Perpendicular section of a spermagonium immersed in the thallus, highly magnified; *a* ostiolum, *b* and *c* different forms of sterigmata, showing the spermatia *in situ.*
Fig. 15.—Perpendicular section of a pycnidium seated on the thallus, highly magnified; *a* ostiolum, *b* basidia and spores, *c* detached spores more highly magnified.
Fig. 16.—Spores of *Physcia parietina*, highly magnified.
Fig. 17.—Perpendicular section of a lecideine apothecium, slightly magnified.
Fig. 18.—Perpendicular section of a dimidiate peridium of a *Verrucaria*, slightly magnified.
Fig. 19.—Perpendicular section of a peridium of a *Graphis*, showing the dimidiate form, slightly magnified.
Fig. 20.—Perpendicular section of an entire peridium of an *Opegrapha*, slightly magnified.
Fig. 21.—A perpendicular section of an apothecium immersed in the thallus, slightly magnified.

* Read before the Birmingham Natural History and Microscopical Society on March 9th and 30th, 1880.

pleasant. It is with the view of helping the student over these initial difficulties that the present paper has been written.

The vegetable kingdom is divided into two great sections, the *Phanerogamia* and the *Cryptogamia*, the former possessing flowers containing male and female organs, the latter being destitute of flowers, and having their male and female organs less conspicuous or altogether concealed within special receptacles. Lichens* belong to the section *Cryptogamia*. They are closely related to other sub-divisions in this section, viz., *Fungi* and *Algæ*, the line of separation on either side being so indistinct that it is not always easy to say where it runs. Nature, indeed, has drawn no definite line even between the animal and vegetable kingdoms, much less between the sub-divisions of the vegetable kingdom. Notwithstanding this near approach of Lichens to Algæ on the one hand, and Fungi on the other, the students of each have, by mutual consent, agreed to certain limitations which serve all practical purposes. Lichens are distinguished from certain Fungi to which they have a resemblance by possessing in their structure the green bodies called *gonidia*, of which we shall have to speak at length hereafter; from Algæ they are distinguished by bearing reproductive spores in asci. Other points of difference can only be understood by the student as he becomes more fully acquainted with the subject, hence these must suffice for the present.

A perfect Lichen consists of the *vegetative* part called the *Thallus*;† and the fruit-bearing receptacles, the *Apothecia*,‡ considered to be the female organs, seated on the thallus; with which are found associated the *Spermagonia*§ and the *Pycnides*,‖ considered to be the male organs. Although every Lichen should, theoretically, have these parts all present, it must be understood that the thallus is often so imperfectly developed that it is scarcely discernible, or, as in parasitic species, is absent, while in others, though the thallus is perfectly developed, the apothecia are hardly ever to be seen, and the spermagonia and pycnidia are still more rarely to be found.

We will proceed to notice these various parts more in detail, beginning with

THE THALLUS.

I.—The thallus differs much, according to the species, in form, size, colour, and texture. Having regard to the surface on which a Lichen grows, the thallus may be *upright* or *prostrate*, *i.e.*, vertical or horizontal.

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* This word, which is pronounced Likens, the ch being hard, is said to be derived from the Greek word λειχην a wart.

† From θαλλός a frond or green leaf.

‡ From ἀπο upon, and θήκη a sack.

§ From σπέρμα a seed, and γονὴ generation, in allusion to their function.

‖ From πυκνότης, indicating many things pressed one against the other, probably on account of their close growth.

The *upright* thallus may assume one of two forms known as the *fruticulose** and *filamentous* forms.

1st.—The *fruticulose* form is so named because of its general resemblance to a miniature shrub. It is attached at the base, from which it ascends in one or more stems, with or without branches, which are flat or cylindrical. The most familiar illustration of this form is that of the Iceland moss of commerce *(Cetraria Islandica,)* (Plate V., Fig. 1,) imported and sold in every chemist's shop.

2nd.—The *filamentous* form is that in which the stems arise from a small base of attachment, and consist of thread-like, rigid, or flaccid, upright, prostrate, or pendulous filaments, often repeatedly branched. The Beard Moss *(Usnea barbata)* (Plate V., Fig. 3,) so frequently to be seen on old trees, is an example of this form.

The *prostrate* thallus may be either attached to its support by a small space only, or by the whole of its under surface. As this division includes the major part of Lichens it has been sub-divided into, 1st, the foliaceous, and 2nd, the crustaceous forms.

1st.—The *foliaceous* thallus.—This consists of leaf-like expansions, spreading horizontally, attached by one or more points on the under surface to the substance on which it grows. It is often cut or torn at the margin into more or less irregular lobes, which at times overlap each other. In some species having a foliaceous thallus the attachment beneath is by numerous small filaments, which, though suggesting the idea of rootlets, serve no such purpose; they are called *rhizinæ.*† *Parmelia saxatilis*, one of the commonest British species on rocks and trees, presents these rhizinæ in abundance.

2nd.—The *crustaceous* thallus.—As the name implies, this forms a more or less thick crust, generally attached by the whole of its under side, but often free at the margin. Some of the chief forms of this must be particularised. It begins to depart from those already mentioned by the

Squamulose‡ thallus.—This is formed of small scales, either detached or united to each other by the margin, and affixed to the substance on which it grows by its under surface. The outline is very variable, affording important characters in the distinction of species. *Squamaria crassa*, a common species on the earth in limestone districts, will illustrate this form of thallus. (Plate V., Fig. 6.)

Granulose thallus.—This is formed by a thin layer of irregularly sized granules, each granule separated from the other, or united into a continuous surface. It prevails largely in the genus *Lecidea.*

* From *frutex*, Latin for shrub, *fruticulose*—diminutive.

† From ῥίζα a root.

‡ From *squama*, Latin for the scale of a fish.

Scurfy thallus.—In this form the surface is torn up into minute flat scales, thickly distributed, giving it the scurfy aspect implied by the name as ordinarily understood.

*Areolate** thallus.—In this form the crust of the thallus is divided into minute spaces, which are either depressed, flat, or convex. These spaces are sometimes rendered more conspicuous by having a border round each, formed by a fissure in the crust. This occurs abundantly in the genus *Lecidea*. (Plate V., Fig. 7.)

Pulverulent† thallus.—This is the granulose thallus, having the granules more minutely divided, appearing under a pocket lens as if dusted over the surface with a fine dry powder. This is one of the least developed forms of a Lichen thallus.

Besides these more marked forms of the thallus there are many variations, the terms for describing which will be found in an admirable glossary in "Leighton's Lichen Flora."

There are two terms of frequent use in describing the thallus which it may be well to explain here. When a thallus presents a definite outline, clearly marking how far it extends on the rock or bark, it is said to be *determinate*. When there is no distinct or clearly defined outline, but it dies away in patches, it is said to be *effused* or *indeterminate*.

The *size* of the thallus varies from a minute point only to be seen by the aid of a magnifying glass up to one or even two square feet in superficial extent. We refer exclusively to British Lichens. The genera which contain the largest species are *Sticta*, *Stictina*, *Peltigera*, *Parmelia*, *Usnea*, and *Ramalina*. Occasionally species belonging to other genera than these named, will, under particularly favourable circumstances, extend their thallus to an unusual size.

The *colour* of the thallus includes all shades of green, varying to yellow in one direction, to brown in another, and to blue in another. It may be black, or gray, or white; it may be pale yellow, citron yellow, or orange yellow; never blue or red, except modified very much by other tints. As a rule, the *gonidia* contribute largely to the colour of the thallus, and become more conspicuous when moistened by water, hence the predominance of green.

The texture of the thallus may be soft and gelatinous, as in *Collema*; spongy, as in *Peltigera*; fragile, as in *Stereocaulon*; tough, as in *Cetraria*; firm and hard as in *Roccella*; tartarious and brittle, as in many of the *Lecideæ*. In fact, the variations are infinite.

Having thus briefly glanced at the external characters of the Lichen thallus that are mostly perceptible to the unaided vision, we shall next proceed to point out the main features of the microscopic structure of the thallus.

[TO BE CONTINUED.]

* From *areola*, Latin for a little bed, or quarter, in a garden.

† From *pulvis*, Latin for dust.

MIDLAND UNION OF NATURAL HISTORY SOCIETIES.

NORTHAMPTON MEETING, JUNE, 1880.

GEOLOGICAL EXCURSION.

On the route settled for the Geological Excursion on Friday, June 18th, the following formations will be encountered:—Glacial Gravel; Great Oolite Limestone; Great Oolite, Upper Estuarine Clay; Inferior Oolite, Lower Estuarine series and Ironstone, Northampton Sands; Upper Lias, Middle and Lower Lias.

I.—Leave Northampton and proceed in a north-easterly direction to the boring by the Water Company, near to the petrifying spring on the Kettering Road. The well-sinking commences at the surface of the Upper Lias Clay, which it penetrates through a thickness of about 150ft. It then passes through 37ft. of Middle Lias, and then through about 25ft. of Lower Lias; to a total depth of 213ft. From the bottom of the well a boring was carried down a further depth of 157ft. 6in. in the Lower Lias; no water, works abandoned for some time. The Company are now proceeding with a 15in. or 16in. bore, and have passed through the Lower Lias, the object being to penetrate to the water stones of the Lower Keuper. From here by the Racecourse to

II.—Bass's Pit.—The section is here based by the Upper Lias Clay. This passes up into the ironstone beds of the Northampton Sand, and is surrounded by the white sand of the Lower Estuarine.

III.—Kingsthorpe Brick Pit.—If the section be in a favourable condition the junction of the Lias and Inferior Oolite will be well shown.

IV.—Shittlewell Quarry.—Lower Estuarine of Northampton Sand.—The section here is a continuation upwards of that in the brick pit, with rock beds more calcareous than ferruginous. False bedding to be observed, and action of water charged with carbonic acid. The white sand of the Lower Estuarine comes in at the top of this section. Then through the village of Kingsthorpe to

V.—Kingsthorpe Sand and Sandstone Pits.—Ironstone is here observable at the base, the main section consisting of Lower Estuarine Sand or Sandstone. Plant bed "Oolitic Coal." Here will be read the sectional remarks upon coal of Samuel Sharpe, Esq., F.G.S., (from his second edition of "Rudiments of Geology,") as revised and approved by the greatest living authority upon that subject. Then towards

VI. and VII.—Boughten Green to Moulton Park Pits and Bank's Pit.—Exhibiting Upper Estuarine Clay and Limestone, (Great Oolite,) and Glacial Gravel. Then back through Northampton to

VIII.—Duston Ironstone Quarries.—Here on the south-west side of the Weedon Road is a brick pit in the Upper Lias Clay. In the Ironstone Quarry the base-bed consists of a dense dark-green arenaceous bed, deposited under the same conditions as those above them, but unaltered by oxidation, containing less iron but more phosphoric acid. Fossils in this bed have usually their tests preserved, and are frequently of a pure white colour. Higher up the beds are more ferruginous, but with some green cores; above they vary in condition, but are red throughout. From a bed in this quarry Mr. Sharpe obtained a beautiful Star-fish, *Stellaster Sharpii*, now in the British Museum. Specimens of casts of corals are numerous, frequently with the crypts of the little boring Mollusc, *Lithodomus inclusus;* Ammonites *(Murchisonæ, corrugatus,* &c.,) *Nautilus obesus*, and numerous fossils of the Inferior Oolite have been collected. There is a band almost made up of *Astarte elegans*, which band occurring in other quarries to the west marks an horizon over a considerable area.

IX.—Duston Old Quarry.—Red building stone, Inferior Oolite. At the base of this section is a green-hearted stone. In the bed above are also some green-hearted stones and the band of *Astarte elegans*, which, however, in the last quarry was much higher up. At the top the white sand of the Lower Estuarine comes in. The same general series of fossils as those of the Duston Ironstone Quarry have been procured from these beds, and in addition wave-rippled slabs. Tooth of *Megalosaurus*.

X.—Watkin's Brick Pit.—Lower Estuarine, (Inferior Oolite,) Upper Estuarine (Great Oolite) junction with limestone. The upper part of the white sand of the Lower Estuarine may be noted here, above which the only section of the Upper Estuarine Clay exposed in the area traversed is to be seen. The junction of this clay with the Great Oolite Limestone may be seen near the top of the section.

XI.—Watkin's Limestone Pit.—Great Oolite.—This is a shallow pit, the beds of which are less marly than those at Kingsthorpe, but yield the same series of fossils.

WM. HULL.

BOTANICAL NOTES.

I have been requested to give a few notes on the plants likely to be met with near Northampton by the members who attend the Annual Meeting. Visitors entering the county by Market Harboro', and taking the London and North-Western Railway to Northampton, will pass through pretty scenery, following the course of that branch of the Nene which rises on Naseby Field; to the right of the line, on the same side, is Maidwell Dales, the most easterly habitat of *Polystichum aculeatum*. In the sandy fields of the adjoining village of Spratton, the Rev. J. M. Berkeley has gathered the rare *Arnoseris pusilla*; on the left hand, eight miles from Northampton, is Lamport Hall, the seat of Sir Charles Isham, the garden containing some good Alpine plants, while in the rectory pond *Acorus calamus* still grows. From Lamport to Northampton the *Colchicum* occurs plentifully in the meadows, although a continual war is waged against it by farmers, who from time to time lose cattle from eating the capsules and leaves. Near Kingsthorpe, by the rail side, occurs a *Lepidium*, which was at first referred to *Smithii*, but having yellow anthers, shorter styles, and greener foliage, it considerably differs, and may eventually prove to be some other species, coming nearer to *L. heterophyllum* as it certainly does.

The old London and North-Western railway line from Rugby, *via* Blisworth, passes just before reaching Weedon the old habitat at Brockhall for *Eryngium campestre*; nearly opposite the ground rises to Borough Hill, 800ft. above the sea level, on the sandy slopes of which occur *Jasione montana*, *Hieracium boreale*, *Serratula tinctoria*, *Solidago Virga aurea*, *Rosa pimpinellifolia*, *Rosa implexa*, &c. The marshy ground about Dodford yields *Parnassia* and *Polygonum Bistorta*. Weedon has been decided to be the central point of England. Between Weedon and Blisworth Mr. Borrer once thought he saw *Barbarea stricta*, but the record has never been confirmed; the high hedges just before reaching Blisworth, however, contain *Rosa coriifolia*, *Reuteri*, *verticillacantha*, *tomentella*, *sphærica*, *Rubus diversifolius*, *rudis*, &c. The elevated ground above Blisworth, worked for iron ore and limestone, yields *Rosa mollis* and *scabriuscula*, *Campanula latifolia*, &c.: and farther on, near the entrance to the park of our President, Sir Herewald Wake, Bart., *Gagea lutea*, *Viola permixta*, *Campanula Trachelium*, and *Lamium galeobdolon* have been found.

Those members who combine Botany and Geology may find *Artemisia absinthium* and *vulgaris*, *Epilobium brachycarpum*, *Astragalus glycyphyllos*, *Atriplex deltoides*, *Rubus diversifolius*, &c. At the Duston pits and at Watkin's brick pits, *Crepis taraxacifolia*; the roadside between there and Northampton yielding *Rumex pulcher* and *Calamintha menthifolia*.

A short walk by the canal side towards Hunsbury Hill might add *Iris Pseudacorus vera*, *Stellaria glauca*, *Nasturtium amphibium*, *Montia rivularis*, *Butomus umbellatus*, with its lovely flowers, and in the canal and river *Œnanthe fluviatilis*, *Potamogeton mucronatus*, and possibly *P. prælongus*. A short distance below Northampton are the sewage works, and mal-odorous as is the locality, that will prove no insurmountable obstacle to the enthusiastic botanist who wants to add *Lepidium Draba*, *Sisymbrium Sophia*, *Chenopodium olidum*, *rubrum*, *viride*, *paganum*, *Atriplex Smithii*, *angustifolia*, *hastata*, *Datura stramonium*, *Polypogon monspeliensis*, *Schleroschloa distans*, or *Melilotus officinalis* and *alba* to his collection. In addition to the list of plants given in Mr. Scriven's interesting paper on Yardley Chase may be mentioned as likely to be found: *Pedicularis sylvatica*, *Carex remota*, *sylvatica*, *glauca*, possibly *Strigosa*, *Potentilla procumbens*, *Helleborus fœtidus*, *Lathyrus sylvestris*, *Monotropa*, *Neottia nidus avis*, *Habenaria chlorantha*, *Spirea filipendula*, *Pyrus communis* and *aria*, *Scirpus sylvaticus*, &c., and in Castle Ashby ponds *Myriophyllum spicatum*, *Ceratophyllum submersum*, &c. The ponds between Northampton and Hardingstone should be visited by microscopists, as they are singularly rich in Desmids, &c.

I can only wish that each visitor may as much enjoy his or her Northamptonshire rambles as the writer has, and should the weather prove favourable, there is little doubt that the meeting will be thoroughly enjoyed, and prove remunerative to students of all branches of Natural History.

G. C. DRUCE, F.L.S.

THE CRYPTOGAMIC FLORA OF WARWICKSHIRE.

BY JAMES E. BAGNALL.

(Continued from page 83.)

492.—*Rhynchostegium tenellum* Dicks. *Hypnum tenellum* Dicks., Wils., Berk., Hobk. On walls and wall tops, rare. On stone coping and brick work of the railway bridge between Sheldon and Marston Green ! December.

494.—*R. confertum* Dicks. *Hypnum confertum* Sm., Wils., Berk., Hobk. Shady banks, roots of trees, woods, &c., not unfrequent. Sutton Park, in many places ! Copt Heath ! Solihull ! road from Warwick to Stratford ! Acocks Green ! October.

I find a form of this species with complanate foliage on a bank in the lane from Olton station to Shirley, which I think is var. *b. serrulatum* Turn.

496.—*R. murale* Hedw. *Hypnum murale* Hedw., Wils., Hobk. On walls and bridges, local. Bridge over Canal near Acocks Green ! Sutton Park, on Hartopp's Park wall ! Stone wall near New Fillongley Hall ! &c. November.

497.—*R. rusciforme* Weis. *Hypnum ruscifolium* Dill., Wils., Berk., Hobk. Stones near streams and water-falls, walls, damp walls, &c., frequent. Sutton Park, water-fall at Bracebridge Pool ! Arbury Park ! Near Holywell ! Curdworth ! Solihull, &c. November.

499.—*Plagiothecium latebricola* Wils. *Leskea latebricola* Wils. (Wils.) *Hypnum latebricola* Hobk. *Philoscia latebricola* Berk. On decayed stems of *Valeriana officinalis*, very rare. Windley Pool Coppice 1868 ! not abundant. Abundant in Waters Wood, Shustoke, 1880.

By the kindness of Dr. Braithwaite I have recently had the opportunity of comparing my plant with specimens named by Dr. Lindberg, and find my plant identical with them.

502.—*P. denticulatum* L. *Hypnum denticulatum* Dill., Wils., Berk., Hobk. In damp woods and on damp banks. Frequent, July. Sutton Park ! New Park ! Middleton Park, Solihull ! &c.

503.—*P. elegans* Hook. *Hypnum elegans* Hook., Wils., Berk., Hobk. On dry banks in woods, very local. Sutton Park in several places ! This I have also carefully compared with specimens from Dr. Lindberg.

504.—*P. sylvaticum* L. *Hypnum sylvaticum* L., Wils., Berk., Hobk. On moist banks and tree roots near water, local. Marsh above Powell's Pool, Sutton Park, in good fruit 1870 ! Shirley ! Bearley ! Hartshill Hayes ! September.

505.—*P. undulatum* L. *Hypnum undulatum* Wils., Berk., Hobk. On damp banks, in woods, and heath lands, "Coleshill, Allesley, Rev. W. T. Bree," Purt., local. Sutton Park ! Hartshill Hayes ! Trickley Coppice ! Not found in fruit.

510.—*Amblystegium serpens* L. *Hypnum serpens* L., Wils., Berk., Hobk. Banks, roots of trees, damp walls, &c., very common. Sutton Park ! Olton ! Acocks Green ! Yarningale Common ! &c. May.

511.—*A. radicale* P. Beauv. *Hypnum radicale* Wils., Berk., Hobk. On the roots of trees near water, very rare. On the roots of alders in coppice by Windley Pool, in fruit ! 1876. May.

512.—*A. irriguum* Wils. *Hypnum irriguum* Hook et Wils., Wils., Berk., Hobk. On damp stone and brickwork near water, rare. Keeper's Pool, Sutton Park ! April.

513.—*A. fluviatile* Swartz. *Hypnum fluviatile*, Sw. Very rare. On a water-wheel in Sutton Park ! January, 1877, fairly abundant.

514.—*A. riparium* L. *Hypnum riparium* L., Wils., Berk., Hobk. On damp wood and stone work in pools, canals, &c., June, frequent. Brinklow ! Canal bank, Olton ! Sutton Park, Acocks Green !

Var. *longifolium* Brid. On the brickwork of a well near Sutton Park, and in Windley Pool Coppice, Sutton Park. A very peculiar form, having the habit of *Fontinalis.*

515.—*Hypnum aduncum* Hedw. *H. Kneiffii* B. and S., Wils., Berk., Hobk. Marshes and marshy meadows, rare. Sutton Park!

Recorded by Purton from Bidford Grange, (Bree,) but from his remarks it seems evident that he did not understand this species. Found by Webb in fruit, Sutton Park.

516.—*H. exannulatum* Gümb. Bogs and marshes, local. Keeper's Pool, Sutton Park! Long Moor Mill Pool! In a marsh by Blythe Bridge! Bog near Packington Park! *H. aduncum* Wils., Bry., Brit.

517.—*H. vernicosum* Lindb. *H. pellucidum* Wils. MSS. In deep marshes, rare. With fertile flowers by Windley Pool and Bracebridge Pool, Sutton Park!

518.—*H. Cossoni* Schpr. *H. intermedium* Lindb. Marshes, rare. Keeper's Pool, and other pools at Sutton Park.

I have recently had an opportunity of comparing this plant with an authentic specimen of *H. intermedium* from Dr. Lindberg, and find the two plants identical. Fruiting, May, 1878.

519.—*H. Sendtneri* Schp. Marshes, rare. Long Moor Mill Pool!

522.—*H. fluitans* L. Pools and slow streams frequent, rare in fruit. Sutton Park in many places! Marston Green! Blythe Bridge! A more rigid form than type, with sub-erect capsules, occurs on the border of the stream above Long Moor Mill Pool, Sutton Park! April—June.

523.—[*H. uncinatum* Hedw. I have a specimen of this moss, found by H. Webb at Moseley, on walls; it may possibly occur in the Lias districts of Warwickshire.]

524.—*H. filicinum* L. Marshes, drains, and damp banks in a marly soil, rare in fruit. In good fruit, Keeper's Pool, Sutton Park! and Canal Bank, near Rowington! Arley! Coleshill Pool! near Stratford-on Avon. April—May.

525.—*H. commutatum* Hedw. Marshes, and near streams, local. Near most of the pools in Sutton Park, but very rarely fruiting! Canal bank, near Rowington! April.

526.—*H. falcatum* Bridel. Marshes, and near streams, rare in fruit, very local. In fruit April, 1869, at Long Moor Mill Pool! Occurring at most of the other pools in Sutton Park! A variety, probably H. sulcatum *Schpr.*, occurs at Bracebridge Pool, Sutton Park!

535.—*H. cupressiforme* L. Trees, stones, heaths, woods, &c. Winter. A frequent and very variable species. Type frequent.

Var. minus. Sutton Park!

Var. lacunosum. *Hoffm.* Churchyard wall, Milverton!

Var. filiforme. On trees, Marston Green!

Var. elatum. Bracebridge Pool, Sutton Park!

H. resupinatum Wils. *H. cupressiforme* var., Berk. Local. On trees. Marston Green! Sutton Park, Olton! &c. This is a distinct variety, quite unlike type in habit. Winter.

H. Lindbergii Mitt. *H. pratense* var. *b*, Wils., Berk. Damp heathy wayside, rare. Lane, near Sharman's Cross, Shirley! Sutton Park, by Bracebridge Pool! Near Berkswell Railway Station. Lane from Four Ashes to Hockley!

538.—*H. molluscum* Hedw. Banks in a marly soil. Local. Sutton Park, near Long Moor Mill Pool! Marl Cliff! Bearley! Near Stratford-on-Avon! In fruit near Wixford, December, 1875! Near Arley!

540.—*H. palustre* L. Rare. On stone and brickwork, near water. In a drain, canal bank, near Holywell! On brickwork of dam, Bracebridge Pool, Sutton Park! Barren.

548.—[*H. Sommerfelti* Myr. On calcareous banks.
This moss I have found on the calcareous banks of canal near Hayhead, Staffordshire, and it will probably be found in like habitats in Warwickshire.]

550.—*H. chrysophyllum* Brid. On marly heath lands, rare. Yarningale Common, near Claverdon! Marly banks of Rowington Canal! Barren.

552.—*H. stellatum* Schreb. Marshes and damp marly banks. Local. Several of the marshes in Sutton Park! Marshy heathland, Ballard's Green, near Arley Wood! Marly bank, Wixford, on the way for Exhall! July.

551.—*H. polygamum* B. and S. Tree roots near water, rare. Side of stream above Blackroot Pool, Sutton Park! Marsh, near Tythall Lane, Solihull!

Var. *b*, *stagnatum* Wils. In a pond near Stratford-on-Avon, in the Alcester Road!

553.—*H. cordifolium* Hedw. Marshes and bogs, rare. Sutton Park near Bracebridge Pool! Windley and Long Moor Mill Pool, in fine fruit! May.

554.—*H. giganteum* Schpr. Marshes and pools, rare. Long Moor Mill, Bracebridge and Keepers' Pools, Sutton Park! Marsh near railway station, Acocks Green!

556.—*H. cuspidatum* L. Marshes, bogs, and wet places, frequent. Fruiting abundantly in most of the marshes in Sutton Park. Blythe Bridge! Arbury Park! &c. April.

557.—*H. Schreberi* Ehrh. Banks, heaths, woods, local. Abundant in Sutton Park, always barren! Near Solihull! Haywoods!

558.—*H. purum* L. Heaths, woods, banks, &c., frequent, rare in fruit. In good fruit on a bank near Bentley Heath, January, 1871! Sutton Park! &c. December.

559.—*H. stramineum* Dicks. Marshes and bogs, rare. Near Long Moor Mill, Bracebridge, and Blackroot Pools, Sutton Park!

561.—[*H. scorpioides* L. Was found by H. Webb at Moseley, near Birmingham, in a marsh near where the College now stands. I have never found it in Warwickshire.]

562.—*Hylocomium splendens* Dill., Hedw. *Hypnum splendens* Hedw., Wils., Berk., Hobk. Banks and woods, Local. Banks near Blythe Bridge, Solihull! Canal banks near Olton! Rowington! Shrewley Heath! Spring Wood! and Chalcot Wood, near Hockley!

565.—*H. brevirostre* Ehrh. *Hypnum brevirostre* Ehrh., Wils., Hobk., Berk. *Hypnum triquetrum, var. b minus.* Purt. "Wood abundant. Woods, Allesley and Meriden, (Bree.)"

I have not seen this in Warwickshire.

566.—*H. squarrosum* L. *Hypnum squarrosum* L. Wils., Berk., Hobk. Woods, banks, pastures, in damp places, frequent, rare in fruit. In fruit above Blackroot Pool, Sutton Park, November, 1868! and in Arbury Park, with old capsules, near the Hall!

567.—*H. loreum* L. *Hypnum loreum* L. Wils., Hobk., Purt. "Woods and on heaths among bushes in dry mountainous countries, common; woods, Allesley (Bree.)"

568.—*H. triquetrum* L. *Hypnum triquetrum* L. Wils., Berk., Hobk. Banks and woods in a marly soil. Local. Canal bank, near Olton! Middleton Wood! Wood near Moor Hall! Bearley Bushes! &c. November.

The following additions have been made during the present year, viz.:—

455.—*Pylaisia polyantha* Schreb. *Leskea polyantha* Wils., Hobk. On trees, rare. Frogmore Wood, Temple Balsall.

521.—*Hypnum revolvens* Swartz. In marshes, rare. Abundant at Earl's Wood, near Reservoir. May.

I have also found *Campylopus flexuosus* abundant in Sutton Park, thus confirming Purton's observation of its occurrence in Warwickshire; and *Mnium rostratum*, Shustoke, in fine fruit, April, 1880, recorded by Purton from Oversley Hill, but thought to be doubtful as a Warwickshire plant.

A VISIT TO THE CRESWELL CAVES.

BY JAMES SHIPMAN.

During the latter years of the late Duke of Portland it was a rare thing to be permitted to visit Welbeck. Not so much, perhaps, because the old duke had any great objection to sightseers themselves as from a strong desire to let the outside world know as little as possible of what was going on in the way of alterations and improvements on the estate, until such time as his plans were completed. When, therefore, the Nottingham Naturalists' Society obtained permission to visit the princely halls of Welbeck and the pre-historic caves at Creswell Crags, the event was looked forward to with unusual interest. The annual excursion of the Society in July last year was devoted to this classic ground, but the weather proving unpropitious, arrangements were made for this, the second visit, a week or two afterwards.

The stretch of country it was felt desirable to traverse necessitated an early start for those who meant to go over the whole of the ground. Accordingly, the party set out while the mist of approaching rain was as yet undistinguishable from the gray light of dawn, reaching the quiet, straggling hamlet of Creswell at about half-past seven. Physical needs had not been forgotten, and a very refreshing breakfast awaited the visitors at Mr. Woodhead's cottage.

There is nothing very remarkable about the country as seen from the village, which is nestled in a small valley worn out of the Lower Magnesian Limestone of the Permian. It is in the ravines, or "grips" as they are called, formed by the streamlets eating their way through the limestone rocks, where the most charming scenery is met with. Even to the non-scientific the pleasure derived from a stroll along these glens is almost enough to induce them to become geologists. The most interesting of these ravines seemed to lie among the gentle hills away to the north-west of Creswell. Leaving Creswell, therefore, and tracing the brisk Wolland in the direction of its source, the excursionists soon found themselves descending into one of those glens, called Hollin Hill Grip, where the thin-bedded lilac-weathered limestone rocks rose into wall-like cliffs on each side. Occasionally the winding cliffs assumed the appearance of small dismantled turrets or bastions, now grass-grown, with here and there a fissure or a recess, partly concealed by young trees and creepers, while the gnarled oak (*Quercus pedunculata*) was observed curiously adapting its stem to the geometrical lines of bedding and of joint-planes in the limestone rocks. Another of these picturesque glens was Markland Grip, if anything even prettier than Hollin Hill, while the ground between the two cliffs was a level lawn of long grass. The streamlet which had formed this charming rock-work was almost lost to sight as it hurried along at the foot of the cliff on our left. It furnished a good illustration of the work capable of being performed by a tiny rivulet in a hilly district; indeed, to anyone but a geologist it must have seemed as if the ravine was formed for the streamlet, and not that the latter had scooped out the ravine. Once more threading country lanes for about a mile, we came to a narrow dale, fringed with young trees on each side. This was Markland Hollow. As we descended, water could be heard trickling deep in the recesses hidden by the foliage on our right, and presently we saw the stream emerging from among huge masses of fallen rock.

Returning to Creswell, after a circuit of about four miles, the excursionists were joined by a contingent who had come up by a later train, the party now numbering something like eighty, including a good sprinkling of ladies. A move was then made towards Creswell Crags, which, through the labours of the Rev. J. M. Mello and Prof. Boyd Dawkins, have recently proved so rich in the remains of Post-Pliocene animals and of Palæolithic man.* But what, and where, are Creswell Crags? Just on the brow of the gentle ridge of limestone that hems in the vale of Creswell on the east, and at a spot about half a mile from the village, a patch of dark green could be seen, while in the interstices of the clustering foliage could be discerned the bluish-gray limestone that formed the walls of a ravine. This was Creswell Crags. The ravine in which the caves are situated runs east and west, and was evidently formed by the stream which flows through it, but which has of late years been dammed up and converted into a lake stretching from cliff to cliff—the lake being about four hundred feet wide. This ravine is about one-third of a mile in length, and is bounded by beautifully wooded cliffs, in places fifty or sixty feet high. The limestone is very hard and massive here, with an easterly dip rather difficult to trace; and on either side of the ravine the crags are much fissured, now and then forming tolerably-sized caverns, which open some fifteen feet above the level of the lake. Altogether the scene presented by Creswell Crags is extremely pretty, and reminds one of the more majestic, though perhaps not more picturesque scenery of the Derbyshire Carboniferous Limestone. The caves are all, save one, on the the north or Derbyshire side of the ravine, this ravine being the boundary between that county and Notts. The difficulty of clambering up the talus to the caves, saturated as the ground was with the almost continuous rain, did not at all deter the ladies from making the attempt, and they explored the caves with characteristic curiosity.

The first cave entered was the "Pin Hole," which penetrates horizontally some forty or fifty yards into the hill. The deposits which formed the floor of this cave (to quote the authors above-mentioned) consisted of a few inches of surface soil, in which a fine flint flake was found. Below this came red sand, rich in bones, many having evidently

*Quarterly Journal Geological Society, Vol. XXXI-II-III.

met with. The bones were in various stages of preservation, though lying side by side. Besides the remains of the larger animals, great quantities of the teeth and bones of small rodents *(Arvicola*, &c.,) were disseminated through the sand, which also contained cycloid fish scales been gnawed by hyenas, of which numerous teeth and lower jaws were and other fish remains. This deposit rested on a highly calcareous sand cemented into semi-concretionary-looking masses, but containing no bones.

The next cave, called "Robin Hood's Parlour," was about a hundred yards further on. This cave contained five or six chambers, and was lighted with candles. The excavations carried out here disclosed the following interesting succession of deposits :—

(a) Dark surface soil, (two to five inches,) containing fragments of Roman and Mediæval pottery, a human incisor, and some bones of sheep, hare, hog, goat, dog, and the Celtic shorthorn.

(b) Very hard limestone-breccia, (a few inches to three feet,) cemented with masses of stalagmite, and containing a large number of bones of hare, fox, horse, woolly rhinoceros, wild boar, Irish elk, bison, reindeer, wolf, numerous flint flakes and chips, as well as one or two flint cores, and a few quartzite implements.

(c) Cave-earth —light-coloured calcareous sand, (a few inches to three feet,) containing flint implements, split or chipped quartzite pebbles, evidently fashioned by man, some decidedly Palæolithic, as well as remains of the lion, spotted hyena, fox, wolf, grizzly bear, Irish elk, reindeer, bison, horse, woolly rhinoceros, and mammoth.

(d) Red sand, containing comparatively few bones, but many worked quartzite pebbles, and having near its base patches of highly laminated red clay. The bones were of the same kinds as those in the cave-earth, with the addition of the hare.

The most important of all the discoveries in Robin Hood's Parlour, however, was a small fragment of a rib-bone, on which was a rude incised picture of the fore part of a horse, exactly similar to the Palæolithic figures that have been found in some of the Continental caves. At the far end of the same chamber, in the same cave-earth, at a depth of about one foot, was found a canine of *Machairodus latidens*, "a formidable animal, with teeth not unlike sabres, with serrated edge," whose remains have only twice before been found in England.

According to Professor Dawkins, this cave furnished evidence of having been inhabited by the same kind of Palæolithic men as the caves of the South of England, of France, Belgium, and Switzerland. A comparison of the bones and implements showed that the great majority of the animals in this cave were killed and eaten by hyenas; while the smoothed and rounded surfaces of many of the teeth and bones indicated that this occupation was occasionally interrupted by floods. While the red loam *(d)* so abundant in the caves in the South of England was accumulating, the hyenas which inhabited the cave were disturbed by the visits of Palæolithic hunters, who left behind them implements of quartzite, ironstone, greenstone, and flint.* The numerous flint-flakes and fragments of charcoal in the breccia above the cave-earth seem to indicate that man was then the normal inhabitant of the cave; while the broken bones of that animal prove that he fed on hares. Although the remains of the dog were found in the deposit, the associated appearances lead to the belief that it was not then the companion of man.

Passing round to the opposite side of the lake, the visitors entered what is called "The Church Hole," a fissure-cave in the cliff about five feet wide, and about fifteen feet above the level of the water. It runs horizontally into the limestone for 155 feet, and then rises at a considerable angle for another forty-one feet, where it ends in a choked-up crack. A passage had been cut through the deposits which formed the floor of this cave, showing a section of them on either hand. A large number of bones of the woolly rhinoceros, the mammoth, the horse, the reindeer, the bison, the brown bear, and the hyena were met with during the excavations here. The greatest thickness of these deposits was nine feet, which occurred at a point thirty-one feet from the entrance to the cave. The deposits themselves were found to be almost identical in character with those of "Robin Hood's Parlour," and doubtless were accumulated at the same time and under similar conditions. It only remains to be added that this cave was illuminated by lime light.

"In the Creswell Caves," says the Rev. J. M. Mello, F.G.S., in a very interesting paper read before the Burton-on-Trent Natural History and Archæological Society,† "they had a most important chapter in the history of early man—a sequence of implement-bearing beds, which showed a progress in civilisation such as had not been observed in any other series of caverns in any other part of the world. They learned from them that even the Palæolithic age of man had its periods—the earliest, that in which man was a savage in the very lowest stage of civilisation, having only such tools as he could roughly fashion out of pebbles. These were followed by tools made of flint, as a more tractable and better cutting material. Those were improved upon, and were even supplemented by bone and other materials for tools. The discoveries at Creswell, where the better-finished type of implements were found above the ruder, showed either that the more civilised men succeeded the earlier savage race, or that the latter, in the course of ages, improved in the art of tool-making, and learnt not only to shape the flint more elaborately, but also to make use of bone for domestic purposes."

The remainder of the day was devoted to an inspection of the magnificent subterranean galleries and halls of Welbeck Abbey, two miles away. Here the marvellous dimensions of some of the buildings, and the richness of ornamentation that met the eye at every turn, excited wonder and admiration, though why the majority of the new apartments should be constructed with their ceilings level with the grassy slopes of the park was a paradox no one could solve.

* The implements and ornaments of Palæolithic age found in Robin Hood's Cave alone amounted to no less than 1,040.

† "Caves and their Occupants," in the "Third Annual Report of the Burton-on-Trent Natural History and Archæological Society." (1879.)

METEOROLOGY OF THE MIDLANDS.

THE WEATHER OF APRIL, 1880.

BY W. JEROME HARRISON. F.G.S.

April, true to its traditions, brought some very changeable weather. The first week was wet and stormy, with strong south-west winds, and thunderstorms on the 5th and 6th. Then the wind changed, and continued cold and dry from the north-east for the rest of the month. Rain fell frequently, but in small quantities; there was a hailstorm on the 26th. Sky generally cloudy, although there were a few bright days, and only one or two frosty nights. Lunar halo seen at Loughborough on 19th. Vegetation generally backward, but in advance of 1879. General indications taken in connection with the re-appearance of sun-spots and auroras point to a cessation of wet seasons and a hot summer.

Natural History Notes by Observers.—*Coventry.*—The rainfall of April has not been up to the average, and during a great part of the month we have had cold and drying winds from the north-east. The weather has not been such as to force a rapid growth of vegetation, but the continued drying process which the land has been sustaining is for the most part very favourable. The spring-sown grain has been well got in, and has come up healthy and regular, and the low-lying meadows are again becoming dry and sound. It is only by walking over the low or ill-drained land that one can realise the astonishing deterioration which frequent floods and wet seasons have produced. In many places which used to be good pasture, the finer grasses have nearly disappeared, and have been supplanted by a growth of coarse water weeds and sedges. The spring can scarcely be said to be an early one, but still it is much in advance of last year. The elms and the hedges are already green with leaf, and everything is in a condition to make a very rapid growth if we have warm rains. The fruit trees promise quite as well for blossom as might be expected, considering that the fruit-bearing wood was ill-ripened by the cold summer of 1879. At Stoke, I notice that the trees which have the best appearance of blossom are those which happen to have their trunks protected by a growth of ivy or woodbine around them. *Uppingham.*—*Prunus spinosa* in flower by April 10th; *Vicia sepium*, 10th; *Cardamine pratensis*, *Geranium Robertianum*, and *Primula veris*, 11th; *Anthriscus sylvestris*, 14th; *Veronica Chamædrys*, 27th; *Stellaria Holostea*, 28th; *Ajuga reptans*, 29th; Chiff-chaff *(Phylloscopus collybita)* and Willow Wren *(P. trochilus)* heard on 4th; Nightingale *(Daulias luscinia,)* 17th; Cuckoo *(Cuculus canorus,)* 27th; Swallow *(Hirundo rustica,)* seen 23rd. *Wrottesley.*—Swallows first seen on April 19th; Cuckoo first heard, 24th; Plums and Cherries in bloom, 26th, nearly a month earlier than last year. *Woolstaston Rectory.*—Cuckoo first heard on 27th. *Shifnal.*—Young Rooks hatched on 9th, Sand Martins arrived on 12th, wild Cherry blossoms on 19th, when first Swallow *(H. rustica)* seen; Willow Wrens arrived on 24th, Cuckoo heard 26th, Damson trees in full bloom on 27th. *Stratford-upon-Avon.*—Swallows seen, 16th; Oak leafing, 20th; Ash makes no sign as yet. *Coston, Melton Mowbray.*—Cuckoo heard, 27th. *More Rectory.*—Garden Warblers arrived, 6th; Swallows, 22nd; Redstarts, 30th. *Burton-on-Trent.*—Horse Chestnut leaf, 12th; large white Butterfly, 3rd; Queen Wasp, 4th. *Altarnun.*—Cuckoo heard, 19th; Water Ousel's nest and eggs found on 17th; Whortleberry in abundant flower on 20th. *Stroud.*—Cuckoo heard, 28th. *Oakamoor.*—Cuckoo heard, 18th. *Orleton.*—Swallows on 21st; Chiff-chaff, 24th; Cuckoo, 23rd. *Bishop's Castle.*—Martins seen here on 30th, but at Clun on 27th; Cuckoo not yet heard (May 1st) probably owing to dry weather, as I observe him to be more musical in wet than in dry weather. *Waltham.*—Cuckoo, 20th; Swallows, 25th; Lesser Celandine flowered 2nd. *Castle Ashby.*—Nightingale heard on 20th, Cuckoo on 22nd. *Cheltenham.*—22nd, *Cardamine pratensis*, abundant in Severn Valley on meadows flooded last year; a beautiful sight. 23rd, *Cuculus canorus*, near Tewkesbury; *Phylloscopus trochilus.* 24th, *Hirundo rustica* (six) over fish-pond. 30th, *Fringilla cœlebs* nesting in garden. 23rd, a Robin's nest, with eggs, by water side; Whitethroats common. 22nd, Apple trees in full bloom; Plums nearly over.

STATION.	OBSERVER.	RAINFALL.				TEMPERATURE.			
		Total for M.	Greatest fall in 24 hours.		No. of rainy d.	Greatest ht.		Great'st cold	
		In.	In.	Date.		Deg	Date.	Deg	Date.
GLOUCESTERSHIRE.									
Cheltenham	R. Tyrer, Esq.	1·88	·35	3	18	61·3	19	27·5	30
Stroud	S. J. Coley, Esq.	3·08	·75	1 & 4	14	62·0	19 & 21	32·0	27
SHROPSHIRE.									
Haughton Hall, Shifnal	Rev. J. Brooke	1·57	·42	15	17	60·0	19	29·0	30
Woolstaston	Rev. E. D. Carr	2·11	·66	3	17	60·0	20	28·0	30
More Rectory, Bishop's Castle	Rev. A. Male	2·15	·45	7	19	60 0	19	29·0	30
Larden Hall	Miss F. R. Boughton	2·39			17				
Bishop's Castle	E. Griffiths, Esq.	1·86	·40	3	17	63·0	30	30·0	11, 27, 30
Cardington	Rev. W. Elliot	1·91	·46	3	18				
HEREFORDSHIRE.									
Stoke Bliss	Rev. G. E. Alexander	1·91	·53	15	18	59·0	20	33·0	26 & 29
WORCESTERSHIRE.									
Orleton, Tenbury	T. H. Davis, Esq.	2·12	·72	15	20	66·2	21	27·3	30
West Malvern	A. H. Hartland, Esq.	2·17	·43	15	19	60·0	20 & 23	31·0	26
Pedmore	E. B. Marten, Esq.	1·55	·47	15	14	65·0	22	25·0	29
Longlands, Stourbridge	J Jeffries, Esq	1·58	·45	15	13	63·0	20	30·0	29
Dennis, Stourbridge	Mr. C. Webb	1 40	·43	16	17	61·0	3	30 0	30
Evesham	T. J. Slatter, Esq.	1 73	·34	15	21	63·5	20	31·5	30
STAFFORDSHIRE.									
Dudley	Mr. J. Fisher	·94	·43	3	8	76·0	19, 20, 23	32·0	27 & 29
Kinver	Rev. W. H. Bolton	1·39	·49	3	15	63 0	19	29 0	29
Walsall	Mr. N. E. Best	1·90	·58	15	14	62·0	18	30 0	29
Grammar School, Burton	C. U. Tripp, Esq.	1·46	·67	3	14	68·0	18	32·0	30
Weston-under-Lyziard R'tory	Hon. and Rev. J. Bridgeman	1·61	·39	15	14	62·0	21	30·0	30
Wrottesley	E. Simpson, Esq.	1·44	·41	3	12	59·3	20	29·5	30
Heath House, Cheadle	J. C. Philips, Esq.	1·43	·31	15	14	59·0	3	31·0	30
Farley, near Cheadle	C L Wragge, Esq.	1·35	·38	3	12	56 9	3	32·0	30
Oakamoor	E. Kettle, Esq.	1·46	·40	3	12	58·0	3	27·0	30
WARWICKSHIRE.									
Coventry	J. Gulson, Esq.	1·70	·42	3	16	65·0	19	31·0	
Coundon, Coventry	Lieu.-Col. R. Caldicott	1·56	·28	3 & 15	16	62·0	19	33·0	26
Bickenhill Vicarage	J. Ward, Esq.	1·08	·29	15	8	65 0		37·0	
St. Mary's College, Oscott	Rev. S. J Whitty	1·39	·44	15	16	61·1	19	30·5	30
Henley-in-Arden	T. H. G. Newton, Esq.	1·67	·38	15	15	62·0	17 & 19	30·0	30
Rugby School	Rev. T. N. Hutchinson	1·44	·24	3	13	64·4	19	32·2	30
Snitterfield Stratf'd-on-Avon.	J. Goodacre, Esq.	1·47	·39	15	15	62·2	19	26·2	30
DERBYSHIRE.									
Stoney Middleton	Rev U. Smith	1·56	·40	3	10	60·0	20	26·0	29
Linacre Reservoir	C. E. Jones, Esq.	1·34	·44	3	13				
Spondon	J. T. Barber, Esq.	1·41	·52	3	14	64·0		30·1	
Duffield	W. Bland, Esq.	1·58	·53	3	14				
NOTTINGHAMSHIRE.									
Hodsock Priory, Worksop	H Mellish, Esq.	1·20	·39	15	14	63·4	19	25·0	30
Park Hill, Nottingham	H. F. Johnson, Esq.	1·74	·45	3	13	62·2	19	35·1	29
Tuxford	J. N. Dufty, Esq.	2·22				65·0	19	30·0	29
LEICESTERSHIRE.									
Loughborough	W. Berridge, Esq.	1·51	·25	3	21	64·6	19	29·8	30
Ashby Magna	Rev. E. Willes	1·59	·42	3	13	71·0	20	27·0	30
Kibworth	T Macaulay, Esq.	1·87	·30	25	19				
Belmont Villas, Leicester	H. Billson, Esq.	1·62	·33	3	18	65·2	19	32·5	30
Town Museum, Leicester	W. J. Harrison, Esq.	1·57	·34	3	21	64·2	19	32·5	30
Syston	J. Hames, jun., Esq.	1·38	·39	3	16	64·0	8 & 30	33·0	30
Waltham-le-Wold	E. Ball, Esq.	2·13	·50	3	16	64·0	19	32·0	6
Coston Rectory, Melton	Rev. A. M. Rendell	1·75	·33	15	18	66·	19	31 0	6 & 30
Dalby Hall	Mr. G. Jones	1·76	·26	4	18	66·0	19	28·0	27
Market Harborough	S. W. Cox. Esq.	1·94	·35	25	16	63·0	17	27·0	30
NORTHAMPTONSHIRE.									
Towcester Brewery	J. Webb, Esq.	1·57	·33	15	14				
Castle Ashby	R. G. Scriven, Esq.	1·45	·32	2	15	63·0	20	33·0	10 & 30
Kettering	J. Wallis, Esq.	1·82	·27	15	21	65·0	20	35·0	13
Althorpe	G. S. Groom, Esq.	1·62	·29	15	15	65·0	19	28·0	30
Pitsford	C. A. Markham, Esq.	1·63	·37	14	16	67·0	19	30·0	6, 11, 26
RUTLAND.									
Uppingham	Rev. G. H. Mullins	1·91	·28	3	22	64·5	19	32·1	27
Northfields, Stamford	W. Hayes, Esq.	1·70	·42	13	8	64·0	17	32·0	12
Altarnun Vicarage	Rev. J. Power, M.A.	5·31	1·48	6	17	65·0	5	30·0	10, 13, 30
Oxford	E. J. Stone, Esq	1·90	·52	14	19	63·8	19	31·4	30
Ventnor	W. T. Ryder	1·87	·33	14	14	59·0	25	37·0	27

Correspondence.

Volvox globator.—I shall be glad to be informed where, near Leicester, the *Volvox globator* can be found. For two or three summers I have tried almost all the ponds in the neighbourhood, and have hitherto failed.—S. G. L.

[*Volvox globator* is very capricious in its appearances and disappearances. It has been found near Leicester in a pond on the Ansty Lane, near the Gilroes Reservoir; also in a pond on Beacon Hill, Charnwood Forest.—W. J. H.]

Helix Lapicida.—During a recent walk I found, on the roadside near Halloughton, Notts., about 1¼ miles south-west of Southwell, one dead specimen and a fragment of another of *Helix lapicida*. Close, searching did not reveal any more, or any live ones. This is rather a curious locality, as the soil is Upper Keuper red marl, and the nearest locality, as far as I know, Pleasley Vale, about twelve miles away, where I found it a short time ago. There is no limestone nearer than the Magnesian Limestone of the Leen Valley. Dr. Gwyn Jeffreys, in his work on British Conchology, remarks that it is not restricted to calcareous districts. This being the first time I have found it away from such, I thought it worthy of remark, it being a new locality for Notts.—C. T. Musson.

Moles.—I noticed in the May number, (page 117,) a letter signed "Enquirer," remarking on the unusual number of molehills this last winter, and asking for some explanation of the cause. The reason is probably not that the moles have been unusually busy, but that they are unusually abundant. It seems probable that a wet summer is favourable to the habits of moles, as the ground continues soft and in a suitable condition for working their subterranean passages in search of food. A dry summer is fatal to them, the ground becoming as hard as iron, and the grubs and worms on which they feed descending far out of their reach; and in such summers I have found them lying about on the top of the ground in scores, starved out. If this is so, we may see, in the increase and prosperity of the mole family during the succession of wet summers, of which we have been complaining, an interesting example of the law of the "survival of the fittest."—Richard E. Scriven, Castle Ashby, Northampton.

Larentia Cæsiata.—During a week's run in the Peak of Derbyshire, I took a few specimens of the very beautiful larva of this species. It is said to feed on bilberry and heather, but I found it, both by day and by night, exclusively on the latter, while it feeds chiefly, if not entirely, on the former. The colouring of the larva remarkably resembles that of the heather shoots; and there are two leading varieties, pink and green, the former resembling the withered shoots of last year, while the latter are strikingly like the young budding shoots of the present season. The object of this is obvious—the protection of the larva from its natural enemies, birds. But it is truly extraordinary that the plant imitated is not that on which the larva feeds, but that on which it rests when not feeding.—Chas. F. Thornewill, Burton-on-Trent.

Ash Leafing.—I have to-day, May 17th, seen the Ash breaking out into leaf in this neighbourhood, and in a slightly more advanced stage at Dudley Castle.—C. Cochrane, The Grange, Stourbridge.

Natural History Notes.—The Oak in leaf, May 7th; a Clouded Yellow Butterfly *(Colias edusa)* was captured May 3rd; Orange Tip seen May 1st; Hawthorn in bud, but not in blossom, May 8th; Ash not in leaf, same date.—A. Davis, jun., Great Marlow, Bucks.

Natural History Notes.—April 16th, Swallows first seen; 20th, *A. prodromaria* taken, Blackthorn, fl.; 29th, Corncrake heard, took larvæ of *M. oxyacanthæ.* May 3rd, Cuckoo heard, took larvæ of *N. xanthographa*, *N. brunnea*, *T. fimbria*; 4th, took larvæ of *L. cæsiata*; 7th, Milkwort *(Polygala vulgaris,)* Yellow Pansy *(Viola tricolor,)* Lead Plant *(Arenaria verna,)* fl.; Moonwort *(Botrychium lunaria)* appearing; 10th, took *A. psi*; 13th, took *A. derivata* and larvæ of *N. augur*; 17th, took *L. argiolus* and *A. cardamines*; Swifts seen; 18th, took *E. vulgata*, *C. unidentaria*, and larvæ of *P. iota*, *C. xerampelina*, *D. cæruleocephala*, *N. encullatella*; Nightingale heard.—C. F. T., Burton-on-Trent.

Botanical Notes from South Beds:—

Name.	Date. 1880.	Aspect.	Situation, &c.
Stellaria holostea........	April 22nd.	W.	Hedge bank.
Orchis mascula	,,	,,	Wood.
Ranunculus aquatilis	April 17th.	,,	Running water.
Vaccinium myrtillus	April 24th.	S.	Lower Greensand Range, under fir trees. Had been in blossom a week or more.
Valeriana dioica	,,	open.	Marshy meadow.
Scilla nutans............	,,	S.E.	Coppice, on sandy soil.
Prunus cerasus..........	April 12th.	W.	Railway bank.
Ajuga reptans	April 28th.	,,	Edge of a wood.
Vicia sepium............	,,	,,	Hedge bank.
Sanicula europea........	,,	S.W.	In a coppice.
Veronica chamædrys	,,	,,	Hedge bank.
Asperula odorata........	,,	W.	Coppice.
Sisymbrium Alliaria	April 24th.	open.	Brook side.
Equisetum arvense......	April 19th.	,,	Brook side.
Fritillaria meleagris	April 27th.	,,	Grazing land, on the borders of Herts.
Polygala vulgaris........	April 29th.	W.	Hedge bank.
Pyrus malus	May 1st.	S.	Hedge row.
Carex panicea	,,	open.	Marshy meadow.
Viburnum lantana		S.	Hedge row.
Geranium Robertianum..	May 5th.	W.	Hedge bank.
Nasturtium palustre	,,	open.	River bank.
Geranium molle	May 8th.	,,	Fallow field on chalk.
Reseda lutea............	,,	W.	Old chalk pit on the Chilterns; very early.
Chrysanthemum leucanthemum..............	May 10th.	,,	Railway bank.
Alchemilla vulgaris......	May 8th.	,,	Edge of a wood.
Potentilla Tormentilla....	May 9th.	open.	Grassy lane amongst furze; sandy soil.
Anthyllis vulneraria	May 13th.	W.	Chalk hills.
Lychnis diurna	May 15th.	,,	Damp wood on clay.
,, vespertina......	,,	,,	Railway bank.
Carex disticha	,,	open.	Bog.

J. Saunders, Luton.

Natural History Notes.—I heard, for the first time about here this year, the Cuckoo on the 30th of April, and the Corncrake on the 2nd of May. The Oaks are all pretty well in leaf now, very few Ashes show even any signs of coming out. As far as my observation goes, the Oaks always do come out first. I should like to know if anyone has known any year in which the Ashes (taking the general average) have beaten the Oaks.—Oswald W. Feilden, Frankton Rectory, Oswestry.

Phenological Observations, 1880:—

Name.	Date.	Aspect	Situation, &c.
Saxifraga tridactylites ..	April 17th.		On wall.
Sisymbrium Alliaria	,, 20th.	S.	Hedge bank
Ulex Europæus	,, 21st.	S.E.	Side of hill
Prunus insititia ?	,, 21st.		On hedges.
Prunus domestica	,, 21st.		On hedges.
Stellaria Holostea	,, 24th.	S.W.	Hedge bank.
Scilla nutans............	,, 24th.	S.W.	Hedge bank.
Pyrus Malus............	,, 25th.	S.	On tree in hedge
Plantago lanceolata	,, 21st.		On clay bank.
Arum maculatum	,, 26th.	S.S.W.	Hedge bank.
Veronica chamædrys	,, 26th.	S.S.W.	Hedge bank.
Paris quadrifolia	,, 26th.	S.W.	In wood.
Primula elatior	,, 26th.	N.	Edge of wood.
Equisetum arvense......	May 1st.	Open.	In cornfield.
Viburnum lantana	,, 3rd.	S.E.	On hedge.
Carex sylvatica	,, 3rd.	S.W.	In spinney.
Ranunculus aquatilis	,, 3rd.	Open.	In pond.
Orchis mascula	,, 3rd.	S.E.	In wood.
Veronica serpyllifolia	,, 3rd.	S.S.W.	In sandpits.
Cerastium glomeratum ..	,, 3rd.	S.S.W.	In sandpits.
Fragaria vesca	,, 3rd.	S.W.	In wood.
Ranunculus bulbosus	,, 5th.	Open.	In pasture.
Doronicum pardalianches	,, 7th.		Hedge bank.
Cratægus monogyna	,, 7th.	S.W.	In hedge.
Geranium Robertianum..	,, 7th.	S.W.	Hedge bank.
Ranunculus acris........	,, 10th.		Damp pasture.
Geranium molle	,, 10th.	S.S.W.	Hedge bank.
Ajuga reptans	,, 10th.		Damp pasture.
Barbarea vulgaris	,, 11th.	S.S.W.	Hedge bank.
Ranunculus repens......	,, 12th.		Side of pond.
Potentilla Tormentilla ..	,, 12th.	S.W.	In wood.
Arenaria trinervis	,, 17th.	W.	Side of hedge.
Myosotis sylvatica	,, 19th.	W.	Hedge bank.
Trifolium pratense	,, 19th.	Open.	In pasture.
Sanguisorba officinalis ..	,, 19th.	Open.	In pasture.
Anthoxanthum odoratum	,, 19th.	Open.	In pasture.

Swallows first seen, April 21st. | Cuckoo first heard April 23rd.
Nightingale first heard, April 22nd. | House Martins first seen May 3rd.

R. R., Castle Ashby.

Phenological Observations, taken in the vicinity of Farley, near Cheadle, Staffordshire, during April, 1880:—April 2nd, Plover's eggs found, probably the first. *Vaccinium myrtillus* (Bilberry) in first stage of young leaf on the moorlands adjacent. 3rd, *Mercurialis perennis*, a fine plant in point of growth, but even now chiefly in bud and only a few solitary flowers; plants of *Anemone nemorosa* in full flower, others partly in flower, and some specimens bursting; Wood Violets also out, and the same remarks as to last apply; Wild Rose in full young leaf, and *Adoxa moschatellina* in fine flower and growth; occasional portions of hedges of *Cratægus oxyacantha* in full young leaf. 4th, *Lamium purpureum* in flower; first eggs of *Turdus musicus* hatched. 5th, *Corylus avellana* (portions of) in full catkin by streamlet; Birch in green bud, and Sycamore in full green bud; *Rubus idæus* (wild Raspberry) in full young leaf in Churnet Valley. 7th, off-shoots from base of Elm trunk bursting into full young leaf; *Tussilago Farfara* at Oakamoor only in bud. 8th, first flowers of *Leontodon Taraxacum* by way side. 10th, saw *Alauda arvensis* and heard it singing for first time this year; first saw *Nepeta Glechoma* in flower on rabbit warren; *Vanellus cristatus* by now sitting; first flowers of wild *Primula veris* brought to me, said to have been seen in flower about April 3rd. 16th, *Ulex Europœus* (yellow Gorse) in flower, closely adjacent to wet waste ground; some Sycamore trees in young leaf, and a few Birch trees also on warren ground; heard *Cuculus canorus* for first time this year in Churnet Valley woods; *Strix aluco* hooting early in month. 18th, *Cardamine pratensis* in full bud towards bursting in old wall, first noticed; *Luzula campestris* (specimens of) in flower on lawn. 7th, *Caltha palustris*, first in full flower at Oakamoor in wet field. 19th, *Caltha palustris* becoming general. 20th, Lilac in full young leaf. 21st, *Alnus glutinosa* partly in young leaf; Birch generally coming into young leaf; *Nepeta glechoma* very general and in full flower. 10th, one of the *Hirundinidæ* first seen at Oakamoor. 23rd, specimens of wild Cherry in blossom at Oakamoor, others in bud or bursting; *Primula veris* becoming generally in flower in meadows; plant of *Narcissus Pseudo-narcissus* growing in field only in mature bud; specimens of *Cardamine pratensis* well in flower; a few instances of *Pteris aquilina*, one to two feet high in new growth. 24th, *Chrysosplenium (C. oppositifolium?)* well in flower by streamlet; Birch tree in full young leaf. 21st, (close approx.) first flowers of *Geranium Robertianum* in old wall facing S.S.W. 25th, *Cratœgus oxyacantha* budding and bursting only in neighbourhood of Weaver Hills, two miles N.E. from Farley, and about 950 feet above sea; at Farley 650 feet above sea, in some cases in full and developed young leaf; *Lychnis diurna* showing its first flowers; *Tussilago Farfara* still in flower. 26th, Limes bursting into leaf; *Cardamine pratensis* very general and in full flower in Churnet Valley; Birch generally in young leaf; first flowers seen of *Veronica Chamædrys*, the specimens gathered from old wall facing S.S.W. 16th to 19th, about this time *Lamium maculatum* first in flower in Churnet Valley. 13th, *Petasites vulgaris*, said to be in first full flower by Churnet River. 24th, *Myosotis arvensis* coming out by this date; saw a few isolated flowers April 29th. 25th, *Stellaria Holostea* becoming general. 30th, *Alliaria officinalis* bursting into flower about now. 30th, *Salix*——? overhanging pond still slightly in flower.—CLEMENT L. WRAGGE, F.R.G.S., F.M.S.

OAK AND BEECH LEAVES gathered in Churnet Valley Woods, near Farley, Staffordshire, May 4th, 1880. As to former, the first leafing I have noticed hereabouts; only a few instances of shoots from lower branches in this condition; higher parts of Oak only in bud. As to latter, a few instances of off-shoots from lower branches only, in young leaf; other parts of Beech quite bare. May 21st, first young leaves of Ash gathered; not fully expanded. A good look-out kept.—C. L. WRAGGE.

NOTES ON COMPARATIVE FORWARDNESS OF ASH AND OAK.—April 23rd.—*Llaneast, Cornwall.* An Ash and an Oak were noted near each other close to a stream. The Ash in partial flower, the buds of the Oak only just beginning to swell. Conditions of position, &c., very similar. May 3rd.—*Llangollen, North Wales.* An Ash and an Oak were again noted.

having similar conditions as to position, but this time on the side of a steep hill. In this case the Oak was in leaf; the Ash was covered with last year's fruit, and showed no likelihood of having blossoms or leaves for some time to come.—C. U. Tripp.

The Oak Leafing or in full leaf in all the lanes about Coleshill and Whitacre, May 16th. No apparent sign of leafing on Saturday, the 8th, the showers in the middle of the week having exerted a great influence on the leafing of trees. Trees growing in large woods scarcely so forward as those growing in the open. The Ash showed no sign of leafing, except in two young trees seen in a sheltered wood. The Beech very erratic. In the lane from Duke's Bridge to Whitacre there are abundant trees in full leaf. Trees just showing for leaf and trees showing no signs of leafing mingling their branches, in some cases growing side by side, in others on opposite sides of the same lane.—J. E. B.

The Old English Kite or Glead.—I should be glad to hear, through any correspondent of the "Midland Naturalist," whether the old English Kite or Glead is still existing in his neighbourhood. Some fifty years ago it was quite common about here, and ten or a dozen of these fine birds might be seen gliding round and round at a great height. I have a fine specimen of a female Glead, which was shot in the neighbouring woods of Linley, in June, 1861; and I have seen one or two about occasionally, up to ten years ago, but now, I fear, they must be considered as extinct in this neighbourhood, but are still found in North Wales. The common Buzzard or Dunkite is in the same case, and we have only the Kestrel and Sparrow Hawk remaining. The Brown Owl is still plentiful about here, but the White or Barn Owl is very rare.—Arthur S. Male, More Rectory, Bishop's Castle.

Ornithological Notes.—There is no period of the year more interesting to the ornithologist than that included between the dates of my last letter, April 15th, and the present one. During this time the observer who lives in the country can hardly fail to note some new arrival daily; thus I have sixteen records between April 16th and May 2nd inclusive. They are—April 17th, Sand Martin; 18th, Swallow; 19th, Yellow Wagtail; 22nd, Tree Pipit and Common Whitethroat; 23rd, Nightingale, Sedge Warbler, Grasshopper Warbler, and Redstart; 24th, Lesser Whitethroat; 25th, Garden Warbler and Cuckoo; 28th, Whinchat; 29th, Landrail; 30th, House Martin; May 2nd, Grey-headed Wagtail, and lastly on 15th inst., Swifts. With regard to the last named bird, I notice in the "Midland Naturalist" for May a report of Swifts being seen in Warwickshire on April 8th. This is clearly a mistake, as they never reach this country before the second week in May, and are the last of the family to arrive. Harting, in his "Summer Migrants" says, "as a general rule, the Swift is not observed in this country before the third week in May." This is, I think, rather a late average date. I have noticed them as early as May 5th, (1878); May 8th, (1877); and as late as May 16th, (1874.) My average date for seven years is May 9th. On April 18th, I saw the last of the Fieldfares. The Grey-headed Wagtail *(Motacilla flava)* I saw for the first time alive; it is very rare, at least in this country. It was in company with two Grey Wagtails, and at first I thought it was a Yellow Wagtail *(Motacilla rayi)*; a closer inspection, however, satisfied me that it was the Grey-headed. I might add, as a probable explanation of its occurrence, that I have never seen anything like the number of Yellow and Grey Wagtails in any former year.—Thomas Macaulay, M.R.C.S.L., &c., Kibworth, 20th May.

Ornithological Notes.—The summer migratory birds have not yet arrived in large numbers, though many of them announced themselves as usual about the middle of the month. The little Chiffchaff is the first comer, and arrived before the middle of March, He was not only earlier, but in much greater numbers than usual; whilst the Willow Wren, which commonly arrives about the same time, and is so similar in appearance that it is difficult to distinguish one from the other except by the song, did not make its appearance till nearly a month later.—The Cuckoo was heard near Allesley on the 17th, and on the 19th a few Swallows appeared both at Col. Caldicott's and at Stoke. They at once flew to the outbuildings, where their last year's nests were made, and they seemed glad to perch frequently and rest after their long travel.—On the 25th I saw the White-throat and the Redstart; I also heard a Corncrake on that day, but have heard nothing of her since.—On the 29th I heard the Nightingale in Willenhall Wood. I think they are not plentiful about us this year, as I have only heard that one at present.—As yet I have not heard the Blackcap. They are due about the 20th April, and I consider them the most charming of all our songsters.—At Stoke we have certainly no dearth of our old friends the Blackbirds, Thrushes, Chaffinches, and Wagtails. The irrepressible Starling too, has been holding great gatherings in parliament assembled, and as usual they are building all about us, wherever a suitable chimney or spout or old tree can be found.—T. Gulson, Coventry, May 6th.

Marine Excursion.—The Natural Science Section of the Nottingham Literary and Philosophical Society are making arrangements for a summer excursion to the Isle of Man. The main object of the excursion will be to examine the marine fauna and flora by dredging off the coast during fair weather. Inland excursions will also be organised for the purpose of observing the many interesting geological, archæological, and botanical features of the island. The beginning of August is the time proposed, and Port Erin is to be the head quarters of the party. It is expected that all who join the party will contribute their share of the general dredging expenses. If twenty join this will not exceed 15s. each. Persons who contribute towards the dredging expenses, whether belonging to the excursion party or not, will be entitled to a share of the specimens obtained. The expenses for a fortnight—the length of time it is proposed to stay—including railway fare, and hotel accommodation, are estimated at about five guineas each. The excursion will be open to the members of all the societies in the Midland Union. Those who wish to take part in the excursion, will oblige by giving in their names and addresses as early as possible, but not later than Wednesday, June the 30th, to the Hon. Secretary, *pro tem.*, Mr. E. Wilson, 18, Low Pavement, Nottingham.

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY. —Microscopical General Meeting.—April 20th.—Mr. J. E. Bagnall exhibited *Oxalis acetosella, forma purpurea*, a rare variety from Bushwood, Lapworth; *Viola Reichenbachiana* from Lapworth Street, local in Warwickshire; *Plagiothecium latebricola*, very rare in Warwickshire; and *Jungermannia crenulata* from Berkswell, new to Warwickshire. Also on behalf of Mr. W. H. Wilkinson, specimens and drawings of *Lophocolea heterophylla*, one of the Hepaticæ from near Stratford. Mr. J. F. Goode exhibited a four-inch objective, by Zeiss, constructed on a new principle, the back lens of the combination being moved by a screw collar so as to alter the power from four to two inch; the field of this lens embraces a circle of one-inch diameter. Mr. W. G. Blatch exhibited *Megacronus cingulatus*, a rare beetle, new to the district, found on the 18th at Sutton Park. Mr. T. Bolton exhibited fry of Perch, hatched from spawn laid by fish in the Aston Aquarium fourteen days' previously. Mr. W. H. Jones exhibited sample of Paraguay Tea, the produce of *Ilex Paraguayensis*, used instead of tea in South America. Mr. Montagu Browne exhibited a monstrosity—a lamb having its two eyes joined into one on the top of the head, no face, but a long hanging proboscis instead, and ears and mouth in a line underneath, the later very rudimentary, and consisting of a straight row of teeth not covered by lips; three living Bats *(Plecotus communis)*; and a living Slow-worm *(Anguis fragilis)* Mr. I. J. Cotton exhibited a living green Snake *(Natrix torquata,)* captured the day before at Kenilworth. Mr. W. G. Blatch read a paper on "Two of our Garden Pests, the Currant Moth and the Gooseberry Saw-fly," giving a full description of their life-history and the means usually adopted for their destruction. The paper was illustrated by drawings. Geological Section.—April 27th.—Mr. H. W. Jones exhibited the river Lamprey *(Petromyzon argenteus.)* Mr. R.W.Chase exhibited a specimen of the Peregrine Falcon *(Falco peregrinus,)* killed near Bridgnorth. The Rev. J. Caswell read a paper on his "Botanical Tours in Ireland in the years 1876-77-79." The paper described the scenery, and gave lists of the rarer or more remarkable plants in the west of Ireland, and also in the neighbourhood of Dublin. It was announced that Dr. Deane would contribute a paper in May, on the "Study of Geology" as the first of a series of geological papers by various gentlemen, to be read at the succeeding meetings of the year. General Meeting.—May 4th.—Mr. J. Morley exhibited the fourth series of Nature-printed British Ferns, containing many curious varieties. Mr. W. Graham exhibited *Idolocoris elephantis*, parasite of elephant, and presented a mounted specimen to the Society. Mr. Montagu Browne exhibited three eggs, laid by a common grey Parrot, which was known to be over thirty years old; also a male Sheldrake *(Tadorna Vulpanser,)* caught in a rabbit warren at Barmouth. Mr. W. G. Blatch exhibited some pieces of wood of the Aspen, infested with larvæ of one of the Longicorn Beetles, *Saperda populnea;* also specimens of the perfect insect. Mr. C. Pumphrey exhibited *Paris quadrifolia*, Herb Paris, from Hopwood Dingle. Mr.W. Southall exhibited *Arum maculatum*, a proterogynous flower, to show the mode of fertilisation. Mr. W. G. Blatch read a paper (illustrated by a lithographed plate) on "A cheap and useful Entomological Cabinet," which will appear in a future number. Biological Section.—May 11th.—Mr. H. E. Forrest read a paper by Mr. W. P. Marshall on "Dr. Siemens' experiments as to the influence of the electric light upon vegetation." These experiments show that plants exposed to sunlight by day and the electric light by night flourish better than those exposed to daylight only. Further experiments proved that plants will grow and flourish under the electric light alone, even better than under daylight. The leaves of plants placed within two feet of the electric lamp were scorched at the edges, as if from great heat, but when removed to a distance of seven feet they recovered. The ventilators of a hothouse being closed, a temperature of seventy-two degrees was maintained by the electric lamp alone. Strawberries, &c., exposed to the electric light, in addition to daylight, ripened sooner than others not so treated. The paper elicited a lively discussion. Mr. H. E. Forrest exhibited a method of observing Polyzoa, or other large objects in bottles, without removing them. The whole bottle, corked, is placed on the stage of the microscope, and the portion to be examined covered with a cover glass,which is made to adhere to the bottle by a drop of water or glycerine, thus producing a flat surface through which to view it. Mr. Bolton exhibited marine specimens from the Menai Straits, including Doris, Tube Worms, Coryne, and Tubularia. Mr. J. Levick exhibited an Amœba of extraordinary size, and *Uroglena volvox* from Sutton Park. Mr. J. E. Bagnall exhibited *Sphagnum auriculatum* and *S. fimbriatum* from Umberslade; rare species. Mr. Wills exhibited *Spirogyra* and *Staurocarpus gracilis* in conjunction. May 17th.—On Whit-Monday over forty of the members of the Society made an excursion to Warwick and Stoneleigh. At Warwick the morning was spent in visiting many of the principal places of interest, among them being the

Museum, Leycester's Hospital, and the Parish Church. After partaking of luncheon at the Woolpack Hotel, the party drove to Stoneleigh Abbey, stopping a short time on the way to examine Guy's Cliff. By the kind permission of Lord Leigh, they were allowed to go through the Abbey and about the Park, where they examined with interest a fine old oak tree, eighty feet in height and thirty feet in circumference. A pleasant drive back to Warwick was followed by a tea at the Woolpack, after which the party returned to Birmingham. Microscopical General Meeting.—May 18th.—Mr. J. Levick exhibited *Rhipidodendron Huxleyi*, a flagellate monad first found on the borders of Dartmoor by Mr. W. Saville Kent, and named by him; Mr. T. Bolton exhibited a very rich gathering of *Hydra vulgaris* and Rotifers from Edgbaston Pool. Mr. J. E. Bagnall exhibited *Menyanthes trifoliata*, *Hypnum giganteum*, and other plants from Old Park, Warwick.—A vote of thanks was unanimously passed to Lord Leigh for his kindness in allowing the members access to the Abbey and Park on Whit-Monday.—Mr. A. W. Wills gave an account of the Desmids of Sutton Park, illustrated by numerous living specimens in the microscopes, and beautiful coloured drawings. He stated that he had discovered no less than seventy-five species within the limits of Sutton Park, and gave a list of their names, which will appear in a future number of the "Midland Naturalist."

BIRMINGHAM AND MIDLAND INSTITUTE SCIENTIFIC SOCIETY.—April 28th. Mr. A. N. Deakin, B.A., read a paper on "Curiosities of Criticism."—May 12th. Mr. A. Cresswell gave a lecture on "Duplex Telegraphy."—May 17th. The members went by rail to Shrewsbury, and walked *via* Atcham to Wroxeter. After luncheon the party walked to the Wrekin.

OSWESTRY AND WELSHPOOL NATURALISTS' FIELD CLUB.—The first excursion for this year took place on Thursday, April 29th. After meeting at Chirk station about 1 30, the party took their way through Bryn Kinalt Park, by the kind permission of Lord Dungannon, and along the banks of the Ceiriog to the junction with the Dee; then up Coed-y-rallt, from the top of which there is a very fine view of the Vale of Llangollen, Wrexham, and the Cheshire hills; thence the route lay up the picturesque Glyn Morlas, and along the line of Watts' Dyke to Belmont, and the walk was ended at Gobowen. Among the plants found were *Narcissus bifolius*, Sweet Cicely, and alternate-leaved Golden-Saxifrage; also Harts' Tongue Fern. The day was fine and the walk lovely. The second excursion took place on Thursday, May 20th. After meeting at Bultington Station, the party proceeded to explore the volcanic range which stands in front of the Long Mountain. Moel-y-Golfa was first ascended, and the labour of climbing its steep sides is well repaid by the magnificent panorama stretched out beneath you. As the view on the Welsh side was very clear, Cader Idris, Plinlimmon, and the Arans were distinctly visible. The camp on the neighbouring hill of Cefn-y-Cartell was very plain. It is said by some to have been the camp of Caractacus, and that he was defeated in Moel-y-Golfa by the Romans. The party then crossed the intermediate valley to the Breidden, and thence made their way to Pool Quay Vicarage, where they were very hospitably invited to tea. Among the plants found were *Saxifraga granulata*, *Sedum Forsterianum*, *Geranium sanguineum*, *Lychnis viscaria*, *Helianthemum vulgare*, and Oak Fern. The day was very fine, and the excursion was a most enjoyable one.

EXCHANGE.

Wanted, Books.—*Malacologia Monensis*, by Edward Forbes, and other works on Conchology. Shells or books in exchange, or cash.—C. T. Musson, 68, Goldsmith Street, Nottingham.

MIDLAND UNION OF NATURAL HISTORY SOCIETIES.

THIRD ANNUAL MEETING AT NORTHAMPTON.

The Council of the Union met at half-past twelve o'clock in the Council Chamber of the Town Hall, Northampton. There were delegates present representing seventeen societies. The arrangements for the Annual Meeting having been made, the Council adjourned to the Plough Hotel, where, with a large number of visitors, they partook of luncheon.

ANNUAL MEETING.

The Annual Meeting took place at three o'clock, and was also held in the Council Chamber of the Town Hall, the PRESIDENT of the UNION (Sir Herewald Wake, Bart.) in the chair. There was a large attendance, including Lord Lilford, (President of the Northampton Natural History Society); Revs. W. Thornton, F. C. Alderson, George Nicholson, and Canon Scott; Messrs. J. Eunson, F.G.S.; G. C. Druce, F.L.S. (local Hon. Sec. of the Union); George Scriven, R. G. Scriven, W. Hull, A. Kempson, H. Terry, J. Jeffery, — Bailey, and T. L. Cordeux and C. E. Crick, (the Hon. Secs.) of the Northampton Natural History Society. There were also present the following delegates and members of other Societies in the Union:—Rev. Canon Wormall, M.A., Bedfordshire Natural History Society; Rev. Dr. Deane, Mr. W. R. Hughes, F.L.S., Mr. E. W. Badger, (Hon. Sec. of the Union,) Mr. John Levick, Mr. H. E. Forrest (Assist. Hon. Sec. of the Union,) Mr. John Morley, and Mr. C. Pumphrey, Birmingham Natural History and Microscopical Society; Mr. Lawson Tait, F.R.C.S., Birmingham Philosophical Society; Mr. C. J. Watson and Mr. W. H. Cox, Birmingham and Midland Institute Scientific Society; Mr. H. F. Devis, Birmingham School Natural History Society; Rev. C. F. Thornewill, M.A., Burton-on-Trent Natural History, &c., Society; Col. H. Basevi, Cheltenham Natural Science Society; Mr. Pearce, Dudley Geological, &c., Society; Mr. F. T. Mott, F.R.G.S., and Mr. W. J. Harrison, F.G.S., Leicester Literary and Philosophical Society; Dr. T. Appleby Stephenson, Nottingham Literary and Philosophical Society; Mr. James Carver and Mr. Levi Lee, Nottingham Naturalists' Society; Rev. O. M. Feilden, M.A., Oswestry and Welshpool Naturalists' Field Club; Mr. Edwin Wheeler and Mr. J. W. Bodger, Peterborough Natural History and Scientific Society; Rev. T. Auden, M.A., Shropshire Archæological and Natural History Society; Mr. Egbert D. Hamel, (Hon. Treasurer of the Union,) Mr. Alfred Lucy and Dr. Colin G. Campbell, Tamworth Natural History, &c., Society; Rev. J. E. Vize, M.A., Woolhope Naturalists' Field Club; and others.

Mr. G. C. DRUCE (one of the Hon. Secs. of the Union) having read the circular convening the meeting, Mr. H. E. FORREST (Assistant Hon. Sec.) read the minutes of the last Annual Meeting at Leicester, which, on the motion of Mr. F. T. MOTT, seconded by Col. BASEVI, were confirmed and signed.

The PRESIDENT (Sir Herewald Wake, Bart.) then delivered the following address:—

THE PRESIDENT'S ADDRESS.

I have first to congratulate the Union on the presence of Lord Lilford, whose state of health it was feared would prevent his being with us to-day. Happily the cause for the fear has been removed. It was because of the anticipated unavoidable absence of the noble and learned President of the Northamptonshire Natural History Society that I rashly undertook the duties, for this year, of President of the Midland Union of Natural History and Scientific Societies. I need hardly make the same remarks of self-depreciation as my predecessors in this office, as I feel that it is impossible that I should be mistaken for a man of learning; my remarks will, therefore, be received for what they are worth, and I am glad to say that on this, the third occasion of such a gathering as the present, I have a less difficult, if not a more pleasing task to perform. In fact, I think that I shall be justified in taking a slight retrospect of the work already performed by the Union before passing to a consideration of its future prospects, and the glorious capabilities of such a splendid organisation as we possess.

If I may borrow a simile from botany, I might compare the Midland Union of Natural History Societies to a potato plant, which, green and flourishing, fairly represents its condition; each branch representing a society, and, if you like, each leaf a member; the flowers and fruit to correspond to its useful publications, collections, catalogues, &c. But under the surface we find the most useful fruits of all, viz.—the solid benefits which each member of the Union derives from the opportunities afforded for much useful and friendly intercourse, which otherwise would not haveexisted.

By means of this Union life-long friendships have no doubt been formed, and are forming, among fellow-students of nature, and we must bear in mind that an enlargement of the circle of acquaintance necessarily enlarges the useful sphere of action of a cultured mind. The advancement of scientific knowledge among individuals has been rendered easier and more certain, and the fact that the acquirement of such knowledge is both a pleasant and an easy task has perhaps been brought home to many. Another point is that, with a more extended knowledge of Natural History and other sciences, a number of prejudices and old world superstitions are being daily more successfully combated, and, as the truth spreads, it has the effect of ameliorating the conditions of those orders of life more or less dependent on the merciful consideration of mankind.

To be more particular, it is satisfactory to observe that the Union is gaining strength, and that the Societies that belong to it are now twenty-three in number. I have been informed by the able editors of the "Midland Naturalist," that that invaluable periodical is not in quite such a flourishing condition, as regards circulation, as it ought to be, which is a matter of regret. The circulation is extending among the outside public, but the circulation among our Societies has fallen off some 150 copies monthly. As to the contents of the "Midland Naturalist," they surely speak for themselves.

Mr. Harrison's scheme for the examination of the glacial drift of the Midlands, in spite of the adverse elements, has at least been fairly started, and, with reference to his excellent plan of procedure, I would suggest that, on the same plan, the whole district embraced by the Societies of the Union might be mapped out, and a perfect set of geological charts and maps prepared under its auspices.

In the photographical section of the Northampton Society, my friend Mr. Scriven has come forward this year with an exceedingly useful and graceful addition to the tangible results of our scientific labours. I refer to the series of photographs of the celebrated trees of the Midland Counties which he has commenced, of which two beautiful plates have been published in the journal of our Society.

With reference to that journal, I may add that the editorial committee have every reason to be proud of it, as everyone who has seen it will agree. All the same I would point out to all the Societies, including my own, the danger of withdrawing any support from the authorised journal of the Union, and I think that every member of a Society which has its own journal should make it a point of honour not to cease taking in the "Midland Naturalist," as it was started on the understanding that it would be supported by all the Societies of the Union. Again, those gentlemen who contribute papers to their own Society's journal should not hesitate to give the Union journal the preference, should its editors request them to do so. Without some such understanding, it might happen that the "Midland Naturalist" will not be able to enlarge its scope, and grow in stature and bulk, as it no doubt will do if we only centralise our efforts.

And that leads me to the consideration of one of the chief uses which an organisation like this one of the Union might be put to, and that is to collect into a focus the work of the different Societies; to enable them, by combining their efforts, to produce a greater quantity of work, and of a better quality, than could be done by their separate efforts. To give a fuller explanation of my meaning, I will take as an hypothesis that it is decided to set some work on foot to be accomplished by the combined talent and energies of all the members of the Union. The character of that work having been agreed on, (which even as a suggestion I must leave to the superior judgment of your Council,) a central committee might be appointed to carry it into effect, by receiving and revising, and if necessary weeding the contributions forwarded by the different committees; these sub-committees again being appointed by each society to receive and revise the contributions of its members. These contributions, to avoid the slightest excuse for those jealousies which might creep even into the most fraternal association of human beings, I would suggest should always take the form of notes, or some other plan might be resorted to where it was necessary to amalgamate the materials at hand. And it is this very power of addition and subtraction, which the Central Editorial Committee would possess, which would ensure the matter for publication being complete in every sense of the word. It would be time enough to talk of publishing such a work when it was ready for the press; and I imagine that, with the hearty co-operation of all the members of the Societies of this Union, sufficient first-rate material could in time be collected to make it a certainty that any publisher would be glad of the chance of such a work.

With regard to the plan for presenting prizes for competition for scientific essays and such like, I am sure that it is a step in the right direction, and it is certainly following the example of old-established Societies, which have found such a method to produce excellent results. I see that the Royal Society has this year offered an open prize for the best essay on the Pea Weevil, its life-history, and the best method of preventing its ravages. That affords a very good example of the use of such competitions, for it cannot fail to elicit all the best information to be obtained on this subject, and it turns the attention of entomologists in an eminently practical direction.

I feel that, being more especially a student of Entomology, it will not be out of place if I make a few remarks on that science. I regret to have observed that amateur entomologists are too apt to take what I may characterise as a rather superficial line of study, and this in either one of the two following directions. In the first place, one finds that their attention is too much confined to the mere occurrence of species in a particular district, and, in the second place, many are apt to be led away by the fascinations of collecting, thus seeming to lose sight of the truth, viz., that one new fact concerning the economy of some well-known insect, whether that insect be reckoned among our friends or foes, is of far more importance than the discovery and record of the rarest and least known species in any particular locality. Of course it is a very great triumph to secure a specimen of some rare moth or butterfly, but it cannot be so useful or such a triumph as to discover the best means of finding and destroying the eggs and larvæ of some common garden pest.

Finally, I would suggest that it is time for the Societies forming this Union to endeavour to enlarge their useful sphere of action in a direction which, I hope, I may be allowed to call a liberal one. I mean to say that, having all the advantages of culture that we have, we should endeavour to share them as much as possible with those who have neither the means nor opportunity of themselves taking up the study of the natural sciences. We should not, I think, confine the knowledge we have acquired only to those who are in our own class of life, and it would be, I think, a glorious thing to undertake a crusade against the ignorance of the poorer classes of even the simplest facts in natural history and other sciences. I think it would be a step in the right direction if the eminent scientific gentlemen amongst us were, in their different districts, to consent to give a course of free lectures; and if the whole society brought its influence to bear in every possible way to advance the teaching of the sciences in our schools.

Amongst other sciences, I think perhaps that, with the ever-extending franchise of this country, it would be well if political economy were not so much neglected, and after reading, writing, and arithmetic, instruction in the true principles of political economy ought to come first.

I fear I am diverging from my legitimate path, but with reference to politics in connection with Natural History, I think I shall be in order when I remind the members of this Union that it was Mr. Gladstone's Government which granted the funds necessary to build the magnificent new Natural History Museum at Kensington. I am sure you will all join with me in expressing the hope that Prof. Owen will live to see the completion of the great work which he mainly set on foot by his exertions, and that the vast stores of natural history specimens now hidden in the vaults of the British Museum will be soon accessible to all of us.

In conclusion, I must add that, in the name of the Natural History Society of Northampton, I most heartily bid you welcome to our ancient borough, and I hope that you will find both pleasure and profit during your visit here, and that, though this is the first, it will not be the last time such a meeting as the present will take place in this town.

Immediately afterwards, the Rev. C. F. Thornewill proposed, and Mr. Lawson Tait seconded, and it was unanimously resolved :—"That the thanks of this meeting be given to the President (Sir Herewald Wake, Bart.) for the address now read, and that the address be printed in the 'Midland Naturalist.'"

Mr. Edward W. Badger (one of the Hon. Secs. of the Union) then read the following report :—

THE COUNCIL'S REPORT.

The second annual gathering of the societies constituting the Midland Union, held last year at Leicester, was in every way successful; there was a good attendance of delegates from all parts of the Midland Counties; the local arrangements were excellent, and admirably carried out; the President's address was interesting and suggestive, and was listened to with marked attention; the scientific conversazione—a novelty in Leicester—was well attended, and afforded opportunities for intercourse between members living widely apart, while it yielded much pleasure and instruction to the visitors; and the day set apart for the excursions to Charnwood Forest was fortunately one of the few fine days of last year—a year which will long be remembered as one of the coldest, wettest, and most disastrous of recent times. About two hundred members and friends joined in the excursions, two in number, one devoted to investigating the botany, and the other the geology of the district; and, thanks to the two gentlemen who respectively led the excursions—Mr. F. T. Mott, F.R.G.S., and Mr. W. Jerome Harrison, F.G.S.—the large parties under their guidance spent the day most agreeably.

Your Council have to report that during the year the Bedfordshire Natural History Society and Field Club has joined the Union. They also have to report, and do so with regret, that two Societies have withdrawn from it—viz., the Rugby School Natural History Society, and the Woolhope Naturalists' Field Club. They particularly regret losing the membership of the last named Society, which has done, and is doing, much good and useful work, and they trust the members may be induced to reconsider the subject and re-enter the Union. The Woolhope Club has for many years past been steadfastly pursuing the study of fungology, and the papers read before it have thrown much light on obscure points which needed elucidation; while their annual fungus forays, which have a European reputation, are attended by large numbers of the leading students of mycology. The club is also engaged on an important work now in course of publication—" The Herefordshire Pomona " —a work of great national value. Two parts have already been issued, full of matter of the deepest interest to all who are engaged in fruit-growing, whether in orchards or gardens, and both have been lavishly illustrated by woodcuts and coloured portraits of apples and pears which, whether regarded as works of art, or as contributions to the stores of knowledge respecting our hardy fruits, are deserving of hearty commendation and support. It is no small thing for one of our provincial societies to have projected and so far carried towards completion a work of such importance to the country at large, involving, as it has done and must continue to do for several years to come, a vast amount of careful and painstaking labour, and a considerable expenditure of money. Part III. of the Pomona, giving coloured drawings of 40 different varieties of fruit, is nearly ready for publication, and Part IV., which will be issued next year, is in preparation. Three other parts, one to be issued annually, will, it is believed, complete the work. For the information of members who may desire to possess copies of this valuable book, your Council beg to state that Mr. J. Reginald Symonds, Bridge Street, Hereford, will, on application, send a prospectus of the scope of the work; terms on which it may be had, &c.

It will be in the remembrance of the members that at the Birmingham meeting of the Union a resolution was passed referring to the Council a request to consider whether the subject of the glacial drift deposits is not one well adapted for conjoint observation by the Societies in the Union. It was subsequently unanimously agreed to ask the co-operation of all the Societies in dealing with the subject, and some interesting papers having a bearing on it have from time to time appeared in the Societies' journal; but for some unexplained reason the amount of practical work yet done has so far been much smaller than your Council had reason to anticipate. Mr. W. J. Harrison, who suggested the subject, has laboured zealously to get it taken up, with what results will be gathered from the following communication:—

"Leicester, May, 1880.

"GLACIAL DRIFT OF THE MIDLANDS.

"In answer to the enquiry of the Hon. Secs. of the Midland Union of Scientific Societies as to the work done in connection with this question, I can only mention the following points:—

"(1.) Two important papers by Mr. D. Mackintosh, of Liverpool, have been read before the Geological Society of London, referring mainly to the Drift of the West Midlands; other notes have appeared in the 'Midland Naturalist,' in the Report of the British Association, and in those of some of the local societies. It is very necessary that the facts stated in these reports should be examined and confirmed by other workers.

"(2.) I have sent out to various individuals and societies thirteen typical sets of the rocks of Charnwood Forest, for comparison with the boulders which may occur in their neighbourhood; and have corresponded with various members upon the subject.

"It seems to me, however, that some decided stimulus to work is needed; the study of the Glacial Drift is now ripe for decision; it was the first subject taken up by the Union, and, if the Council could see any way of encouraging work on the question, I should be thankful.

"W. JEROME HARRISON, F.G.S."

Along with this communication, Mr. Harrison forwarded another, for which your Council desire to bespeak your most thoughtful consideration; for it seems to them to afford a way of encouraging definite and useful work on the subject of the glacial drift deposits, as well as on any others which from time to time may be fixed upon to engage the attention of the members of this Union. Mr. Harrison says:—

"Leicester Town Museum, May 8th, 1880.

"To the Hon. Secretaries of the Midland Union of Scientific, &c., Societies.

"Gentlemen,—A consideration of the working of our Union since its commencement leads me to the conclusion that it would be desirable, not only to place definite objects of work before the Members of our Societies, but also to offer some recognition of good work done.

"If the funds of the Union permit, or, if a special fund could be raised for the purpose, I would suggest that a gold medal be offered annually for some subject connected with the Natural History of the Midlands; the subject to be announced at least one year beforehand.

"Subjects connected with the various Natural History Sciences might be taken in turn, and I believe that the plan would secure the performance of some excellent work. Certificates of merit might be awarded to all papers which gave evidence of original work.

"The working details of a plan to carry out this scheme would be very simple: The subject should be announced annually at the General Meeting. Papers should be sent in under a motto, (with name and address in sealed envelope,) and the Council should depute skilled experts to examine and report on them. Successful papers should be published in the 'Midland Naturalist.'

"I remain, Gentlemen,

"Obediently yours,

"W. JEROME HARRISON."

This suggestion has the hearty approval of the Council, and they strongly recommend the Union to adopt it. If the funds derived from the small subscription of membership should not be sufficient for the provision of such an annual reward as is proposed, a special fund for the purpose would have to be raised; but your Council do not think there would be any great difficulty in obtaining the requisite money; some of the larger societies would probably be willing to vote one or two guineas each annually to the medal fund, while among the three thousand members it surely will not be an impossible task to find a sufficient number able and willing to contribute the small balance which may be required in addition to the contributions from the societies.

Two invitations have been received for the holding of next year's Annual Meeting, one from the Cheltenham Natural Science Society, the other from the Nottingham Literary and Philosophical Society. Your Council have unanimously agreed to recommend that the invitation from the Cheltenham Natural Science Society be accepted, and that the meeting for 1881 be held at Cheltenham.

The "Midland Naturalist" has during the past year published a number of important and interesting papers, and has thoroughly sustained the high character which it won at the outset. It has given figures of numerous additions to the freshwater fauna of England, discovered, delineated, and described by members of this Union. Of these may be mentioned as specially worth notice *Leptodora hyalina*, *Daphnia Kahlbergensis*, and *Anuræa longispina*. Your Council have pleasure in acknowledging the generous liberality of the Birmingham Natural History and Microscopical Society, which has gratuitously supplied the journal with most of the plates with which it has been embellished during the past year; they have also to acknowledge similar gifts from Mr. Lawson Tait, F.R.C.S., and Mr. Walter Graham, F.R.M.S. Especial thanks are due to Professor Huxley, F.R.S., for his kindness in allowing the societies' editors to publish his valuable address on "The Work of Microscopical Societies" in the journal of the Union, and to many other eminent men for their contributions to its pages. The gratuitous and useful labours of the editors must also be warmly acknowledged. Your Council are pleased to report that those gentlemen have consented to continue their labours. In making this announcement, they again feel compelled to urge on the societies, and every member of them, the bounden duty of supporting the "Midland Naturalist" by subscribing for it regularly. As the support given is a totally inadequate recognition of the labour and money spent on the publication, your Council have to announce that after the present year the subscription will be raised from 4s. to 6s. per annum, that being the price which is willingly paid by the general public.

On the 1st of October next the scientific institutions of the Midland counties will receive an important addition by the opening at Birmingham of Sir Josiah Mason's Science College. For several years past very large sums of money have been expended by the benevolent founder on the beautiful, extensive, and commodious building which henceforth will be the centre of scientific life in the district to which our Union extends. Four professorial chairs have already been efficiently filled by the appointment of Professors Hill, Tilden, Poynting, and Bridge, viz., those of Mathematics, Physics, Chemistry, and Biology. The range of studies already provided for is such as to qualify students for passing the examinations necessary to obtain the degrees of B.Sc. and D.Sc. of the University of London. Besides this systematic instruction popular instruction will be given in the practical applications of science by means of evening lectures to artisans and others unable to attend the regular college course. Before long Geology and Mineralogy, with their application to mines and metallurgy, and other branches of science, will be included among the subjects taught. Already the formation of a Natural History Museum has been begun at the College, and a well-known member, Mr. S. Allport, F.G.S., has been appointed curator. It is to be hoped that the advantages offered by Mason's College will be largely used by residents in the Midland counties. Mr. Allport is prepared to issue the programme of studies for the first session, and to answer the enquiries of intending students.

Another member of the Union—Mr. W. Jerome Harrison, F.G.S. —has been appointed to an office of much importance, in discharging the duties of which, it cannot be doubted, he will exercise a most beneficial influence on the rising generation of a large and populous town—namely, the office of Demonstrator of Science to the Birmingham Board Schools, in which it has been decided that elementary science is henceforth to be regularly taught.

The Birmingham Natural History and Microscopical Society have recently taken a step which your Council think some of the other Societies in the Union will like to be aware of; they have decided to admit, without subscription, to the privileges of the Society, a limited number of young persons of both sexes who show a taste for the study of natural science, under the following regulations:—

"Any student of natural history who has attained the age of fourteen, on the nomination of two members, to one of whom he or she is personally known, or on the recommendation of the Head Master or Mistress, Professor or Lecturer of any College, School, or other educational institution of the district, seconded by a member, and supported by the recommendation of the Committee, may be elected an associate at any general meeting, and shall then, subject to the laws of the Society, but without payment of any subscription, enjoy all the privileges of members except that of voting until he or she shall have attained the age of nineteen, but no longer; but if any associate do not use the privileges aforesaid, the Committee shall have the power to declare him or her to be no longer an associate. The number of associates shall not at any time exceed twenty."

Your Council desire to draw the attention of the members who are interested in microscopy to the facilities now and for some time past afforded by one of the members—Mr. Thos. Bolton, 17, Ann Street, Birmingham—to all who are desirous of studying the rarer forms of freshwater microscopic life. This gentleman will, for a subscription of one guinea, send a weekly supply of living microscopic objects for a period of six months. During the past year he has in this way distributed among many of the members and scientific students in all parts of the country a large number of organisms, which otherwise they would, probably, not have seen, or could not have obtained except with great difficulty. To students of biology Mr. Bolton's "Natural History Studio" has proved a real boon, and Professor Ray Lankester and others have borne testimony to the value it has been to them and to the students who have attended their demonstrations.

Your Council feel they cannot properly omit from their annual report the record of a very valuable work which one of the Societies in the Union—the Birmingham Philosophical Society—has earnestly engaged in—the endowment of original scientific research. With a wise and generous liberality, some of the members have started a fund for this purpose, which already amounts to over £700 in donations, and to £70 in annual subscriptions, out of which a sum of £150 per annum for three years has been voted to Dr. George Gore, F.R.S., author of that valuable book "The Art of Scientific Discovery," which amount is, in the terms of the grant, placed at his disposal in order that he "may have greater facilities for continuing in Birmingham his original researches." The Council of the Philosophical Society propose to make other grants as soon as the funds will permit.

It now only remains for your Council to warmly acknowledge how much they appreciate the excellent arrangements made for the present gathering of the Union by the Northampton Natural History Society, and to ask you to give suitable expression of your thanks for all the trouble and expense which has been incurred by the Society on your behalf, and in the interests of natural science.

The reception of the report was moved by the President and seconded by Mr. W. R. Hughes. After a short discussion on the subject matter of the report, which was approved of by the several speakers,

Lord Lilford proposed, and the Rev. Dr. Deane seconded, the following resolution, which was unanimously agreed to:—"That the report of the Council be adopted, entered on the minutes, and printed in the 'Midland Naturalist.'"

Mr. Egbert D. Hamel (Hon. Treasurer) then read his report, from which it appeared that the current year's income amounts to about £32 4s. 7d., of which £27 2s. 10d. has already been received; that the total receipts since the formation of the Union amount to £50 6s. 2d.; the payments to £28 17s. 1d.; and accounts outstanding about £17; leaving an available balance of cash in hand £4 9s. 1d.; and to be received £5 1s. 9d.; total, £9 10s. 10d.

The adoption of the Treasurer's account was moved by Mr. Lawson Tait, seconded by Mr. C. E. Crick, and unanimously agreed to.

Some discussion then followed on Mr. Harrison's suggestion for the Union to offer a gold medal annually, (details of which are contained in the Council's report given above,) and on the proposition of Mr. E. D. Hamel, seconded by Mr. C. Pumphrey, it was resolved:—"That Mr. Harrison's proposal of an annual gold medal be referred to the Committee of Management, with power to carry it into effect if they think fit."

On the motion of Mr. W. J. Harrison, seconded by Mr. R. G. Scriven, it was unanimously resolved:—"That the annual meeting of the Union in 1881 be held at Cheltenham."

Proposed by Rev. G. Nicholson, seconded by Dr. A. Stephenson, and resolved:—"That the thanks of the Union be presented to the Editors of the 'Midland Naturalist,' the Officers of the Union, (the Hon. Treasurer, the Hon. Secretaries, and the Assist. Hon. Secretary,) for their services during the past year."

Mr. Egbert D. Hamel was then re-elected Treasurer; Mr. Edward W. Badger (Birmingham) and Colonel Basevi (Cheltenham) were elected Hon. Secretaries, and Mr. H. E. Forrest Assist. Hon. Secretary for the ensuing year.

Lord Lilford then delivered the following address:—

LORD LILFORD'S ADDRESS.

Ladies and Gentlemen,

You will, I feel sure, pardon me for commencing the few words I have to say with a sort of preface concerning the position in which I now stand before you. On the two previous occasions on which I had the honour of occupying the chair as President of the Northampton Natural History Society, though I am fully conscious of the small claim I possess to that distinction, the Society had placed me there, and I therefore felt that I was the right man in the right place. I hope that I am not the wrong man to-day, but it is on account of the extreme courtesy and cordiality which I then experienced at the hands of our society that I now feel emboldened to make a sort of personal statement. When I received the first notice of this meeting, and the invitation to preside on this occasion, I was in very bad health, and felt afraid either that I should be physically incapable of accepting the said invitation, or that the state of my health might compel my absence from this country. I am now most thankful to say that those causes for my absence, as you see, no longer exist; but besides these, I had other reasons, with one only of which I will venture now to detain you. I most cordially hoped that this meeting would be (as I am glad to know that it is) well attended, and attended by many gentlemen of far superior scientific knowledge and acquirements to my own, in whose presence I could not dare to deliver an address on what should, in my opinion, be the subject matter of presidential addresses on these occasions, namely, the advance of general scientific knowledge, especially in the branches of Zoology, Botany, Geology, and Meteorology. I am no specialist, ladies and gentlemen; these sciences are sisters, and a study of one of them leads us towards acquaintance with the others, and all, honestly cultivated, lead us into ways of pleasantness, though not invariably into paths of peace. But I, ladies and gentlemen, having been endowed from my earliest recollection with an ardent love for Zoology, am free to confess that I have found its study so delightful and so engrossing, that I have had but little time to spare to the other sisters, and am faithful to my first love to an extent which has rendered me, I fear, almost entirely ignorant of the other charmers. Not to weary you, then, I will only repeat that Zoology is my love, and Ornithology her chief charm in my eyes, and it is on this subject alone that I feel any sort of power to address you.

As I once said in this room before, I hold that "No shoemaker beyond his last" is a very good old proverb, perhaps particularly applicable in this great shrine of St. Crispin, and I propose to confine my further remarks to a few observations upon the Ornithology of our county and its neighbourhood. Before proceeding, however, in that direction, I feel sure that I shall be only expressing the general feeling of our society in bidding a most sincere and hearty welcome to those members of our sister societies who have given us the honour and pleasure of their company at this meeting, in wishing them one and all God speed in their various pursuits, and in expressing a hope that the present may be the precursor of many merry meetings of a similar character.

Now I must turn to our own society especially, and congratulate it on its vigorous, robust, and promising growth. We have not completed our fifth year of existence as a society, but the baby is doing well, enjoying life as an infant should, and, I must be allowed to add, showing many signs of increasing intelligence. It began to speak plainly in February last, somewhat late I must confess, but I think that its utterances are, to put it mildly, worthy of an older child. I speak with some delicacy on this subject, as I have myself had a modest share in the said utterances, in using which term I am of course alluding to our "Natural History Journal," which is, I think, on the whole, a very satisfactory production; long may it continue to be so, and increase in bulk, interest, and intellectual strength.

I have had the pleasure of sending down for exhibition at the Conversazione this evening a collection of birds' skins, containing about 137 specimens and 72 species, all of which, with one exception, were obtained within the limits of the Northern Division of Northamptonshire. This collection has no pretension to be a complete one of our county birds, of which the list (as far as I know) reaches to about 190 species, and no doubt might be greatly enlarged; but I think that these skins form a fairly representative collection of our resident species, with a few migrants and occasional visitors. In thus expressing myself, I must say that our summer visitors are very scantily represented in this collection, and Ornithologists who examine it will perhaps be surprised at the absence of many of our commoner birds. The reasons for these absences are my great objection to destroying our summer visitors, all of which are ornamental, many of them musical, and most of them extremely useful. This objection on my part applies also to our commoner resident birds; for I say to myself, what is the use of taking the life of a bird whose habits may be studied, so to speak, at one's door, or in everyday walks or rides. In the case of what we call *rare* birds the above objections apply still more forcibly, especially for this reason—that many species common on the continent of Europe are now rare in England, simply and solely because they are not allowed to exist here; several of such birds, at least, if left unmolested, would, I firmly believe, become common, breed, and establish themselves amongst us, do no appreciable harm, and add vastly to the enjoyment and interest of the country walks of all rational beings. The difficulty here arises in the question how local collections of birds are to be rendered complete without the destruction of the uncommon birds aforesaid. The question is a perfectly fair one, and not a very easy one to answer. The suggestion that I would offer is, to make our collection as complete as possible of birds actually obtained in our district, by beginning with our common species, whose loss will be imperceptible, and, in a few special instances, advantageous to certain classes of the community; to represent our less common species by foreign specimens; above all, never to offer money for so-called rare birds; to trust to the liberality of those who may and do not share *our*, perhaps, I should say *my*, feelings on this subject, and who are inclined to favour us with such specimens as they unfortunately kill, and to keep an accurate and circumstantial record of all occurrences relating to this branch of science. On this subject I may, perhaps, be allowed to read two letters which have lately appeared in the *Field*, one from my friend, Captain Clark-Kennedy, and the other from myself:—

"NATURALISTS AND THE WILD BIRDS ACT.

"It is only a week since I wrote you word of the occurrence of a Black-winged Stilt in the marshes near Eastbourne, in Sussex, where I am temporarily residing. I saw the bird within a few yards of the spot where I was standing, and therefore was easily enabled to identify it with absolute certainty, especially as I am well acquainted with the bird, and have observed its habits, flight, and domestic economy generally in Africa and Northern Asia. Now, I have invariably made it a rule to record, either in your columns or in those of the 'Zoologist,' the fact of any rare bird's appearance in this country; and this I think any Ornithologist is bound to do, for the benefit of his brother naturalists in general, and for the advancement of the study of Ornithology in particular. We all know, of course, that no sooner is any account published of a scarce bird's occurrence in this country, than all those who think they can turn an honest (?) penny by killing it (and afterwards selling it to the highest bidder if possible) at once search for the unfortunate bird throughout the district in which it was reported to have been seen. I was quite cognisant of this fact as far as dealers in natural history wares were concerned; but hitherto I had not thought that naturalists and gentlemen were equally mean in endeavouring to exterminate our rarer feathered visitors merely for their own selfish ends, at the same time figuring as examples of law-breakers. For this very reason I did not send you the note of the occurrence of the Black-winged Stilt until ten days should elapse between the day on which I saw the bird and the day of publication of *The Field* of last week. *The Field*, as everyone knows, is published on Saturday, and on Monday morning the principal local bird-stuffer here (Eastbourne) had several letters, begging him to at once obtain this rare visitor, and forward it to the writers. I was very much surprised to learn that no less than three of these gentlemen were well-known naturalists, one being a clergymen as well as a magistrate. Now, I do not wish to give publicity to such proceedings as these, but for this reason, that I think every right-thinking lover of birds will agree in saying that when a law is made it ought to be upheld; and how is such an end possibly attainable when those gentlemen who ought to be an example to others in a lower (and poorer) station of life are the first to offer money to induce bird-stuffers and others to break the law? I also am informed, on the best authority, that for two whole days a collector (a gentleman?) from near Brighton, was in the marshes where I saw the Stilt, endeavouring to obtain it—but, I am glad to say, without success. I am sorry for the Golden Orioles recorded by my friend Lord Clifton in *The Field* a short time since as having been seen in April (and one shot) near Stanmer Park, as no doubt the others will speedily share the same fate. I only wish there were many others who would be content with being good Ornithologists, like Lord Clifton, without killing everything they see during the summer, and in this way giving our rarer birds a chance to nest with us. It will be long before I again record a rare bird in *The Field* until a month or so after its occurrence—of course I mean in case of a bird observed and not shot; and I recommend a similar delay to all Ornithologists. I have seen both Golden Oriole and Hoopoe, Spotted Crake and little Ringed Plover, and other scarce birds in this country; and, keeping the knowledge to a few trusted friends, in every case these birds bred. These were all in Suffolk. Had I recorded their appearance at once in your columns, what would have been the probable result? They would have shared the fate of other rarities within a very few days. I beg to offer these remarks with all deference to the opinions of brother Ornithologists; but I can scarcely believe anyone will wish that every rare bird that reaches our shores should at once be destroyed. I should be very glad to have the opinion of the Editor on a subject of great interest to us all, and of other Ornithological readers of *The Field*. I saw another very scarce bird in the county of Sussex yesterday, but the readers of your Natural History column will not be informed what it was just at present."

I may, perhaps, mention that I have the honour to be President of the British Ornithological Union, and in that capacity felt called upon to reply to Captain Clark-Kennedy's request for an expression of opinion. This is the letter I wrote:—

"RARE BIRDS.

"As Capt. A. Clark-Kennedy, in the admirable letter which has appeared in your issue of the 22nd inst., has invited an expression of opinion on its subject-matter from his brother Ornithologists, I venture to trouble you with the following remarks:—In the first place, then, let me say that with every word of the said letter I most cordially agree. Accurate records of the appearance of rare birds in our country, with original remarks on their habits, state of plumage, and apparent intentions, are of great interest and value; but their interest and value depend upon their accuracy, and are in no way increased by *immediate* publication, the slaughter of their subject, or the fact that Brown, Jones or Robinson has become the proud possessor of 'one more unfortunate.'

"As long as collectors are to be found who will pay pounds sterling for a bird, because it is said to have been killed or caught in this country, whilst they scoff at the idea of buying for a few shillings an equally good specimen from abroad, so long will professional bird-stuffers be exposed to temptation, to dishonesty, and to infringement of the various Acts of Parliament relating to the protection of birds. Let us then take Capt. Clark-Kennedy's advice to heart, and, when we have the good luck to meet with a rare bird, do our best to cultivate its acquaintance in a friendly and hospitable way, notebook in hand, and exercise our judgment as to the proper time for requesting you to publish our observations.

"As a bright example of the right line of conduct to follow in such cases, let me briefly recall to the memory of your readers that which was adopted by my friend Mr. H. M. Upcher, in the case of the Great Bustard which made its appearance on his property in the early part of 1876. Mr. Upcher is a keen Ornithologist, and a real sportsman in the best sense of the word, and could no doubt have added this fine male Bustard to his collection with very little difficulty; but he did far better—he prevented by all means in his power the disturbance of the bird, and kept the fact of its appearance a secret from all but a select band of friendly Ornithologists, some of whom he invited to come and watch his stately visitor from a safe distance. The result was that the Bustard remained for a considerable time in the district, was the subject of some very interesting notes in *The Field* and other publications, and, we have reason to hope and believe, left our shores without injury. Mr. Upcher was fortunate in being able to keep his visitor and his secret so long; for though a letter from a well-known writer appeared in the *Times* announcing the fact of the bird's presence, the locality therein mentioned was not the correct one, and the Bustard escaped the usual consequences of such unfortunate and ill-timed communications."

With reference to the birds I have sent down, I beg to present a large majority of them to our society, and am glad to learn from Mr. Crick that the society is provided with a proper receptacle for them.*

In conclusion, let me thank you for your very kind reception and attention, and repeat my hope that many more meetings of this sort may be in store for us.

On the motion of the Rev. C. F. Thornewill, seconded by Mr. Lawson Tait, it was resolved:—"That the thanks of this meeting be given to the Right Hon. Lord Lilford for his interesting address, and that he be requested to allow it to be printed in the 'Midland Naturalist.'"

Lord Lilford, in giving his consent, took occasion to recommend the study of the Cheiroptera, (Bats,) of which he had once taken six of the dozen British species.

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* See "Rough Notes on Collection of Northamptonshire Birds, presented to Northampton Natural History Society, June 17th, 1880," page 163.

Mr. BADGER moved the next resolution (which was seconded by Mr. JOHN LEVICK)—"That the thanks of the Union be presented to the Northampton Natural History Society for the excellent arrangements they have made for the present gathering of the Union." The mover took the opportunity to remark on the amount of hard work which the Northampton Committee had done, to provide for the comfort and instruction of the members, and paid a well-deserved compliment to the Rev. S. J. W. Sanders, Mr. C. E. Crick, and others, who had spared no pains to make the meeting memorable and successful.

On the proposition of the Rev. Canon SCOTT, seconded by Lord LILFORD, it was unanimously resolved :—"That the thanks of this meeting be given to the President (Sir Herewald Wake, Bart.) for his able and courteous conduct in the chair."—The annual meeting then terminated.

Immediately afterwards the Council re-assembled, and appointed the following gentlemen (with power to add to their number) the Management Committee for the ensuing year:—The President, Sir H. Wake, Bart.; the President-elect, Dr. T. Wright, F.R.S., (Cheltenham); the Editors of the "Midland Naturalist," the Hon. Secretaries, the Hon. Treasurer, Mr. F. T. Mott, F.R.G.S., (Leicester,) Mr. Edmund Tonks, B.C.L., (Birmingham,) Rev. Dr. Deane, (Birmingham,) Rev. H. W. Crosskey, F.G.S., (Birmingham,) Mr. Lawson Tait, F.R.C.S., (Birmingham,) and Mr. W. R. Hughes, F.L.S., (Birmingham.)

ROUGH NOTES ON COLLECTION OF NORTHAMPTONSHIRE BIRDS,

Presented to Northampton Natural History Society, June 17th, 1880.

BY LORD LILFORD.

As I said in the address*, which I had the honour to read to the General Meeting of the Midland Union of Natural History Societies at Northampton, the present collection has no pretension to be a complete one of the birds of our county, but is a fairly representative one of our resident species, with a few, chiefly autumnal, migrants, and a small number of occasional stragglers.

The only specimen of Peregrine Falcon, *(F. peregrinus,)* is an immature female, shot in the immediate neighbourhood of my house in north Northamptonshire. This species is by no means uncommon with us as an autumnal visitor, attending on the flocks of wild-fowl which visit the Nene Valley. *Vide* Journal of Northampton Natural History Society, No. 1, pp. 7, 8, 9.

The two Hobbies, *(F. subbuteo,)* are a fine adult male, shot in August, 1879, close to Lilford, and a female not so fully adult, shot a few years ago within half a mile of the same spot. This species is a pretty regular though not an abundant summer visitor to our district. *Vide op. supra cit.*, pp. 9, 10.

* See *ante* page 159.

The two Merlins (*F. æsalon*) are immature, male and female, both shot near Lilford, Oundle. *Vide op. supra cit.*, No 2, pp. 28, 29.

Amongst the eight specimens of Sparrow Hawk (*Accipiter nisus*) will be found an adult male, in a state of plumage comparatively seldom met with in Great Britain. *Vide op. supra cit.*, pp. 31, 32.

A pair of Red-backed Shrikes (*Lanius collurio*) I only mention for the reason that this species, which I think I may say was almost unknown in our district thirty years ago, is now a frequent and well-known summer visitor; the same remark applies in a respectively greater or less degree to the Hawfinch, (*Coccothraustes vulgaris*,) the Nightjar, (*Caprimulgus Europæus*,) and the Turtle Dove, (*Columba turtur.*)

The Dipper, or Water Ousel, (*Cinclus aquaticus.*) A specimen of this bird (which I believe to be that in this collection) was shot at Blatherwycke, near King's Cliff, in April, 1868, and is, as far as I am at present informed, the only specimen which has been obtained in our county.

The Greater Spotted Woodpecker, (*Picus major*,) of which this collection contains a pair, shot near Lilford, is not rare with us, but is much less common than the Little Woodpecker, (*Picus minor*,) which is not therein represented.

The Reeves Pheasant, (*Phasianus Reevesii*,) of which the collection contains three pure specimens, two males and one female, besides a very fine male hybrid between this species and the more or less pure common Pheasant, (*Ph. colchicus*,) is an Asiatic species from the mountains of Northern China, which I have introduced with some success into our coverts as a game bird, the finest male of the two pure birds sent, and the hybrid were both shot in a wild state, the latter was wild bred, and had not, I believe, been observed or distinguished before it rose to the gun in one of my woods in December, 1879. I can strongly recommend Reeves Pheasant to game preservers who have large ranges of woodland, as it is a very hardy bird, easy to rear, of a very wild nature, and most excellent for the table.

The Green Sandpiper, (*Totanus ochropus.*) This bird is by no means uncommon with us, and I only mention it because scarcely a summer passes that I do not receive several specimens from neighbours who are puzzled as to what species the bird belongs, and sometimes insist that it is a solitary Snipe, (*Scolopax major*,) which is, as far as my experience goes, exceedingly rare in our district. The Green Sandpiper generally appears with us late in July, or during the first fortnight of August, either singly or in pairs, and frequents the banks of ponds and small streams in preference to those of the river. It may be at once distinguished from any other of our wading birds by its conspicuous white rump, and its loud and peculiar whistle on being disturbed. A few of these birds may be found with us throughout the autumn and winter months, in fact I have notes of their appearance near Lilford in every month of the year, except June, but, as a rule, our summer visitors of this species leave us towards the beginning of October.

The pair of Bewick's Swans, *(Cygnus minor,)* in this collection were shot on the Nene, within a mile of Lilford, by my friend and near neighbour, Mr. George Hunt, of Wadenhoe House, January 28th, 1879, out of a flock of sixteen, of which he had secured another pair, now in his own collection, on the 25th of the said month. I have many notices of the appearance of so-called *Wild* Swans in our neighbourhood, but the majority of those so-called which have come under my notice have been roving specimens of the Common or Mute Swan, *(Cygnus olor.)* Both Bewick's Swan and the Whooper, or Common Wild Swan, may easily be recognised from the Mute Swan with a good glass by the brilliant lemon yellow of the upper portion of the bill in adult birds, and if on the wing in a flock, or sometimes even singly, by their incessant trumpeting cry.

The White Fronted Goose, *(Anser albifrons,)* of which species I exhibited a fine adult male at Northampton, was shot by Mr. G. Hunt, above mentioned, on the Nene, not far from Aldwincle, January 6th, 1880. For full particulars *vide* "Zoologist" for February, 1880, p. 66. I retain this specimen in my own collection.

Two immature male Goosanders, *(Mergus castor,)* shot by my brother, the Hon. L. Powys, out of a flock of some eight or ten, on the Nene, at a short distance below Lilford, in January, 1876. . We generally find a few of this species on the river in severe weather, but adult males are somewhat rare with us, and, though I have seen several on the Nene in that state of plumage, we have not hitherto been able to secure one of them.

The female Scoter, *(Oidemia nigra,)* was shot near Woodford Mill, above Thrapston, about August 18th, 1879, and sent to me in an almost putrid state, which accounts for the bad condition of the specimen. This of course is only a straggler, and not a common one to our inland district. Full particulars of this specimen will be found in "Zoologist" for September, 1879.

The Green Cormorant or Shag, *(Halieus graculus,)* immature, was caught on the towers of Arthingworth Church, on August 31st, 1879, brought to Lilford alive on September 2nd, and lived for several months in my aviary. The Shag, of course, is another accidental visitor to our county, but the above is only one of several occurrences of the species therein, and is fully recorded in the "Zoologist" for October, 1879.

Exactly the same remarks as the above apply to the specimen of Manx Shearwater, *(Puffinus anglorum,)* exhibited at Northampton by me, which was shot on the Nene by Mr. G. Hunt, September 4th, 1879, and which I retain in my own collection. This species has occurred several times to my knowledge in Northamptonshire. Mr. J. Hensman informs me that the specimen of this bird now in the Northampton Museum was caught feeding amongst domestic fowls in that town in September, 1866. For particulars concerning the present specimen *vide* "Zoologist" for October, 1879.

POND LIFE : WHERE TO FIND ANURÆA LONGISPINA.

BY J. LEVICK.

Enquiries for good localities for fresh-water microscopic life are so often made that it is very gratifying to be able to indicate a source from which an abundant supply of new and beautiful forms is now to be obtained, especially as it has none of the ordinary drawbacks common to pond hunting, which prove so insuperable to all but the most enthusiastic. The habitat referred to is not in private grounds, guarded by high and strong fences, where ominous sign-boards disclose the presence of man-traps, spring guns, &c., with other pains and penalties, thoughtfully provided for trespassers ; nor is it an out-of-the-way nook, which needs a journey by rail, or a long walk, and a scramble through bog and briar to be reached. On the contrary, it is in the most convenient of all localities, a spot which may be reached at any time, without fear of injury to the daintiest of prettily-worked slippers—at home !—in the very water brought to us in pipes, and which we are using and drinking every day. This important commodity, supplied by the Corporation of Birmingham, is now a splendid source of, not only old and familiar forms of life, but even rarities, and all that needs to be done to obtain these is to turn on the tap and pass a little water through a very fine strainer or filter, taking care of the residuum, which may in this way be collected.

Under the microscope, this residuum will be found to yield a host of treasures. First to be noticed is that lovely long-spined rotifer, discovered only last year, *Anuræa longispina*, (see "Midland Naturalist," Vol. II., p. 241,) some dead, but many living, sailing to and fro, as it is wont to do, having for its companions *A. stipitata* and *Triarthra longiseta*, the latter looking like a little fat fellow on three long delicate stilts. There are also occasional specimens of *Salpina redunca*, *Dinocharis pocillum*, and a long list of other species, together with a few *Tardigrada*. A remarkable fact is that the *Anuræa longispina* are much more hardy than they were last year, whether they have become more acclimatised, or whether the water suits them better, is not apparent, but they certainly live longer after being gathered than hitherto, and do not seem at all discomforted by being bottled for a time.

Of other interesting forms, the latest addition to fresh-water life is *Ceratium longicorne*, very plentiful, but few living, though its congener, *Peridinium tabulatum*, seems none the worse for its temporary sojourn in the pipes. Large quantities of that curious compound flagellate organism, *Dinobryon sertularia*, comparable to animated ears of barley, are also to be noted. The Vorticellidæ and Entomostraca are also represented, the former by both branched or tree-like, and simple forms, and the latter principally by that lively little crustacean, with his two long and curved antennæ, *Bosmina longirostris*, evidently much the worse for his compulsory visit to town, either the distance travelled or the mode of transit being unsuited to his well-being.

Diatoms are mostly present in the pretty stellate species, *Asterionella formosa*, with a few specimens of *Synedra* and *Pleurosigma*, while desmids are fairly plentiful in the beautiful forms of *Pediastrum granulatum* and *Hyalotheca; Pandorina morum*, *Clathrocystis*, and other algæ have also been found.

It may not be out of place to remark that a recent visit to Olton reservoir yielded most of the good finds of last year, not omitting *Leptodora hyalina* and *Hyalodaphnia Kahlbergensis*, the former translucent beauty being scarce, but the latter abundant, with other rare entomostraca, and that at the "Roll Call" the only missing friends were *Anuræa longispina* and *Ceratium longicorne*, a gap well filled up from an unexpected source.

Possibly some who take great interest in the purity of the water supply of Birmingham may feel alarmed by this somewhat formidable list of "dreadful sounding" names of the living organisms it contains, but perhaps it may help to comfort them to suggest that the presence of these organisms should rather be taken as indicative of the general good quality of the water than otherwise, as some of them, at least, are at home and abroad known as the inhabitants of deep, clean water only.

BRITISH LICHENS: HINTS HOW TO STUDY THEM.

BY W. PHILLIPS, F.L.S.

(Continued from page 128.)

If a thin, perpendicular section be taken of one of the foliaceous species, say for example *Physcia parietina*, and placed under the microscope with a little water, there will be presented to the eye of the student three distinct layers. (Plate V., Fig. 9.)

1st.—The *cortical* layer*, which forms the upper surface or bark of the thallus. It is composed of minute cells, closely compacted together, constituting a firm membranaceous tissue. (Plate V., Fig. 9*a*.) The cells vary in size and outline, the latter being modified by their mutual pressure. The cell walls are comparatively thick, and by transmitted light show a faint degree of colour, more conspicuous in very old specimens of the Lichen. Beneath this cortical layer will be seen—

2nd.—The *gonidial*† layer, which consists of cells filled with chlorophyll, spherical, or nearly spherical, varying in size, and easily separated from each other by the slightest pressure. There would appear to be no actual union between these bodies, though produced one from the other, but they lie loosely together in a tolerably well defined stratum. (Plate V., Fig. 9*b*.) They occur in the thallus of all Lichens, though they differ considerably in form, being first, cells enclosing green

* From *cortex*, Latin for rind or bark.

† From *γόνη*, generation, and *εἶδος*, resemblance, indicating their resemblance in function to the spores.

granular protoplasm, as in those we have now under the microscope; second, cells containing several granules, devoid of any cell membrane, called *granula gonima*; and, third, cells arranged in chains or necklaces. (Plate V., Fig. 10.) These gonidia often thrust themselves up through the surface of the cortical layer, in clusters or heaps, producing the conditions of the thallus known as a *sorediate** thallus. Some very fanciful notions have in late years been broached with regard to the relationship the gonidia bear to the thallus, to which we cannot, in the limited space at our disposal, give more than a passing notice; at the same time it must be admitted that they have the power of carrying on an existence independent of the other constituents of the thallus, and will, on a favourable surface, multiply themselves till they form a pseudo-thallus, but do not produce apothecia. Beneath the gonidial layer may be seen

3rd.—The *medullary*† layer composed of colourless interwoven filaments, branched and tubular, being divided within at certain intervals by walls or septa. (Plate V., Fig. 9*c*.) A section of the thallus of *Peltigera canina* will show both this and the preceding layers in a clearer manner than *Parmelia saxatilis*. Beneath the medullary layer there are often present in foliaceous species the *rhizinæ* which have already been referred to, serving the purpose of attaching the Lichen firmly to its place of growth; in *Parmelia saxatilis* they are black, short, and rigid, but in *Peltigera canina* they are long, pale, and flaccid.

If we had selected a crustaceous Lichen for examination, as for example *Lecidea geographica*, (Plate V., Fig. 7,) we should have found the cortical, gonidial, and medullary layers in precisely the same order as above, but instead of *rhizinæ* we should have seen a very thin layer of dead cellular black matter adhering closely to the surface of the stone, which is called the *hypothallus*.‡ This is formed by the threads first thrown out by the germinating spores, and is the earliest stage of a Lichen thallus. On quartz rock this hypothallus of *Lecidea geographica* is often to be seen in black radiating lines, while as yet no other part of the thallus has been formed.

In some of the gelatinous Lichens, as for example in *Collema*, the cortical layer is absent, while in an allied genus, *Leptogium*, it is reduced to the thinnest possible layer; the gonidial layer and the medullary are also mixed up together in one common stratum. (Plate V., Fig. 10.)

While a well developed Lichen thallus will have the characters above described, it must not be forgotten that in many species it is reduced to such insignificance that it consists of little more than a few filaments, accompanied by a few gonidia lying beneath the epidermis of the bark of a tree, or running through the disintegrated surface of a rock. In species with such an imperfectly developed thallus specimens will occur in which it cannot be detected, it is then said to be *evanescent*; but if present and

* The term *soredia* is from the Greek word σωρὸς, a heap, a pile, indicating the little heaps of gonidia.

† From *medulla*, Latin for pith or marrow.

‡ From ὑπὸ under, and θαλλὸς a frond, *i.e.*, that which underlies the thallus.

concealed beneath the epidermis of the bark it is said to be *hypophlœodal.** This is the condition in many genera, amongst which may be mentioned *Opegrapha*, *Graphis*, *Arthonia*, and *Verrucaria*.

The Reproductive Organs of Lichens.

Having briefly described the leading characters of the Lichen thallus, our next object is to convey in as few words as possible an idea of the mode of reproduction in Lichens. This is accomplished by the means of spores, which are capable of germinating and throwing out from one or more parts of their surface fine transparent threads called *hyphæ*, which form a thin layer by becoming interlaced together, this layer as already described being the *hypothallus*. The spores are produced in a special receptacle seated on some portion of the thallus, or buried in its substance, called the

Apothecium.† The apothecium is capable of assuming a great number of various forms, which it is necessary should be clearly understood; but there are certain essential parts which belong alike to all forms. We will select as a specimen for illustration the common wall Physcia (*Physcia parietina*,) as it is a species usually exhibiting an abundance of apothecia. If a well-grown specimen of this Lichen be obtained by the student‡ he will observe scattered about the centre of the thallus a number of orange-coloured circular shields or cups, surrounded by a pale margin, seated close on the surface, or slightly raised by a broadish stem-like base; these are the apothecia (Fig. 4.) He will observe that the area enclosed by the pale margin is slightly depressed, (Fig. 12,) but less so in the older individuals; this area is called the *hymenium*§ by some, and the *thalamium*|| by others, and is composed of a vast number of club-shaped cells, arranged in an upright position, side by side, within which are produced the spores already mentioned. These club-shaped cells are the *asci*¶ or *thecæ*,** and each one contains in the species under examination eight spores, which escape on the rupturing of the asci at maturity. These asci are not always sack-shape, being sometimes narrowly cylindrical, at others nearly spherical, with numerous intermediate variations.

The spores vary in number in each ascus, according to species, from a single one to a great number, but the most common number is eight. They also vary very much in size, form, mode of internal division, and colour. It is by the aid of these characters that species can be satis-

* From ὑπὸ under, and φλοιὸς the bark of a tree.

† From ἀπὸ, upon, and θήκη, a sac, the part bearing the asci.

‡ To meet the case of such as have no means of obtaining specimens of the commoner species of the British Lichens, the author of this paper has determined to prepare small collections, correctly named, to be obtained post free on application to his address, Canonbury, Shrewsbury, at the following rates:—Elementary Collections of British Lichens, Series I., containing twenty-five specimens, 5s. 6d.; Series II, containing fifty specimens, 10s.; Series III, containing one hundred specimens, 18s.

§ From ὑμὴν, a membrane.

|| From θάλαμος, a receptacle.

¶ From ἀσκὸς, a leather bottle.

** From θήκη, a sack.

factorily determined, as each particular species exhibits its own characteristic spore with wonderful constancy. The spores are believed to be the female organs of the plant, and to acquire their germinating power from a process of impregnation by bodies we shall proceed presently to describe; but in what stage of their existence this process takes place has not yet been satisfactorily shown.

Returning to the hymenium, the student will find other upright bodies intermixed with the asci, surrounding them on all sides, exceeding them slightly in length, but much slenderer, and thicker at the summits than below; these are the *Paraphyses*.* (Fig. 13*a*.) The precise function of these bodies has not been ascertained, but there can be no doubt they serve as a protection to those very important bodies the asci, whatever other functions they may perform. They occur in some species as very slender threads, either simple or branched, and are also often so united together as to be inseparable by pressure; they are then said to be *indistinct*.

This layer, called the hymenium or thalamium, composed of asci and paraphyses, is permeated by a substance called the hymenial gelatine, which holds the whole together in a compact mass. In proceeding downwards in our examination of the apothecium, we come to a layer of small cells, which forms the bed from which springs the hymenium. (Fig. 13*c*.) This layer is called the hypothecium,† because it underlies the asci or thecæ. The colour of this forms an important character in the large genus *Lecidea*, being either colourless or dark coloured. We have finally to point out the excipulum, or receptacle within which the previously described parts of the apothecium are contained. In the species under examination this is formed by a continuation of the substance of the thallus, which has taken the shape of a miniature cup, in the bottom of which the hymenium and the hypothecium are seated. (Figs. 11, 12.) If a perpendicular section be made through the middle of the apothecium, carrying it down through the thallus, there will be no difficulty in seeing, with a pocket lens, the arrangement of all the parts in the order we have here described them. It is only in certain genera that the excipulum is formed of the same tissue as the thallus. It is often formed of its own special tissue, in which case it is called a proper excipulum; and the margin it forms when looked at from above is called a proper margin, whereas in the former case it is called a thalline excipulum and a thalline margin.

There is yet one more term used in reference to the apothecium, which it is necessary to explain—the *epithecium*.‡ This term is used to denote the upper surface of the hymenium, the part that is presented to the light.

The various parts of the apothecium we have described are essentially the same in all, though assuming a multitude of different forms;

* From παρὰ, about, and φύω, to grow.

† From ὑπὸ, under, and θήκη, a sack.

‡ From ἐπὶ, upon, and θήκη, a sack.

hence the student must learn to recognise them however they present themselves in nature. To aid him in this we will point out some of the more striking modifications of the apothecium.

The *Peltiform** apothecium, is so called because of its resemblance to a small shield. It may be in the form of a depression, sunk into the thallus, as in *Solorina*, presenting no margin; or it may be a convex disc arising from the upper surface of the thallus, and having a margin, as in *Peltigera*. It occurs in some genera on the under side of the thallus, as in *Nephronium*.

The *lecanorine* apothecium is so called because it is the characteristic form in the genus Lecanora, and, as we have seen in the specimen under examination, has an excipulum formed from the substance of the thallus. It may be innate or immersed in the thallus, which forms a wart-like tubercle around it, at first entirely closed, afterwards open at the summit, as in *Thelotrema* and *Urceolaria* (Fig. 19;) or it may be raised above the general surface of the thallus on a short stem-like base, as in *Physcia*, *Parmelia*, and *Lecanora*. (Figs. 11, 12.)

The *lecideine* apothecium is that in which the tissue of the excipulum is essentially different from that of the thallus, being, like the preceding forms, either sunk into the thallus or seated on its surface. (Figs. 21, 17.) In this form of apothecium the excipulum is a continuation of the hypothecium as already described, or perhaps more properly the latter is a continuation of the former, presenting no very well defined line of separation. It prevails in the large genus *Lecidea*, hence the name *lecideine*. It is sometimes also called *patelliform*.

The *lirelline*† apothecium is that which forms an elevated ridge, with an opening in the form of a slit running along the top. It prevails in the pictorial Lichens, those which resemble writing, as *Opegrapha* and *Graphis*. The receptacle here is usually black, and consists of a firm cellular substance, and is generally called the *perithecium*‡. If the perithecium entirely surrounds the thalamium, it is called entire (Fig. 20;) if it be deficient beneath, it is called dimidiate. (Fig. 18.) The lirellæ are very variable in form, being immersed or slightly elevated, broad or narrow, straight or curved, simple or branched.

The *pyrenodine*§ apothecium is that in which the excipulum consists of a closed receptacle composed of a dense leathery or brittle substance, with a minute pore at the top caled the *ostiolum*||. It may be globose or conical, superficial, *i.e.*, seated on the surface, or immersed in the thallus. As in the lirelline apothecium, if it surround the thalamium it is called entire, and if deficient beneath it is called dimidiate, and also has the name perithecium applied to it. It is the characteristic form in *Verrucaria*, approaching very closely the genus *Sphæria* in fungi.

* From *pelta*, Latin for target.
† From *lirella* Latin for furrow.
‡ From περὶ, around, and θήκη, a sack.
§ From *pyren*, Latin for kernel, or stone of fruit.
|| From *ostiolum*, Latin for a little door.

These various devices of nature presented to us in the structure of the apothecium of Lichens are directed towards one object—the development, protection, maturing, and dispersing those important bodies, the spores. As we have before hinted, these bodies being regarded as the female organs, we must now turn our attention to the organs designed for their fertilisation. These are believed to exist in the *Spermagonia* and the *Pycnides*, which shall now be briefly described.

The *spermagonia* are minute spherical bodies found on the surface of or embedded in, the cortical layer of the thallus. If one of these be carefully dissected through the middle it will be found to have its interior lined with excessively minute thread-shaped jointed upright bodies, (Fig. 14*c*,) which are called *sterigmata*. From the summits, and also from the joints of these arise still smaller, rod-like cylindrical bodies, which are either straight or curved, these are the *spermatia*. They are produced in great numbers, and find their way through an opening in the summit of the spermagonium into the open air to perform their function of fertilising the hymenium of the apothecium.

The *pycnides* are minute dark-coloured bodies somewhat spherical in form, seated on the cortical layer of the thallus, the interior of which is lined with a layer of simple upright filaments bearing on their summits spore-like bodies, which are called *stylospores*, (Fig. 15, *a*, *b*, *c*.) The filaments bearing the stylospores are called *basidia*. The stylospores are allowed to escape by a pore in the summit of the pycnides. We have now completed the drier part of our subject, not without regretting that so many hard names have had to be used to convey our meaning, the acquirement of a knowledge of which is the tax we all have to pay on entering the domain of science. Once acquired, however, they become our greatest aids to study, and lead to a precision of thought which more familiar but ill-defined terms would utterly fail in. Leaving this thought to console the student for his trouble, we will now turn to easier branches of our subject.

(To be continued.)

FOSSIL FISH REMAINS FROM THE CARBONIFEROUS LIMESTONE OF SOUTH DERBYSHIRE.*

BY E. WILSON, F.G.S.

At Ticknall, the most westerly of eight small inliers of Carboniferous Limestone, on the borders of Derbyshire and Leicestershire, the highest beds of the limestone series are well exposed in the extensive quarries on the estate of Sir John Harpur Crewe, Bart., at the east end of the village of that name. The sections in these rocks here show about twenty-five feet of interstratified blue fossiliferous limestones and shales, capped by about fifteen feet of reddish yellow dolomitic limestone.

* Read before the Natural Science Section of the Nottingham Literary and Philosophical Society, 2nd May, 1879.

From the shaly portion of the Limestone series I have succeeded in obtaining remains—in the shape of teeth (except where otherwise stated)—of the following thirty species of fossil fish. For considerable assistance in the nomenclature of the specimens, rendered difficult by their fragmentary condition, I am indebted to Mr. William Davies, F.G.S., of the British Museum, and Mr. John Ward, F.G.S., Longton, Staffordshire, to whom I wish now to express my thanks.

To the list of Ticknall species here given I append the chief English and Irish localities at which they also occur :—

	Ticknall, (S. Derbyshire.)	North Derbyshire and Yorkshire.	Ireland, chiefly Armagh.	Oreton & Farlow.	Bristol.
PISCES.					
Order Ganoidei.					
Megalichthys Hibbertii (scales.) *Ag.*	..				
Order Elasmobranchii.					
Sub-order Plagiostomi.—Cestraphori.					
Asteroptychius semiserratus (ichthyodurolite)	..				
Chomatodus cinctus. *Ag.*	..	..	..	..	..
" truncatus. *Ag.*	..		..		
" obliquus. *M'Coy.*	..		..		
Cladodus striatus. *Ag.*	..	..	..		
Cochliodus contortus. *Ag.*	..	..	..	..	..
Harpacodus (Ctenoptychius) serratus. *Ag.*	..	..	..	..	
Deltodus sublævis. *Ag.*	..		..	..	
Deltoptychius. *Ag. Spl.*	..	..	..		..
Helodus lævissimus. *Ag.*	..		..	..	..
" turgidus. *Ag.*	..		..		..
" mammillaris. *Ag.*	..		..	..	..
" didymus *Ag.*	..				
Orodus (sp?) *Ag.*	..		..	..	..
Petalodus Hastingsiæ. *Owen.*	..	..	..		
" lævissimus. *Ag*	..		..		
" lobatus *Eth, jr.*	..				
" rectus. *Ag.*	..	..	..		
Petalorhynchus Benniei. *Eth, jr*	..				
" psittacinus. *Ag.*	..	..	..		
" sagittatus. *Ag.*	..				
Pœcilodus obliquus. *Ag.*	..		..		
Polyrhizodus. *M'Coy.*	..				
Psammodus cornutus. *Ag.*	..	..	..		
" rugosus. *Ag.*	..	..	..		..
Psephodus (Cochliodus) magnus. *Ag.*	..	..	..		
Streblodus oblongus. *Ag.*	..		..		
Xystrodus (Cochliodus) striatus. *Ag.*	..		..		
Shagreen *Sp ?*	..				

The following additional genera and species have been described by M'Coy, in his contributions to British Palæontology, as occurring in Derbyshire, chiefly at Ticknall :—

Acrolepis Hopkinsii. *M'Coy.*
Cheirodus pes-ranæ. *M'Coy.*
Leptacanthus junceus. *M'Coy.*
Climaxodus imbricatus. *M'Coy.*
Pœcilodus aliformis. *M'Coy.*
Pœcilodus foveolatus. *M'Coy.*
Petrodus patelliformis. *M'Coy.*
Petalodus rhombus. *M'Coy.*
" acuminatus. *M'Coy.*

In the Geological Survey memoir on the Leicestershire Coal Field no mention is made of the occurrence of fish remains in South Derbyshire. In his Geology of Leicestershire, Mr. Harrison mentions Cochliodus and Petalodus Hastingsiæ as having been found at Ticknall. In the memoir on the Lower Carboniferous Rocks of North Derbyshire, Mr. Etheridge gives, on the anthority of M'Coy, a list of twelve species of fossil fish, of which, however, only four have their localities given, viz., Cladodus basalis and Petalodus sp., from Bakewell; Petalodus psittacinus, from Cromford; and Psammodus rugosus, from Ashford; the remainder are those above referred to as having come chiefly from Ticknall.

Two Ticknall forms, Petalodus lobatus and Petalorhynchus Benniei, were lately described under these names as new species by Mr. R. Etheridge, jun., who obtained them from Scotland, (see Geological Magazine, June, 1875.)

METEOROLOGY OF THE MIDLANDS.

THE WEATHER OF MAY, 1880.

BY W. JEROME HARRISON, F.G.S.

During the first three weeks of May, cold north-easterly winds continued to blow, and, with the exception of that which accompanied a thunderstorm on the 11th, little or no rain fell. On the 26th and 27th, however, a steady downpour took place, which was the time of the maximum fall for all the west and central stations, and the last few days of the month were also showery; there was a hail-storm on the 28th. Vegetation generally was rather backward. A lunar halo was seen at Loughboro' on 20th.

Natural History Notes by Observers.—*Shifnal.*—Landrail first heard on 6th; Hawfinch seen on 11th; Swifts arrive at the Old Church on 16th. *Cheltenham.*—15th, *Veronica chamædrys* in flower, *Orchis maculata* in flower, Hawthorn in flower, near Southam, foot of Cotteswolds, Horse Chestnut in flower, *Turdus musicus* young left nest; 18th, *Cypselus apus* flying over lake in Southam Villa grounds; 26th, *Melolontha vulgaris* in Southam Villa garden. *Bishop's Castle.*—Cuckoo first heard, 1st; Swifts came, 15th. *More Rectory.*—Whitethroat, 7th; Swift, 15th.—*Stroud.*—*Aquilegia vulgaris*, 20th, S.E., in copse; *Lonicera Caprifolium*, 20th, S.E., in copse; *Alchemilla vulgaris*, 22nd, W., by hillside; *Sherardia arvensis*, 31st, S., dry hilltop. *Orleton.*—Whitethroats and Redstarts seen on 13th; summer birds are few in number: Thrushes rarely seen or heard, Blackbirds scarce, and even the Robin is become a rare bird. *Uppingham.*—*Potentilla anserina* in flower on the 16th; *Galium aparine*, 20th; *Trifolium repens*, 23rd; *Lychnis Flos-cuculi*, 23rd;

Lotus corniculatus, 29th; *Hieracium Pilosella*, 29th; *Chrysanthemum Leucanthemum*, 30th. *Burton-on-Trent.*—Noticed at Risley Oak in full leaf on 30th, Ash just coming out. *Kibworth.*—Hawthorn in bloom on 15th. *Waltham-le-Wold.*—Summer birds very scarce; insect life remarkably abundant; Swifts scarce.

STATION.	OBSERVER.	RAINFALL.				TEMPERATURE.			
		Total for M.	Greatest fall in 24 hours.		No. of rainy d.	Greatest ht.		Great'st cold	
		In.	In.	Date.		Deg	Date.	Deg	Date.
GLOUCESTERSHIRE.									
Cheltenham	R. Tyrer, Esq.	·94	·29	27	9	72·	21	28·2	1
Stroud	S. J. Coley, Esq.	1·62	·20	28	6	73·0	22 & 27	30·0	1
Adderley Rectory, Market Drayton	Rev. A. Corbet	2·53	1·53	26	9				
SHROPSHIRE.									
Haughton Hall, Shifnal	Rev. J. Brooke	2·45	1·33	26	8	67·0	21 & 26	31·0	1
Woolstaston	Rev. E. D. Carr	2·79	1·57	26	10	68·0	19	34.0	1
More Rectory, Bishop's Castle	Rev. A. Male	2·77	1·55	26	10	67·0	20	29 0	1
Larden Hall	Miss F. R. Boughton	2·74	1·45	26	10	68·0	31	37·0	1, 6, 7, 8, 9
Bishop's Castle	E. Griffiths, Esq.	2·84	1 60	26	7	71·0	20	30·0	1
Stokesay	Rev. J. D. La Touche	2·96	1·43	26	8	69·5	21	29·5	1
Cardington	Rev. W. Elliot	2·93	1·60	26	10				
Leaton Vicarage	E. V. Pigott, Esq.	2·76	1·56	26	10	66·0	25	27·0	1
HEREFORDSHIRE.									
Stoke Bliss	Rev. G. E. Alexander	2·51	1·10	26	10	69·0	21	37·0	7
WORCESTERSHIRE.									
Orleton, Tenbury	T. H. Davis, Esq	2·71	1·29	26	11	73·3	21	29·8	1
West Malvern	A. H. Hartland, Esq.	1·68	·60	26	6	78·0	21	36·0	6 & 12
Pedmore	E. B. Marten, Esq.	1·80	·63	26	11	70·0	26	28·0	1
Longlands, Stourbridge	J. Jeffries, Esq	1·93	·74	26	9	74·0	26	33·0	1
Dennis, Stourbridge	Mr. C. Webb	1·78	·78	26	10	70·0	26	31·5	1
Evesham	T. J. Slatter, Esq.	1·27	·52	27	12	72·7	21	32·7	1
STAFFORDSHIRE.									
Dudley	Mr. J. Fisher	1·30	·29	26	10				
Kinver	Rev. W. H. Bolton	1·87	·87	26	10	72·0	26	31·0	1
Walsall	Mr. N. E. Best	2·17	·69	26	11	77·0	26	35·0	1 & 8
Grammar School, Burton	C. U. Tripp, Esq.	2·01	·48	26	13	70·0	26 & 29	32·0	1 & 2
Weston-under-Lyziard R'tory	Hon. and Rev. J. Bridgeman	2·51	1·33	26	9	73·0	25 & 29	29·0	1, 6, 9
Wrottesley	E. Simpson, Esq.	2·29	1·11	26	8	67·5	27	34·4	1
Heath House, Cheadle	J. C. Philips, Esq.	2·65	1.13	26	10	63 0	26	34·0	7
Farley, near Cheadle	C. L Wragge, Esq.	2·74	1·10	26	11	61 7	26	31·4	1
Oakamoor	E. Kettle, Esq.	2·47	1·15	26	9	63·3	26	29·4	1
WARWICKSHIRE.									
Coventry	J. Gulson, Esq.	1·67	·41	10	13	70·0	26	30·0	1
Coundon, Coventry	Lieu.-Col. R. Caldicott	2·03	·40	10	12	71·0	26	36·0	8
Bickenhill Vicarage	J. Ward, Esq.	1·73	·52	27	7	59·0		51·0	
St. Mary's College, Oscott	Rev. S. J Whitty	1·78	·41	26	11	69·2	26	34·1	9
Henley-in-Arden	T. H. G. Newton, Esq.	1·73	·45	27	12	74·0	21	29·5	1
Rugby School	Rev. T. N. Hutchinson	1·41	·40	27	11	70·8	21	30·4	1
Snitterfield, Stratf'd-on-Avon	J. Goodacre, Esq.	1·24	·41	27	10	73·8	22	30 5	1
DERBYSHIRE.									
Spondon	J. T. Barber, Esq.	1·87	·46	27	9				
Duffield	W. Bland, Esq.	1·38	·51	26	8				
Fernslope, Belper	F. J. Jackson, Esq.	1·93	·56	26	11	69·0	26	33·0	1
NOTTINGHAMSHIRE.									
Hodsock Priory, Worksop	H. Mellish, Esq.	1·81	·72	26	10	69·7	20	31·0	7
Tuxford	J. N. Dufty, Esq.	1·56				72·0	26	35·0	7
LEICESTERSHIRE.									
Loughborough	W. Berridge, Esq.	1·26	·27	27	11	70·5	26	31·9	1
Ashby Magna	Rev. E. Willes	1·56	·45	10	12	79·0	26	28·0	1
Kibworth	T Macaulay, Esq.	1·76	·40	10	12				
Belmont Villas, Leicester	H. Billson, Esq.	1·59	·41	11	13	72·8	26	33·2	1
Town Museum, Leicester	W. J. Harrison, Esq.	1·63	·41	11	15	69·2	26	32·1	1
Syston	J. Hames, jun., Esq.	1·22	·29	11	9	77·0	3	33·0	1
Waltham-le-Wold	E. Ball, Esq.	1·51	·32	11	9	67·0	21	32·0	2
Coston Rectory, Melton	Rev. A. M. Rendell	1·44	·34	11	11	68·5	26	28·9	1
Dalby Hall	Mr. G. Jones	1·20	·31	27	11	78·0	21	26·0	1
Market Harborough	S. W. Cox, Esq.	2·12	·77	11		68·0	20	32·0	10
NORTHAMPTONSHIRE.									
Towcester Brewery	J. Webb, Esq.	1·14	·29	31	9				
Castle Ashby	R. G. Scriven, Esq.	·85	·22	10	7	71·0	25	37·0	18
Kettering	J. Wallis, Esq.	1·23	·31	10	11	71·0	27	38·0	2, 7, 9
Althorpe	G. S. Groom, Esq.	1·07	·26	10	8	68·0	26	32·0	1 & 9
Pitsford	C. A. Markham, Esq.	1·49	·49	27	11	75·0	26	31·0	9
RUTLAND.									
Uppingham	Rev. G. H. Mullins	1·40	·37	10	13	71·9	20	34·0	1
Northfields, Stamford	W. Hayes, Esq.	1·40	·75	10	9	77·0	26	28·0	1
Altarnun Vicarage	Rev. J. Power, M.A.	1·01	·57	27	5	75·0	27	28·	9 & 10
Oxford	E. J. Stone, Esq	·89	·40	27	6	72·5	22	35·3	8
Ventnor	W. T. Ryder, Esq.	·50	·15	14	7	73·6	26	37·5	1

Correspondence.

Botanical Notes.—It may be interesting to botanists, who have not yet observed it, to know that the Meadow Saxifrage *(Saxifraga granulata)* is growing luxuriantly in Sutton Park this season. This is an introduced plant, and has not, I believe, been reported from that place before. The Lady's Mantle *(Alchemilla vulgaris)* is also growing on a piece of meadow land in the Park. Mr. J. E. Bagnall, in his notes on Sutton Park, says that he has not seen it there since 1869, when it was growing near Keeper's Pool.—B. T., Birmingham.

Phenological Observations from Lincolnshire :—

Name.	Date.	Aspect.	Situation.
Cardamine pratensis	April 16th.	W.	Hedge bank.
Ranunculus auricomus ..	,, 16th.	W.	Hedge bank.
Prunus spinosa..........	,, 18th.	E.	Hedge row.
Caltha palustris	,, 18th.		Ditch in wood.
Anthriscus sylvestris	,, 25th.	S.	Hedge bank.
Sisymbrium Alliaria	,, 25th.	S.	Hedge bank.
Myosotis collina	,, 27th.	W.	Hedge bank.
Orchis mascula..........	,, 28th.		In wood—clay soil.
Geum rivale	,, 28th.		In wood.
Ranunculus aquatilis	,, 30th.	Open.	Pond.
Veronica chamædrys	May 2nd.	S.	Hedge bank—sandy.
Ajuga reptans	,, 4th.		In wood.
Lamium galeobdolon	,, 4th.		In wood.
Endymion nutans	,, 4th.		In wood.
Stellaria Holostea	,, 4th.		In wood.
Myosotis sylvatica	,, 6th.		In wood.
Lychnis diurna..........	,, 6th.		In wood.
Paris quadrifolia	,, 6th.		Wood.
Plantago lanceolata......	,, 6th.	E.	Edge of field.
Pedicularis sylvatica	,, 9th.	Open.	Meadow.
Cratægus monogyna	,, 15th.	S.E.	Hedge.
Ranunculus bulbosus....	,, 15th.	Open.	Meadow.
Geranium Robertianum..	,, 17th.	N.	Hedge bank.
Tormentilla officinalis ..	,, 18th.	E.	Margin of field.
Lotus corniculatus	,, 19th.	W.	Hedge bank.
Ranunculus acris........	,, 26th.	S.	Sunk fence.
Potentilla anserina	,, 26th.	Open.	Edge of pond.
Trifolium pratense	,, 26th.	S.W.	Side of road.
Chrysanthemum leucanthemum	June 4th.	Open.	Edge of gorse covert.
Sherardia arvensis	,, 4th.	Open.	Edge of gorse covert.
Rhinanthus Crista-galli ..	,, 4th.	Open.	Meadow.
Geum intermedium......	,, 4th.	W.	Hedge bank.
Lychnis Flos-cuculi	,, 8th.		Wood.
Ranunculus Flammula ..	,, 8th.		Wood.
Trifolium repens	,, 10th.	Open.	Side of road.
Erodium cicutarium	,, 11th.	Open.	Seed field.
Veronica officinalis	,, 11th.	Open.	Seed field.

Swallows first seen, April 20th.
Cuckoo heard, April 25th.

Swift seen, May 22nd.
Flycatcher seen, May 26th.

A. E. J., Hatton.

Leafing of Oak and Ash.—I noticed Oak trees in leaf on the 11th inst., and I did not see Ash trees as forward until the 24th inst., so I consider, this season, the Ash hereabouts a fortnight later than the Oak.—E. C., Chaddesley, Kidderminster, 27th May, 1880.

White Varieties of Plants.—It may interest some of your readers to know that a plant of *Ajuga reptans*, which I transplanted to the garden two years ago, continues constant. This year it has thrown up numbers of heads of pure white flowers. Though I left part of the root in the wood where I found it, I cannot discover any trace of it there now. In the adjoining field I gathered, on the 4th of this month, a pure white specimen of *Pedicularis sylvatica*. With regard to the proliferous Cardamine mentioned at page 67, (March last,) it proves to be *Cardamine pratensis*.—A. E. J., Hatton, June 12th, 1880.

Botanical Notes from South Beds. Earliest Observed Dates of Flowering :—

Name.	Date.	Aspect.	Situation, &c.
Allium ursinum	May 21st.	W.	Damp wood on clay.
Geum urbanum	,, 21st.	W.	Hedge bank.
Cratægus Oxyacantha	,, 19th.	Open.	Hedge row.
Luzula pilosa var.	,, 22nd.	Open.	Bog.
Chelidonium majus	,, 21st.	S.	Hedge bank.
Quercus (Oak) *foliage*	,, 23rd.	Open.	Leaves well developed.
Fraxinus (Ash) *foliage*	,, 23rd.	Open.	Leaves just expanding, quite a week behind the Oaks.
Nasturtium sylvestre	,, 24th.	Open.	Waste ground.
Habenaria bifolia	,, 24th.	W.	Damp wood.
Rhinanthus Crista-galli	,, 23rd.	Open.	Pasture.
Hottonia palustris	,, 29th.	Open.	Water dyke.
Euonymus Europæus	,, 29th.	Open.	Hedge.
Rhamnus catharticus	,, 29th.	Open.	Hedge.
Chamomilla inodorata	,, 29th.	Open.	Cultivated field.
Lithospermum arvense	,, 29th.	Open.	Cultivated field.
Achillea millefolium	,, 30th.	Open.	Pasture.
Helianthemum vulgare	June 1st.	W.	Hedge bank.
Potentilla anserina	May 24th.	Open.	Road side.
Lysimachia nemorum	June 5th.		Wood.
Orchis maculata	,, 5th.		Wood.
Listera ovata	,, 5th.		Wood.
Lathyrus macrorrhizus	,, 5th.		Wood.
Ranunculus Flammula	,, 6th.	Open.	Bog.
Malva rotundifolia	,, 6th.	S.	Hedge bank.
Bryonia dioica	,, 6th.	S.	Hedge bank.
Gymnadenia conopsea	,, 7th.	N.W.	Chiltern Hills.
Linum catharticum	,, 10th.	W.	Hedge bank.
Viburnum Opulus	,, 13th.	Open.	Hedge row.
Habenaria viridis	,, 13th.	Open.	Moist meadow, on clay.
Orchis latifolia	,, 13th.	Open.	Marsh.
Rosa canina	,, 13th.	Open.	Hedge row.
Thalictrum flavum	,, 19th.	Open.	Brook side.
Cornus sanguinea	,, 19th.	Open.	Hedge row.
Orchis ustulata	,, 20th.	N.W.	Chiltern Hills.

J. Saunders, Luton.

Acronycta alni.—I took a fine specimen of *A. alni* at rest on an oak tree in Repton Shrubs, on June 12th.—J. E. Nowers, Burton-on-Trent.

Phenological Observations made in the vicinity of Farley, near Cheadle, Staffordshire, during May, 1880:—2nd, gathered first flowers of *Galium cruciatum* on hedge bank facing S.; first flowers of *Plantago lanceolata* gathered on lawn; lower branches of some Elms in full young leaf in Churnet Valley woods; *Tussilago Farfara* still in flower at Oakamoor. 4th, *Cardamine pratensis*, *Anemone nemorosa*, and *Caltha palustris* in full flower in Churnet Valley, between Oakamoor and Alton, a fine sight; first noticed *Pedicularis sylvatica* in flower on waste ground; Limes coming into full young leaf; *Geranium Robertianum* becoming plentiful. 5th, first flowers of *Ajuga reptans*. 8th, Salix——? overhanging pond and open to S.S.W., still slightly in flower; Sycamore in full young leaf, except top and ends of upper branches. 9th, first noticed *Veronica serpyllifolia* in flower on warren; *Tussilago Farfara* still in flower in the Churnet Valley; first flowers of *Lamium album* and *Galeobdolon luteum*; *Hyacinthus non-scriptus said* to be in flower. 12th, first saw flowers of *Hyacinthus non-scriptus* on wayside bank in sandy loam, fairly open to S.; gathered first flowers of *Anthriscus sylvestris* and *Ranunculus repens* by wayside on old wall, all three considered very late; *Arum maculatum* expanded, first noticed and gathered on moist ground by wayside bank. 13th, *Cytisus scoparius* just in flower on moorlands between Oakamoor and Cheadle; *Hirundo riparia* very busy nesting. 14th, first full flowers of *Vicia sepium* seen near Cheadle, two days later at Farley; first flowers of *Ranunculus acris* and *bulbosus* gathered. 16th, gathered *Polygala vulgaris* in flower on warren ground. 17th, Laurel in flower in Alton Towers grounds; about this time first flowers of Garlic appeared. 20th, several Sea Gulls said to have flown over to S.W. 21st, gathered first flowers of *Trifolium pratense* in pasture land. 23rd, *Pyrus aucuparia* first in full flower. 25th, *Cratægus Oxyacantha* coming into flower. 26th, gathered first flowers of Horse Chestnut. 30th, first heard Landrail.—Clemt. L. Wragge, F.R.G.S., F.M.S.

The Cuckoo was first heard here on April 18th. The Oak first showed its leaves on May 9th, some time before the Ash, whose leaves did not appear until May 17th. The Hawthorn first blossomed on May 20th.—H. F. Johnson, Nottingham.

Ornithological Notes.—This is rather an early season with birds, probably owing to mild weather in February. I heard the Chiffchaff on March 15th, the earliest date but one (March 9th) some years ago. They are very common this year; I saw a nest built on April 15th. The Tree Pipit was first heard on April 14th, about the usual time. Yellow Wagtails are very abundant this year. Kingfishers—I am glad to say, notwithstanding two cold winters, generally so destructive to these birds, we have some left. I found six eggs on April 27th, fresh, and seven eggs on April 30th, hard sat. From about the 15th to the 25th of April is the usual time for obtaining these eggs. Jackdaws—Found a great many eggs at Bagot's Park on May 14th, but all hard sat. Found a Barn Owl's nest the same day, with four fresh eggs, in a tall oak tree. Water Ouzel—I found these birds are common in Cornwall, and lay from April 9th to end of month. We have not the usual number of Sedge, Reed, or Blackcap Warblers. Willow Warblers are very numerous. Titmice and Golden Crested Wrens are becoming very rare, as are also Bullfinches. Owls will soon be birds of the past, thanks to our keepers. Landrails and Cuckoos seem common this year.—H. G. Tomlinson, Burton-on-Trent.

Ornithological Notes from Oxfordshire.—About the beginning of May an immature Black-headed Gull was picked up here. I am sorry to have to record two male Golden Orioles as having been shot near Great Tew about the same time. I have the following list of summer migrants:—April 23rd, Sand Martin; 24th, Landrail; 24th, Grasshopper Warbler; 26th, Common Tern, (canal, near Somerton); 26th, Ring Ouzel, (Epwell); 29th, Whimbrel, (Bloxham); 29th, Common Whitethroat; 30th, Nightingale; May 1st, Cuckoo; 1st, Lesser Whitethroat; 7th, Tree Pipit; 7th, Redstart; 7th, Sedge Warbler; 11th, House Martin; 13th, Wryneck, (scarce this year); 15th, Swift, (very plentiful); 19th, Garden Warbler; 19th, Wood Wren; 22nd, Spotted Flycatcher; 28th, Whinchat, (Chinnor, Oxon); 29th, Turtle Dove, (same place). Three of these, Tern, Ring Ouzel, and Whimbrel, should more properly be called rare visitants to this county, but as they are summer migrants to England I have included them in the list. On the 23rd of April last I observed a large Gull flying over, but was unable to make out the species. An Oxford taxidermist showed me a Common Buzzard and a male Great Spotted Woodpecker, killed at Bletchington and Hanboro' respectively some time last month. I saw about a dozen Fieldfares on May 9th; this is rather late.—Oliver V. Aplin, Bodicote, Oxon, June, 1880.

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—Geological Section.—May 25th. Mr. Morley exhibited for Mr. Short *Primula farinosa*, from Ambleside. Mr. T. Bolton exhibited *Clava Squamata*, from the Menai Straits. Mr. W. Graham exhibited a spiral form of a Nostocaceous Alga, from Earlswood. Mr. Montagu Browne exhibited a pied specimen of Rook *(Corvus frugilegus)* and a Water Shrew *(Sorex aquaticus.)* Mr. C. Pumphrey exhibited *Helleborus fœtidus*, and a double specimen of *Geum rivale*. Mr. Goode presented to the Society's Library ten volumes of the "English Mechanic," for which a hearty vote of thanks to him was passed. Dr. Deane then read a paper on "The Study of Geology," showing how favourable the Midland Counties of England are for the study, bringing before the members of the Society the various branches of the science, and indicating some lines of research which are awaiting more workers. The paper was very interesting, and gave rise to some discussion at its close.—Special General Meeting.—June 1st. This meeting was devoted to the discussion and adoption of several proposed alterations in the laws of the Society. The whole of the laws had been revised by the Committee. Each law was proposed separately, and passed unanimously. The most important alterations were the formation of a new order of free membership for persons of either sex, between the ages of fourteen and nineteen, under the title of Associates, (their number being limited to twenty,) and the appointment of seven trustees, in whose name the property of the Society is invested by a deed. The special general meeting then resolved itself into an ordinary meeting. Mr. T. J. Slatter exhibited *Polygonatum officinale*, (Solomon's Seal,) *Anemone Pulsatilla*, (Pasque flower,) *A. Apennina*, (Mountain Anemone,) *Thlaspi perfoliatum*, (Perfoliate Pennycress,) and *Hypnum cuspidatum*, from Worcestershire. Mr. W. Southall exhibited *Veratrum album*, the plant from which the Hellebore powder of commerce is obtained. Mr. J. E. Bagnall exhibited *Veronica montana*, from New Park, Middleton. Mr. W. R. Hughes exhibited egg capsules of the Gooseberry grub *(Nematus grossulariæ.)* showing caterpillars escaping, and others free from the egg. Mr. W. H. Wilkinson exhibited *Solanum Dulcamara* and *Hippocrepis comosa*, from near Cheltenham. Mr. J. Levick exhibited *Pandorina morum* in various stages, as ellipsoidal sacs, containing sixteen or thirty-two gonidia, and as large spherical masses containing a number of these groups.—Biological Section.—June 8th. Mr. W. Southall exhibited *Geranium sylvaticum*, (rare,) *Aquilegia vulgaris*, *Convallaria majalis*, *Equisetum sylvaticum*, and *Carex pendula*, from Wyre Forest. Mr. J. E. Bagnall exhibited *Ranunculus pseudo-fluitans*, and *Ulota intermedia*, from Shelly Coppice. Mr. Levick exhibited *Leptodora hyalina*, *Daphnia Kahlbergensis*, *Macrothrix laticornis*, *Daphnella Wingii*, and *Conochilus Volvox*, from Olton. Mr. Morley exhibited a garden daisy, in which the divisions of the involucre had grown into leaves. Mr. Montagu Browne, F.Z.S., read a paper on "The Changes of Plumage in Birds," being a continuation and extension of the subject of a paper read at a former meeting by Mr. W. Chase. The paper, which was illustrated by a number of beautiful specimens, was listened to with much attention, and elicited a lively discussion, in which Mr. R. W. Chase and others took part.—MICROSCOPICAL GENERAL MEETING.—June 15th. Mr. H. W. Jones, F.C.S., F.R.M.S., read a paper on the chemistry of the shells of some crustacea, in which he adduced experiments to prove that the generally received opinion that the shelly covering of prawns, &c., resembles the transparent portions of the shell of the cray-fish or lobster, and not the calcified portion, is erroneous. The paper was illustrated by cast shells of the lobster and crayfish and living prawns. A lively discussion followed on the method in which crustacea cast their shells. Mr. J. Levick exhibited and read some notes upon the recently discovered rotifer *Anuræa longispina*, together with *Ceratium longicorne*, and many other forms of microscopic life, obtained from the town waterworks water! He remarked that possibly some who take great interest in the purity of the water supply of Birmingham might feel concerned at the rather formidable list of dreadful sounding names of the living organisms which he had found in the town water; but for their comfort he would remark that perhaps their presence should rather be taken as an indication of its general good quality than otherwise, as some of the organisms at least are only known as the inhabitants of deep, clean water, both at home and abroad. Mr. J. F. Goode exhibited a garden daisy, with proliferous capitulum. Mr. H. E. Forrest exhibited a leaf of lime tree covered with curious tubular galls, supposed to be produced by insects, but in which no grubs or eggs could be found.—Mr. Montagu Browne exhibited a Gannet (*Sula Bassana*) from the Aston Aquarium. Mr. W. B. Grove exhibited *Gonium pectorale* and a species of Bursaria. Mr. C. Pumphrey exhibited *Aster Alpinus*, *Gnaphalium leontopodium*, a dianthus grown from Swiss plants, and a species of Blatta, found amongst plants in a local nursery.

BIRMINGHAM AND MIDLAND INSTITUTE SCIENTIFIC SOCIETY.—June 5th.—The members made an excursion to Kingswood. At Rowington the church was visited; after which the Rev. P. B. Brodie, M.A., F.G.S. conducted the party to quarries in the Upper Keuper sandstone on Shrewley Common, and described the geology of the district.

NOTTINGHAM LITERARY AND PHILOSOPHICAL SOCIETY.—NATURAL SCIENCE SECTION.—The annual meeting was held on Wednesday, June 9th, the President, Mr. J. J. H. Teall, M.A., F.G.S., in the chair. The following officers were elected for the ensuing session:—President, I. H. Jennings, Esq.; Vice-Presidents, Messrs. G. B. Rothera and E. Smith; Hon. Secs., Messrs. A. L. Kohn and E. Wilson. The committee was also chosen. The subject of the proposed sea-dredging and general Natural History excursion to the Isle of Man was again introduced. Mr. B. S. Dodd, who has lately visited the island, said that the party proposed to stay a week at Ramsey, and then a week at Port Erin. He said that at both these places there were facilities for dredging in shallow water, and shore-collecting with every prospect of good results; that suitable cutter-rigged vessels could be engaged on moderate terms per diem; that the hotel and lodging-house accommodation was good, and the expense of living reasonable, while the surrounding scenery was extremely picturesque. Mr. J. Shipman then gave an interesting sketch of the geology of the island. Mr. Dodd announced the promise of the loan to the party of an Admiralty chart, dredge-line, two dredges, and other apparatus necessary for exploring the sea-bed, and examining and sorting the materials obtained. The Chairman, commenting on the eminent suitability of the island for scientific exploration, advised members to send in their names at once to the Hon. Sec.

ENCOURAGEMENT OF ORIGINAL RESEARCH:

THE DARWIN PRIZE.

It affords us unfeigned pleasure to have the privilege of submitting to our readers the details of a valuable plan for the encouragement and reward of original research by local Geologists, Naturalists, and Archæologists. The scheme, it will be seen, has grown out of a suggestion warmly received at the Northampton meeting of the Midland Union by the members, and by them referred to the Committee of Management to consider and if approved to carry out. The "Darwin Prize" will, we feel assured, act as an incentive to much real and useful work, and we trust no year will pass without that enviable reward being worthily won. The following extract from the letter in which Mr. Darwin gave his permission for the prize to be named after him was in answer to the unanimously expressed desire of the Committee:—

"I request that you will be so good as to inform the members of the Committee that their wish to name the Medal after me is a very great honour, which I gladly accept. It is particularly pleasing to me to have my name connected, in however indirect a manner, with a scheme for advancing Science—the study of which has been my chief source of happiness throughout life."

This plan for encouraging original work affords the utmost liberty, within given limits each year, for the contributions to deal with subjects deliberately chosen by the writers, If, as we hope will always be the case, the communications to be rewarded by the Darwin Prize are the result of much careful investigation, the pages of this journal will be enriched by them, and they will add to the stores of scientific knowledge. Thus next year the whole range of Geology is open to select from, including mineralogy, petrology, and the application of chemistry, the spectroscope, and the polariscope, to the study of rocks and minerals. The following is the scheme adopted by the Committee:—

The Midland Union of Natural History Societies.

Encouragement of Original Research.

The Darwin Prize.

The Council, at the last Annual Meeting at Northampton, submitted for consideration, with their hearty approval, a proposal made by one of their body, Mr. W. Jerome Harrison, F.G.S., to the effect that an Annual Prize should be provided for the purpose of recognising and encouraging original research by Members of the Societies in the Union. The proposal was favourably received by the Meeting, and referred to the Committee of Management, who were empowered to carry it into effect if they saw fit.

After careful consideration by the Committee, at a Meeting held at Birmingham, on Thursday, July 15th, 1880, the President-Elect (Dr. T. Wright, F.R.S.) in the chair, the following scheme was adopted:—

1st.—That a Prize, (to be called, by permission of Mr. Charles Darwin, F.R.S., "The Darwin Prize,") of the value of £10, to include a Gold or Bronze "Darwin Medal," at the option of the successful candidate, be given annually for a paper indicating original research upon a subject within the scope of the Societies in the Union, contributed by a member for publication in the Journal of the Union.

2nd.—That the subjects for "The Darwin Prize," for the three years ensuing, be limited as under—

In 1881 to Geology,
In 1882 to Biology,
In 1883 to Archæology.

3rd.—That a Committee of five, annually elected for the purpose by the Committee of Management, adjudicate the prize to such paper, of sufficient merit, on the subject of the year, contributed as aforesaid to the Journal of the Union, (the "Midland Naturalist,") either actually published, or sent in for publication during the twelve months preceding the 31st of March of that year, and declare the adjudication at the Annual Meeting.

4th.—That right be reserved for the adjudicators to withhold the prize, if in their opinion no contribution has been sent in of sufficient merit.

Contributions for "The Darwin Prize" next year must be forwarded to the Editors of the "Midland Naturalist," Midland Counties Herald Office, Birmingham, on or before the 31st March, 1881.

Herewald Wake, President.
T. Wright, F.R.S., Chairman of the Committee.
Edward W. Badger, Henry Basevi, } Hon. Secs.

Birmingham, July 20th, 1880.

MIDLAND UNION OF NATURAL HISTORY SOCIETIES.

THIRD ANNUAL MEETING AT NORTHAMPTON, JUNE 17th and 18th, 1880.

THE CONVERSAZIONE.

The Conversazione at Northampton was as satisfactory and interesting as those at Birmingham and Leicester at the former meetings of the Union. It was held in the Guildhall, on Thursday evening, June 17th. The suite of rooms was decorated, and the general arrangements carried out by Messrs. M. H. Holding, H. J. Atkins, S. J. Newman, and W. B. Saul, who are to be congratulated upon the result of their labours, and upon the way in which, by the liberal use of placards, they made known to the visitors where the different exhibits were placed in the somewhat complicated building. Valuable help in the same direction was also given in the excellent catalogue, drawn up by Mr. B. Thompson, F.C.S., in which also each exhibit was, as far as possible, carefully described.

The collections of Natural History objects, photographic and general scientific exhibits, occupied the Town Hall, and in the Sessions Court opposite was some acoustic apparatus. The Council Chamber was occupied by microscopes. In an adjacent room Mr. M. H. Holding exhibited, and humourously lectured on, Balmain's luminous paint, kindly lent for exhibition by Messrs. Ihlee and Horne. Along a corridor close by, the walls were covered with a fine collection of engravings, principally by Bartolozzi—collected by a committee, of which the Rev. J. Cunningham and Mr. J. B. Hensman acted as secretaries. The arrangement of the engravings was undertaken by Mr. H. J. Atkins.

The engravings were so numerous that room for a goodly number had to be found in the Town Museum, to which the corridor led, while on a screen at the lower end were some sketch paintings from nature by the late Mr. J. G. de Wilde, long known and much respected by the inhabitants of Northampton and neighbourhood as the editor of the *Northampton Mercury*. In the Museum the geological visitors enjoyed a rich treat in viewing the collection of fossils which were collected by a former Marquis of Northampton, and presented to the Northampton Museum by the late Marquis; also the collection made by Mr. Samuel Sharpe, F.G.S. Mr. William Hull, the Secretary of the Geological Section of the Northampton Society, was in attendance, and courteously gave information respecting the fossils to those who desired it.

Professor Etheridge reports of the Marquis of Northampton's collection of fossils:—"This collection, almost unrivalled in value and in perfection of specimens, is scarcely equalled in the kingdom. . . . I must specially notice the Cretaceous series, which is truly valuable and fine, many of the specimens being unique; also the Solenhofen or Lithographic Slate series, the Oxford Clay Cephalopoda, and the fine series of Devonian Corals, unequalled in any museum." The collection is rendered more valuable to students from the fact that with a few exceptions they are all British specimens.

In the Curator's Room Mr. T. P. Dorman exhibited in the oxyhydrogen microscope a number of microscopic objects.

Of the varied exhibits, the very fine collection of Birds' Skins exhibited by Lord Lilford, and presented by him to the Northampton Natural History Society, must be first mentioned. They number 137 specimens, representing 72 species. Some of the rarer specimens were described by Lord Lilford in the "Midland Naturalist" of last month (see page 163.) Mr. West exhibited a case of Northamptonshire Birds, most of which are now rare; Mr. F. Law Birds' Skulls; and the Rev. G. Nicholson British Birds' Eggs, representing 270 species. Sir Herewald Wake, Bart., also exhibited British Birds' Eggs. In Entomology, the Rev. L. H. Lloyd had two cases of Butterflies; Mr. Truss a collection of Northants Lepidoptera; and the Rev. G. Nicholson a collection of British Butterflies, representing 49 of the 64 known British species. In Botany, Mr. S. Law showed a collection of Northants ferns; Mr. H. F. Devis (Birmingham) some rare plants, including *Helianthemum polifolium*, *Fumaria muralis*, &c.; and Mr. T. Bolton

(Birmingham) a collection of British sea weeds. In Geology, Mr. Horace Pearce, F.L.S., F.G.S., (Stourbridge,) had specimens of Agates from the United States, including *Agate patera*, ribbon variety; bones from Castleton, specimens of mineral ores, &c. Mr. W. J. Harrison (Leicester,) a collection of Rhætic Fossils; and Mr. H. J. Eunson a section showing the strata exposed by a deep well boring at Kingsthorpe, near Northampton.

Photography, under the charge of Mr. H. Manfield, was well represented by the Photographical Section of the Northampton Society. The Autotype enlargement of Castle Ashby Church, from a negative by Mr. R. G. Scriven, and the Autotype enlargement of the ball room, Haddon Hall, from a negative by Mr. H. Manfield, were especially worthy of notice. Two albums of photographic landscapes, &c., representing the work of the section during the past three years, were also exhibited. Mr. H. E. Forrest (Birmingham) also had three albums of landscapes, &c.

Scientific apparatus, under the charge of Mr. B. Thompson, F.C.S., and Mr. G. C. Osborne, was represented by Chladni's figures by Mr. W. J. Morley (Birmingham,) and Mr. B. Thompson; Hughes's audiometer by Mr. G. H. Twigg (Birmingham;) spectroscopes, polariscopes, Messrs. B. Thompson and C. J. Watson (Birmingham;) pyrometers, galvanometers, &c., Mr. B. Thompson; radiometer, Mr. J. Eunson; a new portable form of constant bichromate battery, by Mr. J. T. Godfrey (Nottingham;) Edison's electric pen, by Mr. H. Manfield. Experiments in thermo-electricity, by Mr. C. R. Robinson, &c., &c. Mr. T. Bolton (Birmingham) exhibited the stencilograph. The London Stereoscopic Company exhibited the phonograph and telephone.

Microscopy was chiefly represented by visitors from Birmingham. Mr. W. R. Hughes showed spicules of Sponges, and other specimens illustrative of Marine Zoology; Mr. A. Lucy, *Volvox globator*; the Rev. J. E. Vize, fungi, algæ, &c.; Mr. H. E. Forrest, *Daphnia Kahlbergensis*, and an album of pen and ink drawings of microscopic objects; Mr. J. Levick, *Anuræa longispina*, &c., from Birmingham water supply; Mr. T. Bolton, *Leptodora hyalina*, &c.; Mr. E. D. Hamel, *Euglena viridis*. A variety of mounted objects were exhibited by Messrs. G. H. Twigg, W. H. Cox, C. J. Watson, E. A. Durham, A. Kempson, J. Morley, J. Potts, C. Pumphrey, and others.

At intervals during the evening, a band, under the leadership of Mr. G. Ashton, played selections of music, while the very Rev. Canon Scott, D.D., and Mr. Brook Sampson, Mus. Bac., performed excellently some selections on the organ. Refreshments were well served by Mr. Nicholls. The visitors numbered some 300. The general arrangements were made by a committee, consisting of members of the Northampton Natural History Society, the principal workers being the Rev. S. J. W. Sanders, Rev. G. Nicholson, Messrs. W. Hull, B. Thompson, M. H. Holding, G. Osborne, H. J. Atkins, H. Manfield, T. L. Cordeux, and C. E. Crick, the two last named being the Hon. Secretaries of the Society.

THE EXCURSIONS.

The second day of the Annual Re-union was devoted to excursions in the neighbourhood; one party making the study of the Geological features of the country their chief object, the other mainly bent upon procuring Botanical treasures and objects of general scientific interest.

THE GEOLOGICAL EXCURSION.—The Geologists were about thirty in number, and made a formidable show of hammers and collecting bags, so that the request made by a resident "not to damage the scenery" appeared a reasonable one.

Starting from the Town Hall at about half-past nine, the carriages drove northwards to the site of the boring for water now being executed by the Diamond Rock Boring Company near the Kettering Road. The bore-hole commences in the Upper Lias, and has reached a depth of 640 feet, being now in the blue clays of the Lower Lias. Although the object of this work is to obtain a supply of water from the sandstones of the Upper Trias, it would be of the highest geological interest to continue the boring so as to ascertain what rocks here underlie the Trias. The latter formation, we believe, would be found to be much thinner than where it rises to the surface further west. Continuing the drive on the north side of the town, numerous interesting sections in the Inferior Oolite, Great Oolite, and Upper Lias were visited, and a return was made to the town about two p.m., in order to partake of a capital lunch provided at the Plough Hotel.

In the afternoon the work lay chiefly among the ironstone quarries in the Northampton Sand (Inferior Oolite) on the west of the town, at Duston, &c.; a final return to the town was made at 6 30 p.m. An opportunity was taken at lunch time to present the best thanks of the excursionists to Mr. W. Hull for the able manner in which he acted as leader of the party. The route for this excursion was suggested by Mr. S. Sharpe, F.G.S.

THE BOTANICAL EXCURSION.—This party, forty in number, including several ladies, was conducted by Mr. R. G. Scriven, who had made every arrangement for the comfort and enjoyment of the visitors, who warmly recognised and expressed their sense of indebtedness to their leader. The weather (as foretold by a telegram from the Meteorological Office received the previous evening) was splendid, and everything propitious.

Leaving the Town Hall shortly before half-past nine, the party proceeded in brakes through exceedingly pretty country, gently undulating and well wooded, *via* Cogenhoe and Whiston, where a short halt was made to enable a visit to be paid to the church, a small but perfect example of the Late Perpendicular style, and having a lofty tower of great beauty, dating from 1534. Again entering the brakes, they were conveyed to Castle Ashby, the seat of the Marquis of Northampton. Here an hour was spent in viewing the mansion and grounds. The latter are of great extent, and tastefully laid out, the spring bedding in particular being greatly admired. The mansion is in the form of a quadrangle, built of white stone, and surmounted by a lettered balustrading, formed by the words "*Nisi Dominus ædicaverit*," &c. Close by is the church, entered through an elaborate doorway of the latest Norman; the north aisle is Decorated; the nave, south aisle, and chancel Perpendicular. It contains several beautiful monuments, notably a recumbent figure of Lady Margaret Leveson-Gower, by Marochetti, surmounted by an angel in relief on the wall; a noble colossal seated figure of an Angel of the Resurrection, by Tenerani; a Purbeck marble effigy of David de Esseby, (about 1268,) the earliest knightly figure in the county; and a full-sized brass of William de Ermine, (1401,) wearing a cope.

Leaving Castle Ashby, the party were driven in the carriages to Yardley Chase Farm, where an excellent luncheon was provided. Close to the farm, two remarkably fine old oak trees, called "Gog" and "Magog," were inspected with great interest. From thence the party walked to "Cowper's oak," beneath the shadow of which the poet is said to have written many of his works. The rest of the afternoon was spent in botanising and insect-collecting in Yardley Chase, an ancient forest, one of a series extending along the southern border of the county of Northampton, on the high ground forming the watershed between the Nene and the Ouse. At half-past three, the members re-entered the carriages and returned to Northampton, *via* Denton and Brafield, and a meat tea at the Plough Hotel concluded a most delightful and interesting excursion. Amongst the botanical specimens obtained may be mentioned—*Ranunculus arvensis*, *Specularia hybrida*, and *Lithospermum arvense*, found in a field near Whiston Church, and the following taken in and near the woods of Yardley Chase:—*Polygala vulgaris* var. *depressa*; *Rosa micrantha*, *Sanicula europæa*, *Valeriana officinalis* var. *Mikanii*; *Hypochœris radicata*, *Paris quadrifolia*, *Orchis mascula* and *maculata*, *Habenaria chlorantha*, *Listera ovata*, *Epipactis palustris*, (sp ?); and *Hypericum tetrapterum* not in flower; *Carex remota*, *pallescens*, *glauca*, and *sylvatica*, *Sclerochloa distans*; and *Lastrea spinulosa*.

Insects were not so abundant in the Chase as might have been expected, both from the weather and from the character of the country; and the Entomological section, represented— sad to say!—by one member only, had a comparatively easy time of it. To a certain extent, however, the "catch" made up in quality for what it lacked in quantity, including as it did two decidedly good butterflies, *Leucophasia sinapis* and *Hesperia paniscus*. Other butterflies seen or taken during the day were *Gonepteryx Rhamni*, *Anthocharis Cardamines*, *Argynnis Selene*, *Satyrus Egeria*, *Chortobius Pamphilus*, and *Lycæna Alexis*. Moths were decidedly scarce, the only species of any note being *Halias prasinana* and *Cabera pusaria*; and a large amount of diligent beating for larvæ among the sallows and oaks produced, not *Iris*, as had been fondly hoped, but such every-day things as *Phigalia pilosaria*, *Hybernia defoliaria*, (of course,) and a single specimen of *Eupithecia abbreviata*. The time, however, was too short to allow of a fair examination of the locality; and it is most probable that a longer visit might result in the addition of not a few rarities to the collector's cabinet.

NOTE ON THE MOVEMENT OF THE CELL-CONTENTS OF CLOSTERIUM LUNULA.

BY A. W. WILLS, F.C.S.

It is well known that at each end of the fronds of certain Desmidieæ there is a clear oval or spherical space, within which are seen a number of minute particles in more or less active motion, at any rate during some periods of the life of the plants. This is especially the case in the genus Closterium, and conspicuously so in the largest species, *Closterium lunula*.

In this plant there is also, as has been often observed, a certain motion of the colourless granular liquid cell-contents which form a thin film between the deep green endochrome mass and the cell wall of the frond. This motion has been described as a circulation, but the term is incorrect. The actual character of the movement is one of ebb and flow, alternately towards and from the ends, and, in favourable specimens, careful examination under a $\frac{1}{4}$ or $\frac{1}{6}$ objective and B eye-piece, shows that it takes place in delicate longitudinal lines or bands, and that in *different* lines the flow may be actually in opposite directions at the same time, while in *any one* line the direction of flow is usually reversed every few seconds, a moment of rest or of confused movement of the particles among one another preceding the reversal of the direction.

The cause of this peculiar ebb and flow is simple enough, but I am not aware that it has been previously recorded.

The clear spaces at the ends of the fronds of *Closterium lunula* are really contractile vesicles, and careful observation under the powers indicated above shows that they are undergoing incessant though slight change of form.

The contraction of any part of the surface of the vesicle is followed by an immediate rush of the surrounding fluid to fill the vacuum thus formed, and the direction of the currents, where the transparent spaces allow them to be observed, may be clearly connected with the corresponding contraction of one or other part of the vesicle. I have spoken of their flow being in lines or bands. The expression is merely intended to describe the general appearance of the action. The whole space between the endochrome and the cell wall is, doubtless, filled with the fluid; but the transverse section of the former would probably present a fluted or corrugated form, corresponding to its longitudinal disposition in belts of denser matter; and the flow of the surrounding fluid may probably be determined by the channels formed by this fluted structure.

The movements I have described may probably be found to have their parallel in the smaller species of Closterium, and in other genera of Desmidieæ in which there is a terminal vesicle. Of its reality in *Closterium lunula* any careful observer may convince himself, provided he examine healthy specimens of the species.

I hope to recur to this subject at a future time; meanwhile it is to be distinctly noted that the flow of cell contents, while it is actuated by the contractile motions of the vesicle, is a phenomenon wholly distinct from the swarming of the larger particles within it, the functions of which are, I fear, still hidden in entire obscurity.

MOUNTING BOTTLE FOR MICROSCOPISTS.

My drop-bottle for balsam, damar, &c., is made as follows:—Take a morphia bottle, and with a rat-tail file, bore a hole through the centre of its cork, through which pass a piece of glass tubing, drawn to a point at the lower end and somewhat expanded at the upper. Cover the upper end with a rubber bulb; a nipple with the opening closed by means of a heated rod will answer. Put the medium into the bottle, insert the cork, and it will be air-tight. Do not squeeze the bulb while the cork is in the bottle, for the tube and bulb would then fill with the medium when the pressure is withdrawn, thus rendering the apparatus useless. When cement is desired, remove the cork, squeeze the bulb till as many drops as may be required are obtained, and return the stopper. By care, the cork and neck of the bottle will be kept clean, and the bottle always ready for use.

CHARLES H. COCKEY, M.D.,

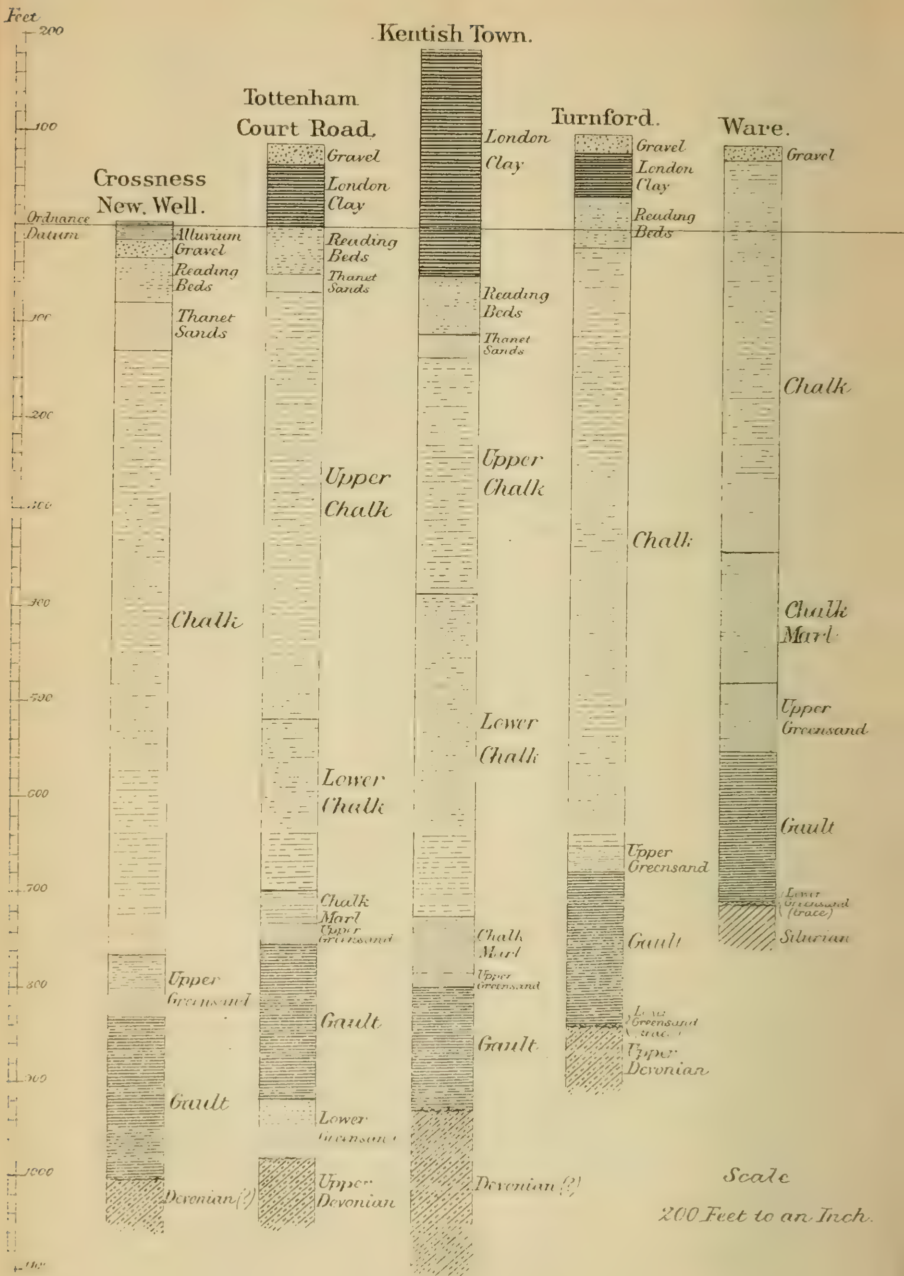
In "American Monthly Microscopical Journal" for July.

ON DEEP BORINGS IN THE SOUTH-EAST OF ENGLAND.*

BY W. JEROME HARRISON, F.G.S.

The mechanical inventions and improvements of the last few years have reacted upon the sciences which gave them birth, enabling us to undertake operations and to make discoveries which we could not hope to do without such aids. Thus, it is now a matter of comparative ease and certainty to make a vertical hole in the earth at any point of from 3in. to 15in. in diameter to a depth of 2,000ft.; the cost of such an operation being from £2 to £5 per foot in depth. On the system adopted

* For the plate accompanying this paper we are indebted to the kindness of Mr. John Hopkinson, F.L.S., F.G.S., the Hon. Sec. of the Watford Natural History Society and Herts Field Club.—EDS. M. N.



WELL-SECTIONS IN THE LONDON BASIN REACHING PALÆOZOIC ROCKS.

DANGERFIELD, LITH. 22, BEDFORD ST. COVENT GARDEN

by the Diamond Rock Boring Company it is, moreover, possible to bring up the rocks passed through in such solid unbroken pieces or "cores" that they are very suitable for geological examination; this is done by black diamonds being set in a circle in the base of a steel cylinder, to which rods are attached, and which is made to revolve by steam power. The rock is abraded by the diamonds and rises in a solid mass into the interior of the steel cylinder; when a sufficient length has been bored, (usually 1ft. or 2ft.,) the columnar piece of rock is detached and brought to the surface, then the cylinder is again lowered and the operation repeated.

The first deep boring ever made in the south-east of England is represented by the central column on accompanying plate, (Plate VI.) It was put down at Kentish Town, in Highgate, a northern suburb of London, about twenty-five years ago, by a company in search of water, and under the advice of Prof. Prestwich.

All Geologists know that London is built on sands and clays of Tertiary age; beneath these lies the chalk which rises up to the north, west, and south of the metropolis, forming the Chiltern Hills and the North Downs. Under the chalk is a sandy bed of no great thickness—the Upper Greensand, beneath which is a stiff blue clay, the Gault; then under the Gault is the bed from which the Hampstead Waterworks Company hoped to get water at Kentish Town, and which is known as the Lower Greensand. However, after passing through 324ft. of Tertiary strata, 645ft. of chalk, and 130ft. of the Gault, the borer entered—not Lower Greensand, as had been expected and hoped—but red and green marls, which we now believe belong to the Devonian formation, thus proving the absence at this point of an immense thickness of intermediate rocks.

The other four sections illustrated on the plate all represent borings executed within the last two or three years. The boring at Crossness, on the south side of the Thames, near Blackwall, was also made for water; it has proved the existence at a depth of 1,005ft. of strata very similar to those at the bottom of the Kentish Town section. After examining specimens of these red marls, I could not help, at a meeting of the Geological Society, remarking their great similarity to the Triassic marls of the Midlands, but of course lithological characters are not of high importance, and, as similar beds occur at one or two points in the Devonian rocks, it would seem more probable that they belong to the latter series; it is certainly remarkable, however, that neither at Kentish Town nor at Crossness did these "red beds" yield any trace of fossils, in which respect they certainly agree well with the Trias.

The Meux Brewery boring was made at the junction of Tottenham Court Road and Oxford Street; here the Palæozoic rocks were struck at a depth of 1,064ft., and penetrated for 80ft.; they were red and green shales full of Upper Devonian fossils, and dipping at an angle of 35 degrees, though in what direction could not be ascertained as, of course, the core is turned round many times before being brought up to the surface.

From a few of the cores which were examined by Mr. C. Moore, of Bath, that gentleman obtained no fewer than 160 species of fossils, chiefly of almost microscopic size.

The boring at Ware (twenty miles north of London, in Herts) revealed the presence of Upper Silurian rocks at a depth of 800ft.; they were Wenlock shales, resembling in every respect the well-known beds at Dudley, and crowded with characteristic fossils, which have been determined by Professor Etheridge. Lastly, at Turnford, near Cheshunt, some six miles south of Ware, Upper Devonian rocks were entered at a depth of 935ft.

These borings tell us that the theory promulgated long ago by Mr. Godwin Austen, that a ridge or axis of Palæozoic rocks extends from the coal basin of Somersetshire eastwards under London and Calais to the Ardennes is a correct one. These old rocks have a high dip, and probably undulate considerably. In some of their folds coal basins may lie, and, as we now know that the beds strike east and west with a southerly dip, it would seem probable that the upper carboniferous rocks (coal-measures) lie somewhere under the south of London, and, if another attempt should be made to reach them, this would be the most likely spot.

Further south the Oolitic rocks attain a great thickness, the Kimmeridge clay being shown by the Sub-Wealden boring (at Netherfield, near Brighton) to be 1,450ft. thick; but the section of this borehole is not contained in our plate, and must be reserved for another note.

SPONGES.*

BY H. J. CARTER, F.R.S., &C.

From the age of Alexander the Great, viz., in the fourth century B.C., when, according to Aristotle, sponge *(σπόγγος)* was "placed beneath helmets and thigh-pieces for the sake of deadening the sound of blows," (? the effect of blows,) almost down to the present time, the Officinal Sponge has been considered chiefly in respect to its uses; and even now a sponge to many is but a sponge in this sense, "and nothing more."

In these days of objective enquiry, however, the human mind, for the most part, is not so stolid; but, seeking eagerly, like a mariner for the relation of surrounding objects that he might be the better able to find his own position on the chart, becomes curious, among other things, not only to consider the various uses to which the Officinal Sponge may be applied, but to know what it is, whence it comes, and what position it holds in the great mass of living beings that is spread over the surface of our earth.

*Communicated by Mr. W. R. Hughes, F.L.S., to the general meeting of the Birmingham Natural History and Microscopical Society, held Tuesday, 29th June, 1880. On Mr. Carter's behalf, Mr. Hughes also exhibited typical specimens illustrating the eight orders of *Spongida* mentioned in Mr. Carter's paper.

As we view the Officinal Sponge, it is nothing but a resilient, horny tissue, which admirably serves the purposes to which it is generally applied, and, looking at it apart from all other connections, we might be inclined to think that it is a product of the earth specially intended for the use of man and nothing else; but knowing now that there are no "hard and fast lines" in creation, wherein all things are united by gradationary transition, so as to produce universal harmony and one great whole, we are irresistibly attracted by this view to consider the connections of the Officinal Sponge, and when we find that it is actually the skeleton or organ of support of a once living being, whose varieties are spread over the earth almost as plentifully as plants, we not only become equally desirous of knowing what these are, but of interpreting thereby the real nature and position of the typical sponge through its varietal transition into the other and better known spheres of development of the animal kingdom which surround it.

Having stated that the Officinal Sponge is an animal product, it will be my business presently to prove this, merely premising now that although very low in *our* scale of creation, it is a long way on the animal side of the imaginary line of demarcation which separates the animal from the vegetable kingdoms, so that it is absolutely an animal as much as that which produces the coral.

A sponge, then, may be defined to be a congeries of living beings which, like the coral, produces various kinds of structure in accordance with the species; of which the Officinal Sponge is one that comes into the market for sale also like the coral, viz., devoid of the soft or more animal parts which produce it. But as all kinds of sponges do not produce an almost imperishable skeletal structure like that of the Officinal Sponge it is desirable to state that (using the term "Spongida" for the whole class) it may be divided into eight orders, as follows:—

Ord. I., Carnosa.—These sponges have *no* imperishable skeleton or organ of support, and substantially present to the unassisted eye nothing but a gelatinous or semi-cartilaginous mass, charged or not with spicules according to the family to which they belong.

Ord. II., Ceratina.—In these there *is* a comparatively imperishable skeleton, composed of horny fibre cored throughout by an axial canal, which, in the fresh state, is filled with a soft granular substance that, on drying, is replaced by a hollow cavity.

Ord. III., Psammonemata.—Here there is not only a horny, fibrous skeleton, with a more or less granular axis in the fibre, but this for the most part is filled with *foreign* material, such as particles of sand, fragments of sponge-spicules, and the like minute bodies, drawn in from the exterior, and, therefore, arranged in position by the sponge *previous* to its becoming the axis of the horny filament.

Ord. IV., Rhaphidonemata.—In these, the horny, fibrous skeleton is well developed and very resilient, but the fibre is axiated by spicules, (siliceous bodies of different kinds varying in form with the species,) *produced by the sponge itself*, and therefore *not foreign;* hence might be termed "proper."

Ord. V., Echinonemata.—Here we have only to add to the foregoing an external set of *proper* spicules, which project vertically from the surface of the fibre, like prickles on a hedgehog's back.

Ord. VI., Holorhaphidota.—We lose the *horny* element here, and, for the most part, the fibre is made up of *proper* spicules, held together by the slightest quantity of sarcode; or they may be dispersed throughout an areolated sarcode, which, in the dried state, looks like crum of bread.

Ord. VII., Hexactinellida.—Again we have fibre here without the horny element, but the fibre is vitreous, so that it is like spun-glass, while all the spicules, of whatever form they may be, axiate its interior. The spicules, too, are all developed upon a hexradiate type, (hence the name of the order,) that is, the central point of the canal, (which traverses all siliceous spicules, and upon whose extension in different directions their ultimate forms respectively depend,) presents six buds or lines radiating from each other at equal angles, so that, if surrounded by a glass cube, they would meet the centre of each side respectively; or there may be no fibre at all, and the areolated sarcode when dry, like "crum of bread," as in many of the Holorhaphidota, where the spicules also are dispersed throughout the mass without any apparent regularity.

Ord. VIII., Calcarea.—Here all the spicules, instead of being siliceous, are, minerally, composed of carbonate of lime.

Of course these orders may be further divided into families, groups, and species, for which I must refer the reader to my "Notes Introductory to the Study and Classification of the Spongida," published in the "Annals" and "Magazine of Natural History" in 1875, (Vol. XVI., pp. 1, &c.) But it must not be assumed that there is any such classification in nature, for this is only human invention to aid the human memory.

Having now given an arrangement of the Spongida in which, beginning with the simplest form, viz., the Carnosa, where there is *no* permanent skeletal structure, we passed on to the Ceratina, &c., in which there *is* one; it may be further observed that this is also the course followed by the development of the embryo of all sponges, so that before the horny skeleton is produced, it is in the state of the Carnosa, where it remains, if belonging to this order; while in the sponges with horny skeleton, it goes on till the latter is produced, before the development is complete.

To facilitate the comprehension of what a sponge is when minutely examined, it might be stated by way of homely simile, that, in structure, it is like a bunch of grapes which has been put into melted wax and kept there until the latter is cool; after which, being held up by the stem, the wax still filling the interstices between the grapes, it is to be pared off down to the level of the bunch and the whole put into a muslin bag which is to be tied round the *neck* of the stem.

In this condition the grapes resemble the spheres which contain the animal parts of the sponge; the wax in their interstices. the parenchyma; the holes between the fibres of the muslin, the pores or inhalent orifices; the stem and its branches, the excretory or exhalent canal system; and when there is a horny skeleton, &c., produced, as in the Officinal Sponge, this is developed in the midst of the parenchyma.

Examining these parts more particularly, the individual sphere is found to be lined with or composed of monociliated, monad-like infusoria in juxta-position whose cilia wave into the hollow interior; presenting two or more openings in its wall which are respectively, in continuation with tubular canals coming from the pores on one side, and going to the excretory canal-system on the other, the former for bringing in the food and the latter for carrying off the refuse. Finally, the parenchyma serves for producing the horny skeleton, &c., (where there is one,) and the temporary location of the reproductive elements, viz., the eggs and the spermatozoa, where, after impregnation, the former become ciliated all over as they pass into the embryonal state, and thus fitted for independent existence, are discharged through the excretory canal-system.

Subsequently, the embryo seeks some hard object for fixation and further development, where it remains growing upwards or horizontally, until it arrives at the form assumed by the matured species; or, if by accident or otherwise it becomes detached and free, then, by growing equally on all sides at once, it may become globular.

The Officinal Sponges, which are divided into the finer and more compact or "Turkish Sponges," which are the dearest, and the coarser and less compact or "Honeycomb Sponges," which are the cheapest, grow on the rocks throughout the Torrid and Temperate Zones under more or less modified structure, but the most marketable hitherto found come from the Levant and the neighbourhood of the Bahama Islands, in the West Indies, respectively, where they are obtained by divers, who, cutting them off, bring them to the surface in baskets; after which the soft parts are drained away in the sun and the imperishable skeleton having been finally cleansed is thus fitted for sale in the marketable parts of the world.

Sponges are so easily propagated by "cuttings," when properly treated, that this has been taken advantage of in the Adriatic for growing the Officinal species.

At present it is not determined where the Spongida should be placed in the animal scale, although, of course, very low down, but when more is known of their structure and species, those alliances will be found to which I have before alluded, and their present enigmatical position thus demonstrated.

Of the important part that the Spongida have played in the geological history of the earth there is no longer any doubt. Their remains occur abundantly from the Silurian* epoch down to the present time, and when it is remembered that a narrow dredge passing over the deep sea bed of the Atlantic for a few miles, forming a kind of path-way through this vast area like a garden walk, comes up literally crammed with the remains of siliceous sponges, it not only gives us some idea of their plentifulness in this dark and dismal abode, but accounts for the immense quantity of their *débris* in some of the Mesozoic Strata, and the influence which their Silica when set free has undoubtedly exerted minerally over the composition of these strata.

Brief as this description of the Spongida is, it has been thought desirable to premise something of the kind, before giving the following:—

List of Sponges dredged by the Birmingham Natural History and Microscopical Society, Falmouth Excursion, 1879, depth 15—50 fathoms.

N.B.—Unless otherwise mentioned, the names of all the following sponges are those under which they appear, and are illustrated in Dr. Bowerbank's "British Spongiadæ," Vol. III., 1874, as this is the work most likely to be generally possessed in England.

Rhaphidonemata.

1.—*Chalina inornata* (B. S., Pl. 83., figs. 12-16, not that of p. 358.) Three specimens.

Echinonemata.

2.—*Microciona plumosa*, Br. *olim.* *Hymeniacidon plumosa*, Bk. (B. S., Pl. 26, figs. 7-13.) *Obs.*—This is Johnston's *Halichondria plumosa*, and although it sometimes may appear under a laminiform growth like *Microciona*, its habit is to be massive and erect. The equianchorate flesh spicule is "angulate," (B. S., Vol. 1, Pl. 6, fig. 143,) not naviculiform as in *Microciona atrosanguinea*, Bk.; and although the red colour of both species may be alike, the spiculation generally, not only differs, but the pungent (? iodine) odour of *Halichondria plumosa* is quite sufficient to detect it even blindfolded.

Holorhaphidota.

3.—*Halichondria panicea* (B. S., Pls. 39 and 40.) Several specimens.

4.—*Isodictya Normani* (B. S., Pl. 56, figs. 1-5.) One specimen. *Obs.*—I can see very little specific difference between this and *I. fucorum* and *I. Alderi*, illustrated in the same plate.

5.—None.

* In course of the discussion which followed the reading of the above paper, Mr. W. J. Harrison remarked that the sponges had even a higher known antiquity than had been assigned to them by Mr. Carter, for their fossil remains had been discovered in rocks of Cambrian age. The researches of Dr. Hicks (see "Quart. Journ. Geol. Soc.") had brought to light four species of sponges from the Menevian Beds of St. David's, in South Wales, and even from strata 1,500ft. lower (corresponding to the Longmynd rocks) he had obtained two species, which had been named *Protospongia fenestrata* and *P. major*. Hence, as the organic origin of the Laurentian *Eozoon* was still disputed, the sponges were entitled to rank among the oldest known fossils.

6.—*Rhaphiodesma floreum* (B. S., Pl. 37, figs. 14-19.) One specimen.

7.—*Hymeniacidon suberea* (B. S., Pl. 36, figs. 1-4.) One specimen. *Obs.*—The sponge here, as is often the case, has replaced the form of the shell with its own substance. The centrally inflated minute flesh spicule has been omitted in the illustration, in accordance with Dr. Bowerbank's description, (B. S., Vol. II., 1864, p. 202, where he states that its absence makes the difference between *H. suberea* and *H. ficus.* But it is not so, for it is equally present in both species, as Johnston's type-specimen in the British Museum testifies, and every other specimen that I have met with on the south coast of Devon, where it is very common, as apparently elsewhere, for from Esper downwards all Spongologists seem to have met with it. Esper called it *Alcyonium tuberosum* (tab. 13, figs. 1-6, ed. *c.*, 1794.)

8.—*Hymeniacidon sanguinea* (B. S., Pl. 32, figs. 5-8.) Two specimens. *Obs.*—This is abundant on the south coast of Devon, and, with *Halichondria panicea*, the hardiest of all sponges, as they frequently grow nearly up to high water mark, and are, therefore, uncovered for some hours during the fall of the tide.

9.—*Trichostemma hemisphericum*, Sars. (Forms of Animal Life on Norwegian Coast, 1872, p. 62, Pl. 6, figs. 1-15.) *Obs.*—This is a specimen of Dr. Bowerbank's genus Polymastia, and very like his *P. robusta* both in form and yellow colour.

Calcarea.

10.—*Grantia compressa* (B. S., Pl. 1.) Two specimens.

11.—*G. ciliata*, Fleming, 1828 (B. S., Pl. 2, figs. 1-15.) Two specimens.

12.—*G. tessellata* (B. S., figs. 21-27.) Several specimens.

13.—*Leucosolenia contorta*, Br. (B. S., Pl. 3, figs. 5-10.) Two specimens. *Obs.*—Dr. Bowerbank's illustration of the linear spicule (fig. 10) is defective. There are *two* forms quite different from each other and from Dr. Bowerbank's figure. See Hæckel's "Die Kalkschwamme," under the name of *Ascandra contorta*, "Atlas," tab. 14, fig. 6, *&c.*

14.—*Sycon rhaphanus*, Schmidt. (Spongien Adriat, Meeres, 1862, s. 14, tab. 1, fig. 2.) Two specimens.

Other Organisms, &c.

15.—*Chirodota digitata* (Echinoderm Synaptidæ) and *Compound tunicate*, gelatinous without spicules, (Synascidiæ Giard.) ? sp. *Obs.*—Examine the surface of the *Chirodota* under water with 1in. focus and high ocular to see the anchorlike calcareous spicules, which are beautiful objects under the microscope.

16.—Residue at the bottom of the jar, chiefly consisting of minute Foraminifera.

Observations.

The specimens of Calcispongiæ are very good, and well worth preserving. Prof. Hæckel's work entitled "Die Kalkschwamme" is essential for studying the species.

BRITISH LICHENS: HINTS HOW TO STUDY THEM.

BY W. PHILLIPS, F.L.S.

(Continued from page 172.)

As no man can work without tools, we will here specify the essential appliances required for collecting, preserving, and studying Lichens. These may be classed under two heads—1st, appliances for collecting; 2nd, those for home study.

I.—*Appliances for Collecting.*—A pocket lens, having a focal length of 2in. or 2½in., which can be obtained from any optician for a shilling. Some prefer having one with three powers, in which case a 1in., a 2in., and a 3in. will be found a convenient combination. The external characters of most species of Lichens can be made out with sufficient precision by the aid of these powers, which is all that is required in field work. The rest must be left for home study.

A hammer such as Geologists carry, with one end broad enough to use with a chisel.

A stonemason's chisel, of good temper, for detaching portions of the rock on which the Lichens grow.

A strong clasp-knife, for removing the bark of trees to which the Lichens attach themselves.

A leather satchel for carrying specimens.

An ample supply of paper for folding up specimens.

II.—*Appliances for Home Study.*—The most important of these is a good compound microscope. It does not necessarily follow that a microscope suitable for the examination of Lichens should be a very expensive instrument. English and foreign makers now supply for about £5 an instrument which will answer all the purposes of the student; but if his means admit of it, there is no economy in having a poor or imperfect microscope, and the best within reach should be procured. Two powers are essential, one a low power, magnifying fifty times, (linear,) the other magnifying from 350 to 400 times (linear.) With such an instrument all can be done that is required.

A small knife for cutting thin sections, with a supply of glass slides and covering glasses, should accompany the microscope.

A glue-pot, with a supply of glue for fastening down specimens on paper, on which to write the names of the species, and the localities where they were gathered, with any other necessary remark. Gum should never be used for this purpose, as many valuable specimens will be lost by being rubbed off in the herbarium. The only specimens that present any difficulty in making secure are such as grow on loose sand or soil, and for these the better plan is to make a pool of dissolved glue on the paper, and place on it the mass of earth while still damp, when the glue, if not too thick, will permeate the whole mass and bind it together. The most friable specimens by this means can be kept together for any length of time, and will endure the rough usage of the herbarium.*

* Still greater security can be given to fragile specimens by glueing them in stout pill-boxes, the wall of the pill-boxes preventing the pressure falling on the Lichen.

A good supply of stoutish cartridge-paper should be kept always at hand, cut into squares of about 4in. by 6in., or 6in. by 6in., according to the size of the specimen Lichen it is to receive, allowing room for notes and drawings of the internal characters. A further supply should be ready, about 10in. by 8in., for placing in a portfolio, on which the smaller pieces bearing the specimens can be pinned to allow for easy removal when they are required for examination. These larger sheets will carry several specimens of the same species, and should have the specific name written distinctly at the bottom of the sheet at the left-hand corner. About fifty of these will be sufficient to place in one portfolio, which may be made of strong cardboard, with tape strings to keep it closed. On the back of the portfolio may be written the genus or genera to which it is devoted, and it can be placed as a book in an ordinary book-case. The size given above is that of Mudd's published Fasciculi of British Lichens, and has the advantage of not being too large for an ordinary book-shelf. Half-a-dozen such portfolios will suffice for a beginner, but it is necessary to fix on the proper size at the commencement, that no inconvenience may be experienced hereafter by discovering that a different size would have been much more suitable.

Three bottles to contain the following chemicals for testing the reaction of Lichens:—A solution of iodine, iodide of potassium, and chloride of lime. Three glass brushes, one to be used for each of the chemicals. Further instructions how to apply these will be given in another place, but I would here remark that great care should be taken not to mix these chemicals by pouring one into a vessel which has contained another, without first washing it, or by using the same brush for two chemicals, as the result of testing would be rendered altogether worthless.

Where to collect Lichens will now require a few remarks. Supposing the student to have provided himself with the necessary appliances just enumerated, he will now undertake his first excursion in pursuit of specimens. He must get well away into the country, at a distance from towns and smoke, for the Lichen loves pure air and free ventilation. It has long since been remarked that they rarely, if ever, attain their perfect maturity in the vicinity of cities or manufactories, where much smoke is found in the atmosphere. Old forests, far-stretching moorland, airy mountain sides, with here and there the jutting rock thrusting its head through the springing heather, the cliffs of sea-shores watered by the spray of the ocean, the stony beds of dry watercourses, such are the places he will find most productive. But if such attractive scenes for Lichen-hunting cannot be visited, the student must make up for the want of such by extra diligence in less promising localities. Some of the most highly-prized species have been found on old rails in the last stage of decay on the highway side, or on the walls of an old ruined barn in the corner of a meadow. The writer remembers once to have found a rare species, new at that time to the British Flora, on an old decayed boot lying in a fallow field. Having gained the most rural spot within his reach, it will be well to look out for an old tree, an ash if possible, and he will find on the bark a number of species which, carefully removed by the aid of a knife and placed in paper, will afford him hours of interesting study on reaching home. *Parmelia saxatilis* or *Ramalina fraxina* may be the first to meet his eye, while, on closer investigation, he will discover *Lecanora subfusca* or *Lecanora varia*, with their abundant apothecia, covering the surface of the bark. Near the base he will probably observe patches of a nearly white crustaceous Lichen, having here and there warty protuberances, with openings in the centre, revealing to a close inspection an almost concealed hymenium—this will be *Pertusaria fallax*. We cannot pretend to enumerate the various species that will reward a careful examination of such a tree as the one we have supposed, but we would advise the collector to secure a fair specimen of all species he can find, for although he may obtain nothing very rare, he will obtain sufficient with which to begin his study. If he can get into the vicinity of rocks which have been exposed to the weather for a long period, or old stone or brick walls, he will not return empty-handed, for a vast number of species find their home on such surfaces as are presented by these. Wherever the tint of colour differs from the natural colour of the rock we may reckon on finding a Lichen. The artist produces his picture by the skilful combination of inorganic pigments—not so Nature—she produces the effects we admire by the aid of highly-organised vegetable growths, and we may rest assured, if we see the bark of trees or the surface of rocks presenting shades of brown, green, or yellow, they arise from the presence of the objects of our search. Within the compass of a square yard a dozen species of Lichens may be flourishing in all their beauty. If the search happens to be on a rocky sea-coast, the student will probably find some of the *Ramalinas* above the line of high-water mark, such as *R. polymorpha*, *R. scopulorum*, or *R. cuspidata*. He will probably find also some of the *Roccellas*, as *R. tinctoria* or *R. fusiformis*, and if his search be pursued lower down on the rocks, washed by the waves, he may find the curious little *Lichina pygmæa*, which resembles a miniature seaweed, but is a true Lichen; and the dark olive green *Verrucaria maura*, which looks, at a little distance, like a coat of paint. Inland rocks, except they be of the very softest nature, will afford innumerable species of interest to the collector. Slate rocks are rich in those splendid species, *Parmelia caperata* and *Physcia parietina*, and the striking variety of *Parmelia saxatilis*, called *omphalodes*. Limestone rocks abound with the brilliant specimens of *Placodium callopismum* and *P. murorum*, with *Lecideas*, *Verrucarias*, and other interesting species. Nor will the earth itself fail to yield a goodly array of *Cladonias*, *Cetrarias*, and *Lecideas*. In fact, whenever the pocket lens is brought to bear with judgment on rock or tree, or hedge-bank, some species will reward the search.

Here it may not be out of place to offer a few hints on *collecting Lichens*.

Select well-grown and complete specimens. I have seen some men contented with a mere fragment of a specimen, destitute of any apothecia, and showing nothing of the margin, where often much of the distinctive character of a species lies. It is as though a single stone from a house would serve to show the style of architecture. It is quite true that some species are rarely found in fruit, but this is the exception rather than the rule.

Collect every species with which you are not acquainted. By doing this much rubbish may be taken home, but it is easily disposed of, whereas good specimens may be passed over which no other opportunity may ever present for collecting. The most advanced Lichenologist often finds in his vasculum at the end of a day's excursion much which home examination proves to be of no value, while some specimen he thought but little of when he gathered it is the gem of his day's work.

Fold up each specimen in paper, and write on it date and locality of growth the moment it is gathered. Some species are very delicate, such as *Caliciums* and *Coniocybes*, and would be destroyed by the rubbing of others against them ; but all are the better for protection. The importance of recording on each the locality will soon be discovered, by the additional advantage it gives to specimens, besides being a contribution to the Flora of the district.

Remove as little of the rock or tree as is consistent with obtaining a good specimen. Facility in using the hammer and chisel will only be acquired by practice and a few bruises of the hand. When the cleavage of the rock favours the operation of removing specimens all is well, but in cases where igneous rock has to be dealt with, or where the Lichen grows on the edges of the laminæ, considerable difficulty will be experienced. Let it be borne in mind that a succession of steady, smart taps will accomplish the object more successfully than one violent blow, whether the rock be hard or soft. In removing corticolous species less skill is required, but if the collector should cut too deep into the tree he may discover himself to be the object of a pursuit by the owner of the property, quite as earnest as that he has himself shown after the Lichens.

Taking for granted that a fair collection of Lichens has been secured, and that attention has been paid to the hints given above, the student will now direct his steps homeward, where he will require a few directions, with which I shall conclude my paper, on *the home study of Lichens.*

(To be continued.)

METEOROLOGY OF THE MIDLANDS.

THE WEATHER OF JUNE, 1880.

BY W. JEROME HARRISON, F.G.S.

With May, the dry period, which had lasted eight months, came to an end, for June turned out very showery, dull, and rather cold. The most remarkable feature was the frequency of electrical disturbances during the latter half of the month ; from the 19th to the 25th thunderstorms of great severity occurred. Driving through Melton Mowbray on the 23rd, at eight p.m., we found the streets covered to depths of from 4in. to 9in. with hailstones, of the size of marbles, which had fallen about an hour previously ; on this day ·70in. of rain fell at Kibworth in about fifty minutes, "nearly an inch" at Market Harborough in thirty minutes, and ·84 at Loughborough in one hour. There was a similar hail-storm at Evesham on the 24th, the stones lying in heaps till the afternoon of the 25th, although the thermometer stood at 73 deg· in the shade. At Nottingham, 1½in. fell in 3½ hours on the 22nd; while at Spondon, on the 24th, 1·90in. fell between 2 30 and 6 55 P.M., nearly all, however, in the first hour and a half. Owing to the dryness of the soil these heavy rains produced comparatively little effect, and at the end of the month the crops generally looked well. The maximum heat in the sun, (black bulb in vacuo,) at Loughborough was 136·2 deg. on the 22nd, and at Leicester 136·5 deg. on the same day.

STATION.	OBSERVER.	RAINFALL.				TEMPERATURE.			
		Total for M.	Greatest fall in 24 hours.		No. of rainy d.	Greatest ht.		Great'st cold	
		In.	In.	Date.		Deg	Date.	Deg	Date.
GLOUCESTERSHIRE.									
Cheltenham	R. Tyrer, Esq.	3·18	·86	22	23	73·7	18	34·0	11
Stroud	S. J. Coley, Esq.	2·81	1·30	25	20	75·0	19	39·0	10
Adderley Rectory	Rev. A. Corbet	3·68	·95	19	19				
SHROPSHIRE.									
Haughton Hall, Shifnal	Rev. J. Brooke	3·86	·55	24	23	72·0	20	35·0	9
Woolstaston	Rev. E. D. Carr	3·07	·74	13	24	71·0	24	37·5	9
More Rectory, Bishop's Castle	Rev. A. Male	3·39	·52	20	21	74·0	25 & 28	34·0	9
Larden Hall	Miss F. R. Boughton	4·26	·59	23	22				
Bishop's Castle	E. Griffiths, Esq.	4·20			20	76·0	18	35·0	9
Cardington	Rev. W. Elliot	3·57	·47	23	23				
Leaton Vicarage	E. V. Pigott, Esq.	3·13	·50	13	26	72·0	22	34 6	9
HEREFORDSHIRE.									
Stoke Bliss	Rev. G. E. Alexander	5·37	1·60	17	19	77·0	19	38·0	9
WORCESTERSHIRE.									
Orleton, Tenbury	T. H. Davis, Esq	4·17	1·03	17	19	74·3	29	34·8	10
West Malvern	A. H. Hartland, Esq.	4·41	·85	17	23	75·0	12	38·0	4
Pedmore	E. B. Marten, Esq.	3·67	69	22	20	82·0	8 & 23	32·0	9
Longlands, Stourbridge	J. Jeffries, Esq	3·85	·93	22	21	77·0	27 & 30	37·0	9
Dennis, Stourbridge	Mr. C. Webb	3·69	1·10	22	21	73·0	18	35·0	9
Evesham	T. J. Slatter, Esq.	3·45	·80	17	23	76·3	12	38·3	10
STAFFORDSHIRE.									
Dudley	Mr. J. Fisher	2·79	·49	23	16				
Kinver	Rev. W. H. Bolton	3·89	·80	22	20	79·0	29	36·0	9
Walsall	Mr. N. E. Best	3·60	1·03	23	19	83·0	29	38·0	8
Grammar School, Burton	C. U. Tripp, Esq.	2·71	·43	15	21	78·0	29	36·0	9
Weston-under-Lyziard R'tory	Hon. and Rev. J. Bridgeman	3·66	·49	23	20	80·0	12 & 18	37·0	9
Wrottesley	E. Simpson, Esq.	3·17	·80	23	16	73·4	19	35·8	9
Heath House, Cheadle	J. C. Philips, Esq.	2·67	·70	19	18	69·9	29	37·5	9
Farley, near Cheadle	C. L Wragge, Esq.	2·78	·44	20	19	69·9	29	36·4	9
Oakamoor	E. Kettle, Esq.	2·65	·41	7	18	70·7	17	31·7	6
WARWICKSHIRE.									
Coventry	J. Gulson, Esq.	2·40	·50	23	18	73·0	22, 23, 24	38·0	9
Coundon, Coventry	Lieut.-Col. R. Caldicott	2·84	·59	25	18	76·0	29	41·0	9
Bickenhill Vicarage	J. Ward, Esq.	3·51	·55	22	16	79·0		50·0	
St. Mary's College, Oscott	Rev. S. J Whitty	2·97	·83	23	18	72·5	29	39·0	9
Henley-in-Arden	T. H. G. Newton, Esq.	2·26	·40	1	19	77·0	18	35·0	9 & 10
Rugby School	Rev. T. N. Hutchinson	2·65	·88	24	17	73·0	18 & 29	37·0	5 & 10
Snitterfield, Stratf'd-on-Avon.	J. Goodacre, Esq.	2·09	·39	22	18	76·0	29	33·0	9
DERBYSHIRE.									
Linacre Reservoir, Chesterfield	C. E. Jones, Esq.	4·36	·71	16	21				
Spondon	J. T. Barber, Esq.	4·65	1·90	24	18				
Duffield	W. Bland, Esq.	4·15	1·13	23	22				
Fernslope, Belper	F. J. Jackson, Esq.	3·49	·91	23	18	76·0	29	37·0	5
Stoney Middleton	Rev. U. Smith	3·10	·66	1	14	72·0	29	34·0	8 & 9
NOTTINGHAMSHIRE.									
Park Hill, Nottingham	H. F. Johnson, Esq.	6·52	1·70	22	18	74·0	29	39·6	10
Hodsock Priory, Worksop	H. Mellish, Esq.	3·09	·47	24	17	75·8	29	36·1	10
Tuxford	J. N. Dufty, Esq.	3·91	·72	22	22	77·0	18	39·0	4
LEICESTERSHIRE.									
Loughborough	W. Berridge, Esq.	3·81	1·25	23	18	74·5	22 & 29	36·7	5
Ashby Magna	Rev. E. Willes	2·98	·56	1	18	85·0	29	35·0	5
Kibworth	T. Macaulay, Esq.	3·81	·86	23	23				
Belmont Villas, Leicester	H. Billson, Esq.	3·66	·84	22	22	75·2	29	38·8	9
Town Museum, Leicester	W. J. Harrison, Esq.	3·80	·87	22	22	73·0	29	38·0	5
Syston	J. Hames, jun., Esq.	3·62	·78	22	20	80·0	19	36·0	5 & 6
Waltham-le-Wold	E. Ball, Esq.	5·26	1·43	23	20	75 0	20	35·0	3
Coston Rectory, Melton	Rev. A. M. Rendell	3·30	·64	1	22	72·2	29	33·3	5
Dalby Hall	Mr. G. Jones	2·83	·63	22	21	81·0	29	41·0	1
Market Harborough	S. W. Cox, Esq.	[illegible]	1·38	23	12	72·0	22	32·0	5
NORTHAMPTONSHIRE.									
Towcester Brewery	J. Webb, Esq.	2·36	·87	24	19				
Castle Ashby	R. G. Scriven, Esq.	2·24	·48	24	19	76·0	28 & 29	39·0	4
Kettering	J. Wallis, Esq.	3·29	·68	25	21	72·0	23 & 30	40·0	5
Althorpe	G. S. Groom, Esq.	2·28	·67	24	18	72·0	27	34·0	4
Pitsford	C. A. Markham, Esq.	1·96	·60	24	19	80·0	12 & 19	33·0	5
RUTLAND.									
Uppingham	Rev. G. H. Mullins	2·96	·66	1	20	74·1	29	37·1	5
Northfields, Stamford	W. Hayes, Esq.	3·1[illegible]	·58	1	19	74·0	28	33·0	9
Altarnun Vicarage	Rev. J. Power, M.A.	2·68	·52	24	16	80·0	19	32·0	10
Oxford	E. J. Stone, Esq	3·37	1·12	25	16	71·2	18	40·9	5

NATURAL HISTORY NOTES BY OBSERVERS.—*Spondon.*—After the thunderstorm of the 24th, the leaves of Broad Beans, Beet, Lettuce, &c., were quite bruised with the violence of the rain, having the appearance of being pinched between the fingers, but the natural state was resumed in two or three days. *Kettering.*—First Wheat seen in ear on 12th. *Burton-on-Trent.*—Elder in flower, 21st; Hay harvest began in last week; a "Sea-Swallow," (common Tern,) on the Trent the last ten days. *Coventry.*—A sea-bird (the Scoter Duck) was killed in the Coventry Canal near Wyken; it is apparently an old male bird. *Shifnal.* —Grain crops greatly improved; Swedes, too, doing well; but Mangolds completely destroyed, (leaves turned into brown paper,) by a leaf-mining grub, the produce of a small fly resembling a house-fly; the same ravaged them in 1861; Turnips, &c., not touched.

Correspondence.

FROGS.—I notice that this year there has been a great mortality among the frogs. I found a large number dead in a little brook about spawning time, and thought they had been killed purposely, but I have since found dead frogs everywhere, so there would seem to have been something like an epidemic among them. Perhaps some of your readers can explain.—R. G. S.

THUNDERSTORM AND HEAVY RAIN AT TRENT COLLEGE, LONG EATON, SOUTH DERBYSHIRE.—On Saturday, July 10th, we were visited by the heaviest thunderstorm that any of us at Trent College can remember. It began at 2 30; at 2 45 there was an interval of about ten minutes, and at 3 15 it ceased. The rain gauge registered 1·07 inch as the result of the thirty-five minutes of downfall. The water in the main drain-pipe that carries the water from the college to the brook burst through into the cricket field in three places, and in one place raised about two yards square of turf at least six inches above the level. It seems to have been quite local, for the first storm missed Sawley altogether, and a little way beyond Risley they had no rain whatever.—A. S.

ACTINIA PER POST.—Will you kindly inform me in next issue how I can best pack *Actinia mesembryanthemum* to go through the post?—C. L. LORD.

[Mr. W. R. Hughes, F.L.S., has favoured us with the following answer to the above question:—"Mr. C. L. Lord will find a full reply to his enquiry in the postscript to my 'Principles and Management of the Marine Aquarium.' As this little book, however, may not be at hand, I have pleasure in answering his question direct. It may not be generally known that most marine animals do better when packed in damp sea-weed than when transmitted in sea-water. All the sea-anemones and corals, all the echinoderms, and several littoral species of fishes, may be packed in this way. Everything, however, depends upon temperature. In the spring, autumn, and winter months, when the external temperature ranges between 30 and 50 deg. Fah., the course recommended may be adopted. If sea-weed is not at hand, then the specimens may be packed in bits of old linen rag saturated with sea-water, folded up in thin gutta percha sheet, and enclosed in a small tin box or hamper. Great care should be taken not to crush the specimens in any way, nor to let them touch each other in packing. Littoral fishes have been sent to me by post from Falmouth, in the weed packing, in a small tin box, and did well after twenty-four hours' travelling. Corals and sea-anemones have also been sent from Devonshire in the rag packing, and did well after eighteen hours' travelling. The Lancelet has, I believe, been forwarded from Naples to England in the weed packing, and did well after a journey of several days. It is desirable to avoid sending marine animals in the hot summer months, when the temperature ranges upwards of 55 deg.; but they may be brought personally by rail in the way described in almost any temperature, if damped frequently *en route* from a bottle of fresh sea-water carried for the purpose. W. R. H." —Eds. M. N.]

Botanical Notes.—If your correspondent, B. S., (page 176) will refer to "The Midland Naturalist," Vol. II., page 190, he will find *Saxifraga granulata* duly recorded from Sutton Park. *Alchemilla vulgaris* I have also found again since the publication of my notes, but, having already recorded its occurrence there, did not again report it. It may interest your correspondent to know that since my notes were published I have found over forty plants new to the Sutton flora. A list of thirty species was published in the annual report of the Birmingham Natural History and Microscopical Society for 1878, and in 1879 I found the following additional plants:—*Barbarea præcox*, *Melilotus alba*, *M. vulgaris*, *Trifolium striatum*, *Vicia segetalis*, *V. Bobartii*, *Rosa biserrata*, *Saxifraga granulata*, *Phleum pratense*, *Triticum repens*, *var. aristatum*, and Mr. A. W. Wills records *Narcissus pseudo-narcissus.* As almost all these plants are found on the new embankments they can only be regarded as aliens, so far as Sutton Park is concerned. I am pleased to find that others besides myself are interested in the flora of Sutton Park.—J. E. Bagnall.

Nephrodium Oreopteris.—Has this fern been noticed in Warwickshire by Mr. Bagnall or any other Midland Botanist? I have recently found it at Baddesley, near Atherstone. Having botanised only in South Wales, I have not yet had an opportunity of making myself acquainted with the Ferns of Warwickshire, therefore do not know whether Warwickshire Botanists consider this a "find." I have seen it growing in large quantities on the Black Mountains, but would hardly like to call it common, or yet frequent, even. I have not given the precise locality so that I may not be instrumental in aiding its extermination should it be rare.—George T. Harris.

[Mr. Bagnall sends us the following reply to above question:— "*Nephrodium Oreopteris* was recorded by Bree from near Coleshill and Allesley, in 1818, *vide* Purton's "Midland Flora," Vol. II., page 508. As a Warwickshire plant it may be considered as comparatively rare now; twelve years ago it was fairly abundant on marly soils all round Birmingham, more especially in Sutton Park. I still find it in Bree's old districts, and in the Middleton and Kingsbury districts. J. E. B."— Eds. M. N.]

Botanical Note.—The date, 7th of July, 1880, reminds me of a Botanical ramble this day three years ago, when I first found specimens of *Verbascum Lychnitis*, catching sight of these tall and distinct-looking plants at some distance off, growing about a depression between steep, and at that time unploughed fields, situated about three-quarters of a mile north-east of the Old Inn, at Whittington, near Kinver, Staffordshire. These and a few other plants there may be worth recording, since I have visited the spot this and last season only to find the land now cultivated, and most of the rarer wild flowers almost, and some apparently *quite*, extirpated. Having reported the occurrence to one or two Botanists, on the 2nd of August following I met there, by appointment, Dr. Fraser, of Wolverhampton; Mr. Edwin Lees, F.L.S., of Worcester; Rev. J. H.

Thompson, of Cradley, Worcestershire; and Mr. King, of Pedmore. At that time it was a remarkable sight to see so many plants of *Verbascum Lychnitis*, to the number probably of more than two hundred, imparting quite a grey and singular appearance to the place. Closely adjoining, about and below the same steep and then uncultivated slope, and a considerable distance even from any detached cottage, we found *V. Thapso-Lychnitis*, the rare hybrid by cross fertilisation between the first-named plants and *V. Thapsus:* the last more sparingly found there. *Erythræa Centaurium* was in immense quantity, colouring the spot over large spaces by its pretty pink flowers. Large plants of *Echium vulgare* grew about the lower ground, and many specimens of *Trifolium arvense* and *procumbens*. *Jasione montana* came to hand, with its unique heads of pale blue clustering flowers, so special among the Campanulaceæ. Many plants of *Silene inflata* grew on the upper part of the slopes, and the pretty little *Calamintha Acinos* was plentiful in the undergrowth, while we fortunately met with one plant of the local, and hereabouts rare, Chicory, *Cichorium Intybus*. When passing through the adjoining fields, we found one or two plants of *Achillea Ptarmica*, seldom found near Stourbridge; also *Scutellaria galericulata*, the blue Skull-cap, and *Linum perenne:* with one solitary plant of *Lathyrus Aphaca*, most rare in this part of the Midlands. Continuing our walk, we arrived at some waste banks at Whittington, near the River Stour, where we met with the Opium Poppy, *Papaver somniferum*, and *Mimulus luteus*, both of which may have escaped from gardens in the neighbourhood. But some fine plants, then in fruit, of the beautiful-leaved *Cardamine impatiens* were doubtless wild; likewise *Malachium aquaticum*, with a profuse growth of the showy Willow Herb, *Epilobium angustifolium*. Such diversified plants, found in so limited a tract of ground, imparted great interest to our very pleasant ramble.—Horace Pearce, F.L.S., Stourbridge, July 7th, 1880.

Phenological Observations, taken in the Neighbourhood of Castle Ashby, Northamptonshire.—May 20th, the green-winged Orchis *(Orchis morio)* first found in full flower, in a sandy pasture field. 21st, the Bush Vetch *(Vicia sepium)* seen in flower on a hedge bank, with S.W. aspect; the specimens had evidently been in flower some days before noticed. From near this I gathered my first specimen of the Dewberry Bramble *(Rubus cæsius,)* and some plants of Medicago, and *Trifolium minus* in full bloom. Flowers of *Heracleum Sphondylium* were also noticed on the same date. 22nd, specimens of the common Avens *(Geum urbanum)* gathered in flower from a hedge bank, facing S.W.; and *Lotus corniculatus* seen on the grassy border of a cornfield; Oak Trees in full flower by this date. 24th, Brooklime *(Veronica Beccabunga)* first seen in flower in ditch open to S.W. Fumitory *(Fumaria officinalis)* on waste ground near a stone pit. White Campion *(Lychnis vespertina,)* *Myosotis arvensis*, and the Field Crowfoot *(Ranunculus arvensis)* in cornfields. 25th, flowers of the Yellow Rattle *(Rhinanthus Crista-galli)* seen in pasture. 28th, Orange Tip and Skipper Butterflies seen in Yardley Chase. Specimens of *Veronica officinalis*, a white variety of *Ajuga reptans*, white Hyacinths, Twayblade *(Listera ovata,)* and the white Butterfly Orchis *(Habenaria chlorantha)* gathered in the woods. In the case of the two last mentioned the lower flowers only were fully expanded. On the same day I noticed the Little Milkwort *(Polygala depressa)* in a dry pasture field. The Shepherd's Needle *(Scandix Pecten-veneris,)* wild Pansy *(Viola arvensis,)* and the Gromwell *(Lithospermum arvense)* in the adjoining cornfields. The Mouse-ear Hawksweed *(Hieracium Pilosella)* I saw in flower by the side of a ditch on the above date, apparently the flowers had been out several days before noticed. 29th, the round-leaved Mallow *(Malva rotundifolia)* first found in flower by the side of a wall facing S.W. Brimstone Butterfly seen in Yardley Chase. June 3rd, flowers of *Lychnis flos-cuculi*, *Chrysanthemum leucanthemum*, and *Sanguisorba officinalis* first observed on clayey banks by a roadside. 4th, first specimens of *Plantago media* gathered in pasture, and flowers of *Viburnum Opulus*, (the Guelder Rose,) and the Spindle Tree, *(Euonymus europæus)* noticed in Denton Wood. 5th, fully expanded flowers of *Leontodon hispidus* (Hawkbit) first seen; partly opened heads were noticed on May 28th. 10th, first flowers of Dog Rose *(Rosa canina)* gathered from a hedge with S.S.W. aspect; flowers of the Spotted Orchis *(Orchis maculata)* and of *Solanum Dulcamara* were first observed on the same day. 12th, Blue Butterfly seen near Yardley Hastings, and Rose Beetle seen near Castle Ashby. 14th, ripe wild Strawberries first gathered, a single cyme of the Elder Tree *(Sambucus nigra)* with fully opened flowers seen on hedge facing S.E. The common Bryony noticed on the same hedge. 15th, Poppies in full flower in cornfields, several plants seen in forward bud on 12th, growing on bank open to S.S.W. 16th, Sowthistle *(Sonchus oleraceus)* and the bright purple flowers of *Prunella vulgaris* first noticed in a sandpit. The little Starwort *(Stellaria graminea)* was seen in flower in Yardley Chase. On the 18th, the Hop Trefoil *(Trifolium minus)* gathered from a roadside near Denton, and specimens of *Anagallis arvensis* from the adjoining cornfields. This latter plant had evidently been in flower a week before seen; several of the corollas had already fallen off. On the same date (18th) I gathered some specimens of that "Queen of the grasses" *Briza media*, whose stamens were then first observed hanging from their ever tottering plumes. 19th, one or two plants of *Valeriana officinalis*, and of *Spiræa Ulmaria* (Meadowsweet) seen in flower by the side of a brook facing west. From a hedge near I gathered several flowers of *Cornus sanguinea* (Dogwood.) 20th, Black Bryony first seen in flower. 21st, gathered specimens of the Bladder Campion *(Silene inflata)* in full flower, on the border of a cornfield. I noticed several other plants growing among the corn in forward bud. 22nd, Potato in flower. 25th, Burnet Moth first seen at Yardley Hastings. First flowers of Privet seen on hedge facing S.S.W. 26th, Wheat ears first seen. 27th, Barley ears first seen. 28th, gathered first flowers of *Rosa arvensis* from hedge facing S.S.W. *Thymus serpyllum* in flower. 29th, specimen of Hypericum and *Ballota nigra* (Black Horehound) seen in flower by a wall with S.E. aspect. Gathered flowers of Yellow Waterlily (*Nuphar luteum,)* Yellow Iris, and Skull-cap from fish ponds. Noticed some White Waterlilies on the same day. Flowers of *Centaurea Scabiosa* (Thrapweed) and *Bartsia Odontites* gathered on the border of cornfield. 30th, Fool's Parsley *(Æthusa cynapium)* and *Scabiosa arvensis* seen in flower in cornfield.—Robt. Rogers.

Phenological Observations taken in the vicinity of Farley, near Cheadle, Staffordshire, during June, 1880:—1st, by now, *Rhinanthus Crista-galli*, *Barbarea vulgaris*, and *Galium saxatile* in full flower. *Ranunculus hederaceus* said to have been seen. 5th, about now, *Saxifraga granulata* first in flower, near edge of wood, foot of Weaver Hills. 8th, *Veronica Beccabunga* first seen in flower by wayside ditch. 10th, *Polygonum Bistorta* first seen fully out in meadow land, foot of Weaver. 12th, first flowers of *Trifolium repens* in old wall facing S.S.W.; by now, *Viola lutea* fully out on Weaver Hills; *Stellaria graminea* first noticed in old wall, open to S. 13th, *Lysimachia nemorum* first noticed by way side, facing N., near Oakamoor. 15th, *Digitalis purpurea* in flower near Ellastone. 16th, first flowers of *Melampyrum pratense* in wood, near rivulet. 20th, by now, *Sanicula Europæa* become general. 22nd, *Scrophularia nodosa* just in flower, by hedge-bank, facing S.E.; *Chærophyllum temulentum* becoming general. Gathered first ripe fruit of *Potentilla Fragariastrum;* first Wild Roses seen in full flower. 23rd, flowers of *Trifolium procumbens* first observed. 24th, by now, *Thymus serpyllum* in flower on slopes of Weaver Hills. 24th, first flowers of *Lychnis Flos-cuculi* in moist ground, and *Geranium pratense* near edge of wood, at foot of Weaver Hills. 25th, *(approx.,)* first flowers of *Prunella vulgaris.* 25th, *Silene inflata* first seen in flower by yew plantation on warren ground; first flowers of *Epilobium montana* appeared; old wall, facing S. 26th, *Stachys sylvatica* first seen in flower on hedge bank, in deep, narrow lane. 30th, *Lonicera Periclymenum* first in flower.—Clement L. Wragge.

Water Shrew.—One fine summer evening as I was sitting in my garden a Water Shrew made its appearance in a small pool of water. The little creature first ran along the bits of sticks and leaves which floated in the water, apparently in search of insects, but every now and then toppled over. This, however, did not seem to be any inconvenience, for it ran along the under side of the floating sticks with as much ease as when on the upper surface; and when it emerged, as it quickly did, its fur did not appear to be at all wet. Having carried on its manœuvres in this way for some time, it betook itself to the edge of the pool, and commenced boring with its head into the ground with extraordinary energy, raising its hinder parts into the air to give force to its exertions; just in the same way as I have seen a mole do when boring into the roots of grass in search of insects in the open air. Having in this manner captured a worm or the larva of some insect, it drew out its head and ate its prey, apparently with great satisfaction, not swallowing it whole, after the manner of a bird, but biting it and eating it by degrees. These operations it carried on for a considerable time, until darkness prevented further observations. These creatures are by no means uncommon in our streams and ditches, but as none of us have been able to capture any of them, we are uncertain respecting their species. I suppose they are the *Sorex fodiens*, Lin. On the 20th of last February, what I suppose was an immature example of this species was taken alive in the harbour opposite the museum, brought down by the freshet. Whole length $3\frac{7}{10}$ inches, head one inch, body $1\frac{4}{10}$ inch, tail $1\frac{3}{10}$ inch; blackish-brown above and beneath, breast ash colour; head elongated into a proboscis, strongly ciliated with long white hairs; muzzle with two rounded, smooth, black lips, slightly parted; legs smooth, livid; feet dark beneath, not ciliated; fore legs $\frac{4}{10}$ inch, hind legs $\frac{6}{10}$ inch.—Martin Simpson, Whitby Museum.

Gleanings.

Introductory Science Primer.—The long-looked-for Introductory Primer by Professor Huxley, F.R.S., has at length been published by Messrs. Macmillan and Co., and has already had an enormous sale.

The British Association.—The fiftieth annual meeting will commence on Wednesday, the 25th inst., at Swansea. The President-Elect is Andrew Crombie Ramsay, LL.D., F.R.S., Director-General of the Geological Survey and of the Museum of Practical Geology.

Manual of the Infusoria.—Mr. W. Saville Kent's long-promised manual will, it is announced, be published by Mr. David Bogue, in six monthly parts, the first of which is to be ready in October next. The complete MS. and drawings are in the printer's hands.

Leicester Museum.—Mr. Montagu Browne, F.Z.S., of Birmingham, author of "Practical Taxidermy," has been appointed Curator of the Leicester Museum, *vice* Mr. W. Jerome Harrison, F.G.S., who has been appointed Demonstrator of Science in the Birmingham Board Schools.

The late Mr. W. A. Lloyd.—It is with regret we announce the sudden death last month of Mr. W. A. Lloyd, at his residence, Lower Norwood. To Mr. Lloyd, probably more than to any one else, the improvements made in the management of Marine Aquaria in recent years are due.

Great Auk's Eggs.—Two eggs of the Great Auk, recently discovered in an old collection in Edinburgh, were sold by auction by Mr. J. C. Stevens, London, on Friday, July 2nd, and were purchased by Lord Lilford for £100 and 102 guineas respectively.

"Notes on the Birds of Northamptonshire."—The first instalment of a work bearing this title has been printed for private circulation by the author, Lord Lilford, F.L.S., F.Z.S. The notes are most interesting, and all the more valuable from being a record of personal observations. This first instalment contains descriptions of seventy-five species of birds.

Photography.—The Secretary of the Photographical Section of the Northamptonshire Natural History Society (Mr. H. Manfield) has been awarded a medal for photographic exhibits at the Sydney Exhibition.

Microscopical.—Mr. Thomas Bolton, 17, Ann Street, Birmingham, has issued a pamphlet, price threepence, on the best methods of examining living organisms under the microscope.

Oxford Natural History Society.—A society already numbering fifty members has been formed at Oxford. Its meetings will be held (by permission of Professor Lawson) in the lecture rooms at the Botanical Gardens. The sections will be presided over as follows:—Botany, Professor Lawson, M.A., (Phanerogams.) and Mr. H. Boswell (Cryptogams;) Ornithology, Mr. Oliver V. Aplin; Entomology, Professor Westwood, F.R.S.; Geology, Mr. E. B. Boulton. Mr. G. C. Druce, F.L.S., is the Hon. Sec.

Sunshine Recorder.—The Meteorological Department has lately issued to its principal stations a simple, yet trustworthy, instrument, whereby the number of hours of sunshine is registered daily with accuracy. This sunshine recorder consists of a glass ball, behind which a graduated card, bent in the form of a semi-circle, is held in a brass ring. The glass ball acts, of course, as a convex lens, and, when the sun is shining, brings the rays to a focus just on the card, which is thereby charred. As the sun's place changes in the sky, so does the spot of light travel along the card; but when clouds obscure the sun, an uncharred interval is seen on the card. We trust there will be plenty of work for this instrument this year.

A Fresh Water Jelly Fish.—*Craspedacustes Sowerbii*, the name given by Prof. Ray Lankester to a remarkable kind of Jelly Fish or Medusa found recently in the Victoria Regia tank in the gardens of the Botanic Society, London, has been replaced by *Limnocodium victoria*, (λίμνη a pond, and κώδων a bell,) given priorly by Dr. Allman. It is new, and the only Medusa which inhabits fresh water. It flourishes in water at a temperature of 90° Fahrenheit, and is supposed to have been introduced with tropical water weeds. Hundreds of adult specimens are now in the tank. They measure only one-third of an inch across the disc. *Nature*, of June 24th, contains a very full account of this interesting organism.

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—Geological Section, June 22nd.—Professor T. G. Bonney, F.R.S., of Cambridge, gave a lecture on "The Older Rocks of Charnwood Forest." Beginning by remarking upon some of the difficulties in the way of a perfectly satisfactory determination of the geology of the district, Professor Bonney described in detail the appearance, both in the field and microscopically, of the various rocks met with. These consist principally of slates and quartzites, coarse ash bed and agglomerates, of which many have been mapped by previous observers as greenstone, felstone-like rocks which have been supposed to be either actually lava flows, or at least to represent the extreme of metamorphism; and the coarse-grained syenites and hornblendic granites, which appear in isolated patches. Of these, the felstones of Peldar Tor and of Sharpley appear, from a variety of evidence, to be fragmental, and the same applies to the so-called "greenstone" of Bardon Hill, which probably belongs to the same series. The latest researches have resulted in the discovery of beds on the east side of the anticlinal axis, which are apparently of the same horizon as those at Peldar Tor on the west of it, although composed of finer materials; also, in a tolerably well-defined horizon, of volcanic breccia, and another of a slate breccia, which appears at Bardon Hill. As to the age of the rocks, Professor Bonney, from considerations of their constitution, strike, &c., inclines to the belief that they are pre-Cambrian, like the Shropshire district near the Wrekin. As to the syenites and granites, several observed junctions prove their intrusive character. A hearty vote of thanks was given to Professor Bonney for his lecture. General Meeting, June 29th.—Mr. Montagu Browne exhibited two albatrosses, *(Diomedea exulans,)* young and old, and the giant petrel *(Ossifraga gigantea.)* Mr. W. Southall exhibited three curious flowers, *(Ceropegia,)* one of them entirely roofed over by a canopy. Mr. H. E. Forrest exhibited *Botryllus polycyclus*, a marine compound Ascidian, remarkable for its circulatory system, the heart first driving the blood in one direction, then reversing, and driving it in the opposite one. Mr. W. G. Blatch exhibited *Diphyllus lunatus* and *Plegaderus dissectus*, two beetles found in a fungus, *(Hypoxylon concentricum,)* from Knowle; and *Donacia comari*, from Sutton Park; all new to the district. Mr. J. Levick exhibited *Leptodora hyalina*, from the canal at Tamworth and the Earlswood Reservoir, showing the young in various stages of development within the carapace, in one the organs being scarcely discernible, in another the legs and antennæ being much larger, the latter with the two branches at the end fairly formed, the young animal closely resembling a Daphnia. Also a living male specimen, showing the method of propulsion through the water. This it accomplishes by bending the plumed branches downwards, when it raises the antennæ, thus offering very little resistance to the water; but when it lowers them, during the downward stroke, these plumed branches are straightened out, and brought to bear in their fullest expanse upon the water. Mr. W. R. Hughes read a paper by Mr. H. J. Carter, F.R.S., on "Sponges," which appears at page 190. Specimens were shown in the microscopes, twelve in number, several of which were lent for the occasion by members of the Society. Mr. Hughes also showed several diagrams of sponges. A vote of thanks to Mr. Carter closed the proceedings. General Meeting, July 6th.—Mr. J. Levick exhibited young of *Leptodora hyalina*, in a more advanced stage than at the previous meeting, and almost resembling the mature animal. Mr. T. Bolton exhibited a marine Polyzoon, *Bowerbankia gracillima*, and a species of Follicularia, from Weymouth; also *Paludicella Ehrenbergii*, *Fredericella Sultana*, *Plumatella repens*, Chætospira, Ophrydium, and other Infusoria, with several Rotifers, all from the River Avon at Evesham. Mr. J. E. Bagnall exhibited *Myriophyllum spicatum*, *Orchis pyramidalis*, and other plants from Stratford-on-Avon; also some large woody Galls, growing on leaves of the elm tree. Biological Section, July 13th.—Mr. Montagu Browne exhibited a beautiful Moth, *Saturnia Pyri*, captured in a timber yard in Lionel Street, but not hitherto recorded as British. It is probable, from the situation in which it was found, that it was imported in some foreign timber, in the pupa state, and developed afterwards.

Mr. J. Levick exhibited several specimens of *Daphnia Kahlbergensis*, showing a remarkable variation in the degree of pointedness of the head; he also showed *Sida crystallina* and *Argulus foliaceus*.—MICROSCOPICAL GENERAL MEETING, July 20th. —Mr. R. W. Chase gave an account of a collection of birds presented to the society by Mr. B. J. Glainville, of Grahamstown, South Africa. It consisted of thirty-eight specimens belonging to the three orders, Accipitres, Passeres, and Scansores, twelve families and twenty-three genera. None of them were of great rarity, but many of them very beautiful. A vote of thanks was unanimously passed to Mr. Glainville for his gift. Mr. J. E. Bagnall exhibited *Gymnostomum tenue*, *Gymnodenia conopsea*, and *Radiola millegrana*, all rare in Warwickshire, from Berkswell, and *Sagittaria Sagittifolia*, from Rowington; also on behalf of Mr. C. E. Crick a number of rare plants from King's Cliff. Mr. W. B. Grove exhibited *Æcidium depauperans*, (Vize,) a fungus found on *Viola*, and distinguished from *Æ. Violæ* by the peridia occurring scattered over every part of the plant, even the petals. It so impoverishes the plant that it can scarcely mature its flowers. Mr. W. Southall exhibited leaf of *Durio zibetinus*, the plant which produces the Durian Fruit. It forms a beautiful microscopic object. Mr. J. F. Greenway exhibited *Stephanoceros Eichhornii* from Blackroot Pool.

CARADOC FIELD CLUB.—The first Field Excursion took place on Friday, June 25th. About twenty-five members were present. The walk was from Berrington Station on the Shrewsbury and Hereford Railway, by Eye and Yarpole—the churches of which places were visited—through the grounds of Croft Castle, to the well-known encampment of Croft Ambrey; thence to Yatton Court, where Rodney Ward, Esq., had hospitably provided luncheon for the party. A visit was paid to the exposure of Aymestry limestone adjoining the village from which it takes its name. Returning by carriage to Leominster, the excursionists dined together at the Royal Oak Hotel, and after dinner a paper was read by the Rev. T. O. Rorke on the various objects of antiquarian interest visited during the day.

DUDLEY AND MIDLAND GEOLOGICAL SOCIETY AND FIELD CLUB.—This Society held their third Field Meeting for this season on Monday and Tuesday, 28th and 29th June, at Leominster and Kington. The party spent some time in examining the fine old church at Leominster, under the guidance of the Vicar, and then travelled on to Kington, when the evening was spent in examining the tilestones and Ludlow rocks of Bradnor Hill and the Arrow Valley. In this district the Upper Ludlow beds lie directly on the Lower Ludlow, as the intermediate Aymestry limestone, which is so well developed in the typical district of Aymestry, a few miles to the north, is here entirely absent. Next morning the party drove to the romantic little waterfall of "Water-break-its-neck," in Radnorshire. The Ludlow beds here yielded a few fossils to the hammers of the geologists. The botanists were also successful in securing some rare plants. On the Monday evening the Annual Meeting was held at Kington, (C. Cochrane, Esq., Vice-President, in the chair,) when the report of the committee and statement of accounts were read and adopted. Alfred Freer, Esq., was elected President for the ensuing year.

NOTTINGHAM LITERARY AND PHILOSOPHICAL SOCIETY.—A Meeting of the Natural Science Section was held June 18th, when a paper was read by Mr. J. J. Harris Teall, M.A., F.G.S., entitled "Archæological and Historical Notes on the Isle of Man;" and Mr. J. Shipman read a second paper on the "Geology of the Isle of Man." The first of the Annual Excursions of this Society was held on Thursday, July 8th. The excursion was made to Arbor Low, Youlgreave, and Haddon. At the first of these places a paper was read by the conductor, Mr. A. H. Scott White, B.Sc., B.A., F.G.S., &c., on the "Megalithic Circle," which will appear in a future number of this magazine. This paper was illustrated by drawings and diagrams (a set being given to each member) and flint implements and pottery. After luncheon at the Bull's Head Hotel, the party visited the fine old church of Youlgreave, when a paper by Mr. S. Dutton Walsh, F.S.A., was read by Mr. A. Marshall, describing the many points of interest. Haddon was reached at 6 p.m.; here the party divided, some visiting the hall, and the rest a quarry in the Carboniferous Limestone.

Plate VII

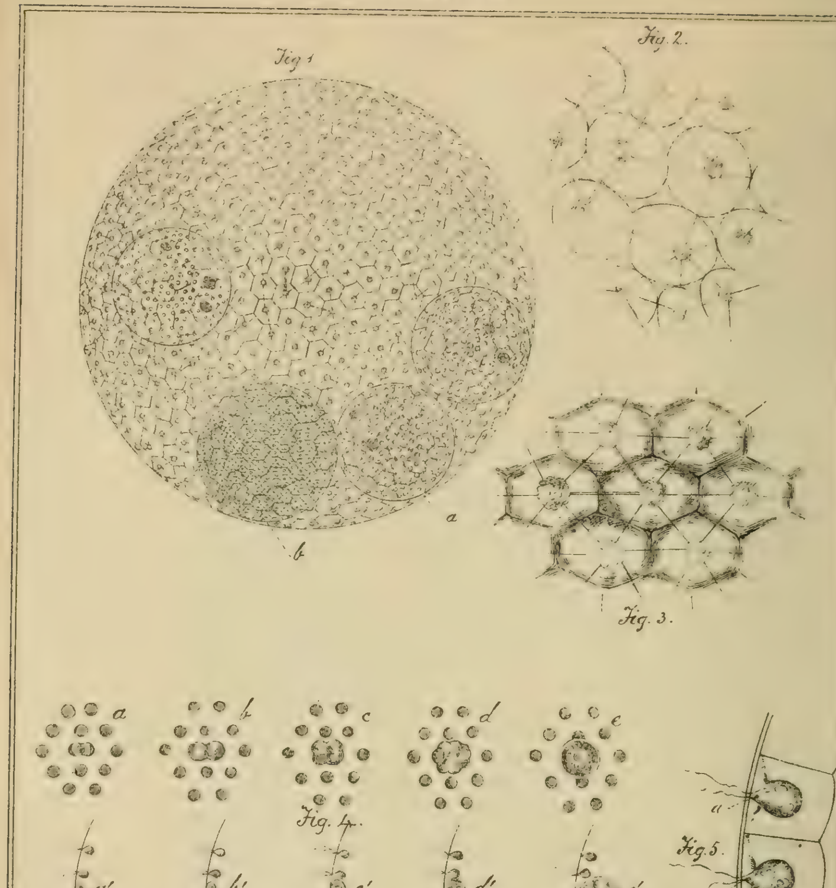


Fig 1
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A. W. Wills del

ON THE STRUCTURE AND LIFE-HISTORY OF VOLVOX GLOBATOR.*

BY A. W. WILLS, F.C.S.

No single organism in Nature has more frequently excited transient feelings of admiration or interest than *Volvox globator.* In the household or at public displays of microscopic objects, none more often elicits expressions of wonder and delight. The exquisitely pure green of its translucent spheres, their inimitable symmetry, and, above all, the perfect grace of movement in a group of these plants, gliding hither and thither with a methodical and stately rotatory motion, passing and repassing, threading their way between one another, the easy regularity of their courses never interrupted by collision, but only checked for a moment when they approach too nearly, and then instantly resumed; in addition, the entire absence of any apparent actuating force to account for this motion;—all these things combine to make Volvox an object of unsurpassed beauty and of perennial delight. Indeed, the microscopist can offer *no* more attractive spectacle than that of a group of Volvox-spheres, young and old, seen under a low power of his instrument, by a well-adjusted dark back-ground illumination.

Yet it is an undoubted fact that the details of their more intimate structure are unknown even to the majority of professed microscopists, chiefly, no doubt, because they can only be revealed by the careful use of somewhat high powers, assisted by the action of various re-agents.

Finding that the descriptions given in ordinary text-books were often too meagre to be of much value, and as often hopelessly obscure, I was led to consult carefully the original memoirs of Cohn, Busk, Williamson, &c., on this subject, and, wherever it was possible, to repeat their observations—and having acquired by this means a far clearer idea of the structure of Volvox than I had hitherto possessed, having also, perhaps, added some few new facts to the common stock of such knowledge, I have thought that a short summary of what is known of its life-history might be of some use to my fellow-students.

REFERENCES TO PLATE VII.

Fig. 1.—Mature Volvox sphere, showing daughter-spheres within, these also containing the enlarged gonidia, from which spheres of the third generation are to be derived; also showing hexagonal structure and connecting threads.
Fig. 2.—Portion of Volvox sphere treated by glycerine, after Williamson.
Fig. 3.—Portion of Volvox sphere after treatment with solution of aniline purple.
Fig. 4, *a* to *e*.—Development of young Volvox from selected gonidia within the parent; *a* to *e*—the same seen in section.
Fig. 5.—Probable section of portion of living Volvox, after Williamson.
Fig. 6.—Volvox ruptured under pressure, and treated by aniline purple, showing radiating streaks of primordial utricle, &c.
Fig. 7.—Portion of cell wall, showing the pores through which the cilia protrude.

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* Read before the Birmingham Natural History and Microscopical Society, May 18th, 1880.

It seems hardly necessary to describe the normal aspect of this organism. Briefly, under a low power, it is seen to consist of a spherical globe of mathematical perfectness, so transparent that, as it glides along, any object over which it passes is clearly visible through its vacant spaces, *i.e.*, through such parts as are not occupied by the structures presently to be noticed, while by focussing the binocular on the lower half of the plant, the effect is obtained of looking into the inside of a glass sphere of crystalline purity and of absolute symmetry. The diameter of a full-grown individual is usually about 1-60″, and individuals are to be found in each colony varying from this down to about 1-180″. The *inner* surface of the sphere is studded at intervals with dark green points, not disposed irregularly, but so arranged that each is usually the centre of a group of six others, placed at the extremity of nearly equal radii. These green points are "*gonidia*," each probably endowed with the potentiality of becoming a perfect Volvox, though only a certain number of them actually undergo that sequence of changes which results in their becoming fresh individuals resembling the parent sphere.

Each gonidium is either spherical or pyriform, (in which case its pointed end is directed outwards,) and contains, in its early stages at any rate, one or more contractile vacuoles disposed among a mass of granular endochrome, and stated by Busk to pulsate rhythmically once in about forty seconds. (Plate VII., Fig. 5.)

At this period are also to be seen in the body of the gonidium one, two, or three—occasionally even more—brilliant colourless spots, from one of which is probably derived a nucleus which can be detected by the use of re-agents at a later period.

There is also often lodged within the substance of the zoospore a brown or red "*eye-spot*," and all the eye-spots in an individual look, so to speak, one way. (Plate VII., Fig. *5a*.)

The apex of each gonidium is more or less produced into a transparent point, from which proceed two cilia, several times as long as the gonidium itself, which pass through two minute pores in the outer cell wall, and move freely in the surrounding water. I am fortunate in having mounted a specimen of Volvox, in which these pairs of *foramina* are clearly shown, and the regularity of their disposition at a uniform angle to the equator of the sphere is striking. (Plate VII., Fig. 7.) It is, of course, by the combined action of these numerous pairs of cilia that the whole organism progresses. Of the direction of the resultant motion we shall speak shortly.

Viewing the surface of the sphere with its convexity presented to the objective, we find, by very careful adjustment of light, that from each gonidium there runs to each of the six surrounding ones a fine thread, sometimes double, occasionally triple, always of extreme tenuity, (Plate VII., Fig. 1;) of *such* tenuity, indeed, as to be frequently invisible; but as the use of certain re-agents often brings these lines into view where it had been previously impossible to detect them, and as they may be sometimes discerned for an instant when the eye is applied fresh and unfatigued to the microscope, where even a moment later they seem to be absent, it may be assumed that the structure is universal, though often far too subtle to be detected. It is needless to say that no skill of the draughtsman can even suggest its infinite delicacy, while the figures given in books, not excepting the beautiful drawings in Ehrenberg's "Infusionsthierchen," exaggerate the strength of the connecting lines to the extent of grossly caricaturing the extreme fineness of Nature's own handiwork. As I sit writing to-day, the afternoon sun of an exceptionally bright day, shining full on my study window, reveals the presence on the outside of the panes of a few spiders' webs, so fine that it is only as the breeze causes them to sway gently to and fro that they shimmer into visibility. When I rise from my seat, and try to discover where they cross the window, they are absolutely gone from my sight. If you will picture to yourself a tiny green bead, surrounded by six others, and disposed upon the outside of this same window, and each connected with its neighbours by one of these fine spider-threads, I do not think the combination will give an exaggerated idea of the superlative delicacy of the network of "protoplasmic threads" with which the surface of a Volvox sphere is diapered.

To return to the gonidia and their history.

A certain number of these in each individual are selected to produce a group of young Volvoces within the parent sphere. The books fix this number as usually four or eight; but out of twenty-five individuals now in the field of my microscope, I find only three containing four incipient spheres of the second generation, while only one contains eight, and there are four containing five, six with six, ten with seven, and one with nine such progeny. Almost every Volvox, when first discharged from the parent sac, and possessing a diameter of about 1-170″, already contains a certain number of enlarged gonidia, destined in due time to become its own progeny. Not only so, but long before its discharge, and while yet it exists as a daughter-cell within the protecting cavity of the parent generation, these selected gonidia are already visible as spots larger and darker than their fellows. (Plate VII., Fig. 6.)

The history of these selected gonidia, as it may be traced in a daughter-sphere recently cast forth to seek its fortunes in the world of waters around it, is as follows:—The enlarged gonidium is at first a flat thin circular disk, appressed to the internal surface of the sphere, and being surrounded by *eight* of the ordinary zoospores, is derived from the coalescence of the two central ones out of a group of ten. (Plate VII., Fig. 4*a a′*.) Shortly, this disk assumes a more distinctly oval form, with a slight constriction across its lesser diameter, in which stage it often much resembles a young Cosmarium. (Plate VII., Fig. 4*b b′*.) It is soon seen to be clearly sub-divided into four, and its thickness having grown *pari passu* with its superficies, the group now protrudes into the internal cavity of the parent plant. (Plate VII., Fig. 4*c c′*.) Repeated sub-division now goes on rapidly, (Plate VII., Fig. 4*d d′*,) till the whole body assumes a spherical form, a distinct cell wall being at the same time formed, which is revealed by careful illumination, and still more clearly by the use of re-agents, as a hyaline sphere concentric to and of larger diameter than the green one within it, so that there appears to be a clear space or ring between the two when seen in section. (Plate VII., Fig. 4*e e′*, and Fig. 6.) Finally, the young Volvox consists of a vast number of deep green granules, closely packed together, and by mutual pressure driven to assume a more or less distinctly hexagonal form, and corresponding in number to the gonidia which are to stud its surface when its growth is completed. (Plate VII., Fig. 6*a*.) Shortly hereafter, the whole organism continuing to increase in size, clear spaces appear between the gonidia, *showing that the enlargement of the cell-wall and its interspaces is outstripping that of the gonidia*, which are now approaching maturity. The interlacing connecting threads are developed simultaneously. (Plate VII., Fig. 1*a*.) During the whole process, the centre of the young Volvox spheres continually recedes from the periphery of the parent, so that when the group of young ones has attained the full development of which it is capable in this stage, they are often pretty closely packed in the internal space, and sometimes even slightly deformed by mutual pressure; each by this time closely resembling the parent in miniature, and already containing enlarged gonidia of the third generation. (Plate VII., Fig. 6.) By this time, the clear space originally visible between the gonidia and the cell-wall has been obliterated, and the cilia may be seen protruding through the latter. Some writers state that the daughter-cells rotate at this period within the parent cavity. I have frequently seen them oscillate so far in one direction, and then back to their original position, but have never observed a true rotatory motion. Finally, the young Volvoces are liberated by the rupture of the parent sac, at a *special point*, *clearly marked out for this purpose in its structure*. (Plate VII., Fig. 6.) I have not met with any observations on this point, but have fully convinced myself that it may always be predicted at what point this rupture will be effected.

The combined action of the pairs of cilia in which the gonidia terminate is the actuating power whence proceed both the rotatory and the progressive movement of Volvox—and these are both in a definite direction. If an imaginary axis be drawn through the sphere, the progressive motion being, so to speak, from the north to the south pole of that axis, *the rotatory motion is usually from west to east*, though not always, being occasionally reversed for a few seconds; but for the greater part of the time it is regularly in the direction indicated, and the *point of rupture of the sphere will be at its north pole*. (Plate VII., Fig. 6.)

It is difficult to determine precisely how this rupture is accomplished, but I believe it to be by a special contraction of the walls of the parent, or of the invisible primordial utricle, *not* by the outward pressure of the daughter-spheres, this force being evidently inadequate to produce the result where their number is small, whatever it may be when it reaches its maximum.

Shortly before the emission of the young, the cell commonly assumes a slightly pyriform shape, and then slowly opens at its apex, but *the aperture is of less diameter* than that of the young Volvoces, and as each of these passes out, the mouth of the bag is visibly stretched, and resumes its original size after each daughter-sphere has escaped; so that it evidently possesses considerable elasticity, a property also made manifest by the fact that the normal form of Volvox may be considerably flattened by the pressure of a glass cover, and yet resume both its spherical form and its motion when this pressure is removed.

Moreover, the daughter-sphere passes out *without rotating*, and from whatever cause it derives its impulse, this often suffices to drive the young Volvox clear of the mouth of the sac to a distance equal to several times its own diameter, in which position it pauses motionless for some seconds, and then, commencing to rotate gently, sails away, at first slowly, then more and more rapidly, to enjoy its independent existence.

After the rupture of the sac, the gonidia near the edges of the opening are seen to quiver from the action of the cilia where they are partially freed from the support of the surrounding envelope, and the same thing occurs when they are forcibly torn from their attachment, in which case they may even move for awhile freely through the water.

The general action of the cilia continues for some time, and the empty sphere rotates as before, its general direction being still from north to south, with the open end to the rear. After a time, which I cannot specify, the cilia cease to play, and the organism decays, having fulfilled its destiny in life.

The birth of the young Volvoces is affected by various circumstances. Doubtless the process is, under natural conditions, most active in the early hours about dawn, when the analogous functions of similar organisms are well known to be most energetic, but in order to see the phenomenon in full vigour it is only necessary to place a number of mature parent-spheres, such as are found in every colony, in a shallow live-trough, and to bring them into a warm room. In an hour's time almost all the young plants will have been liberated. Light and heat stimulate the action, while cold and darkness retard it. The ciliary action is affected in a remarkable degree by altered external conditions. If a drop of water considerably colder than that in which the Volvoces are floating be allowed to flow in under the cover-glass, the whole are paralysed for some seconds, after which they slowly resume their motion. A sudden mechanical shock produces a similar effect, as I have repeatedly seen to happen in consequence of the rude impact of some ferocious Entomostracon.

A sufficient degree of heat to make the water distinctly tepid to the feel, causes instant and simultaneous death of the whole colony.

During the day the majority of the Volvoces contained in a shallow vessel rise to the surface, although they avoid strong direct sunshine, while at night they retire in a cloud to the bottom.

The astonishing number in which the spheres at times appear in some pool and their equally sudden disappearance, have been frequently remarked. Doubtless a very slight change in external conditions suffices on the one hand to favour the development of countless thousands of young plants, and on the other, either to destroy the vitality of the whole colony, or to drive it to seek refuge in deeper water.

A curious instance of this sensitiveness to varying conditions of light and heat occurred to myself. I had two shallow vessels in a north window, each containing a goodly supply of Volvox. Cold and inclement weather, which prevailed for weeks together, seemed to check their increase, for I found but few young spheres from day to day among the older ones. Thinking that a moderate degree of warmth would tend to increase my colony, I transferred one vessel, fortunately not both, to the floor of a warm greenhouse. In forty-eight hours all were dead, and in a few days scarcely a vestige remained of the countless corpses which had copiously strewed the bottom of the glass.

(To be continued.)

ORIGIN OF THE ROCKS AND SCENERY OF NORTH WALES.*

BY J. J. HARRIS TEALL, M.A., F.G.S., ETC., LATE FELLOW OF ST. JOHN'S COLLEGE, CAMBRIDGE.

During the early part of the summer which has just closed I spent six weeks in rambling over the hills and through the valleys of North Wales. The object of the visit was not exactly geological, but the nature of the country is such that no person who is at all acquainted with the science of geology can travel through it without noticing a number of most interesting points. I propose this evening to give, in the merest outline, a sketch of the geological features of the district, and to illustrate this sketch as far as possible from my own observation, and by means of specimens collected on the spot.

I may remind you, by way of introduction, that the region of North Wales is classic ground for the geologist, and that the hills and dales of this most beautiful country have not only been the scene of many a hard fought battle in the early days of British history, but that even in later times they have been the subject of severe disputes between rival schools of geologists.

* This paper, or rather lecture, was delivered before the Natural Science Section of the Nottingham Literary and Philosophical Society. It contains very little indeed that is original, and only professes to be a somewhat popular account of some of the most interesting points in connection with the geology of North Wales. —J. J. H. T.

Previous to the year 1831, the rocks of North Wales were grouped together under the very general and somewhat meaningless term of greywacke, and nothing like a regular order of succession was known to exist. In that and the following year, Sedgwick, assisted by Charles Darwin, examined the rocks which occur along a line passing S.E. from the Menai Straits, and discovered that the principles of stratification, which had been elaborated by William Smith and other pioneers of geology, with special reference to the secondary formations, were equally applicable to the primary formations; although, owing to their greater age, they had been far more affected by the agents which contort, fracture, and alter the rocks of which the earth's crust is composed.

The order of succession established by Sedgwick during the two years previously mentioned, has remained undisturbed in all its essential characters to the present day, and although the name of Cambrian, which he subsequently applied to these formations, is not the one usually adopted, yet to him belongs the sole credit of determining their order of succession in the first instance.

My object this evening is not, however, to present you with a history of the great Cambro-Silurian controversy, but to give some account of the actual structure of the district, and of the changes in physical geography, which an examination of this structure reveals to the geologist.

And in the first place I propose to study the rocks apart from their order of succession. A traveller in North Wales who attentively examines the rocks over which he passes will soon find that, in spite of innumerable minor differences, there are certain well marked types. Let us select a few of these and consider them in some detail. To give names to them in the present state of our science is somewhat difficult, but for the purposes of description it is absolutely necessary. I will, therefore, choose those names which seem to me least objectionable, and at the same time ask you to remember that geologists are not agreed as to the precise signification which should be attached to them. I will select for the most part rocks of which I have specimens, and in what I say about their origin will limit myself to these specimens and to others undoubtedly similar, without pledging myself in any way as to the origin of other rocks to which geologists may give the same name.

The first rock I propose to consider is one to which the term quartz-felsite is now very generally applied. On the north and south shores of Llyn Padarn, the lower of the two Llanberis Lakes, as well as in other regions, there occurs a peculiar rock to which the geological surveyors applied the term quartz porphyry. I have two specimens, one from the north shore of Llyn Padarn, the other from a quarry not far from Cwm-y-glo Railway Station. On the map this rock is represented by a deep red colour, and the mass to which it belongs trends N.E. and S.W., and is evidently continued beneath the lake. It is described in a paper by Professor Bonney, published in the Q.J.G.S., Vol. XXXV., page 312, but I will give the description direct from my own specimens.

The one from the north side of the lake is compact, and of a dull grey colour. It contains a number of small quartz crystals and grains which give it a porphyritic aspect. Under the microscope the grey matrix, when viewed by transmitted light, is seen to be of a dirty brown colour, and to present rather a mottled appearance, the mottling being due mainly to small specks of no definite form, but also, to some extent, to fine needle-like crystals; almost clear spaces may occasionally be recognised between the mottled spaces. When a comparatively low magnifying power is used, a very peculiar and characteristic structure may be recognised in the matrix. The specks which produce what I have termed the mottled appearance, are seen to follow a linear, or perhaps I ought rather to say, a curvilinear direction. Thus, whenever they approach one of the quartz grains, they bend round, and do not end abruptly against it, as we might at first expect them to do. Under the microscope the quartz grains appear as transparent glass, traversed here and there by cracks and lines of minute cavities. Felspar crystals are also seen to be present in the mass.

The specimen from Cwm-y-glo is darker in colour, and contains fewer quartz grains. Felspar crystals are, however, extremely abundant. In hand specimens the rock shows a streaky appearance, and also a peculiar platy—one may almost say slaty structure.

Under the microscope the curvilinear aspect previously described is seen to be developed to a remarkable degree, and the mind almost instinctively looks upon the fragments of felspar and quartz as having been carried along in a current which has solidified in the act of flowing.

This I consider to be the true explanation, for I agree with Professor Bonney that these specimens are really portions of old lava flows, and that the rock masses to which they belong must therefore have been formed at a period when volcanic action existed in the neighbourhood of Llyn Padarn. This conclusion is borne out by an examination of the chemical and mineralogical composition, and of the microscopic appearance just described; while the peculiar platy structure, so common in many lavas, as Professor Bonney points out, is an additional link which completes the chain of evidence.

I may state, in passing, that these rocks belong to a class of lavas not found as a rule at a greater distance than ten or fifteen miles from the volcanic vent, and that it is consequently probable that the volcano which emitted these rocks was not further from Llyn Padarn than this distance, although we have no idea as to its exact locality. It will be as well to refer here to one or two other rocks which occur on the shores of Llyn Padarn.

One of these is a remarkable conglomerate. The term conglomerate is applied to any rock containing water-worn pebbles embedded in a matrix. When the pebbles are small, say about the size of fine shot, the rock becomes a grit. Now the conglomerate of Llyn Padarn varies very much in character in different places. At one spot, near the point of junction with the quartz-felsite, it is composed of a very large number of pebbles of about the same size as those in the Bunter conglomerate. The matrix of the rock is very much altered, and occasionally resembles the quartz-felsite above described. To quote from notes made on the spot: "The included fragments frequently attain the size of an egg, and consist of well rounded pebbles of grey and liver coloured quartzite, a cherty rock of greenish colour, a dark slate, a compact greyish felspathic rock, a quartz-felsite similar to that already described, and a granitoid rock composed mainly of pinkish felspar and quartz. The whole mass is so compact that the pebbles split as readily as the matrix." As regards the origin of this rock, a glance is sufficient to convince one that the pebbles have been formed by water action; their unmistakeable outline renders this certain. The conglomerate, in all probability, accumulated along the shore line of a sea or lake in some former period of the world's history. The pebbles found in the rock are relics of the old land surface of this period, and from them we can learn something of its geological structure. I would call your attention especially to three of the rocks found as pebbles in the conglomerate: the quartzite, quartz-felsite, and the granitoid rock, composed of quartz and felspar.

The quartzite pebbles vary in colour, from liver-colour to grey, the former closely resembling the characteristic pebbles of the Bunter. Under the microscope the quartzite presents all the usual characters of this rock, the grains are in many cases fairly rounded, thus showing that the constituent grains of the pebble owe their form to the agency which has shaped the pebble itself. The old pre-Cambrian land then consisted in part of quartzite, or of a conglomeratic rock cotaining quartzite pebbles derived from a still older continent.

The next rock we notice is the quartz-felsite. The occurrence of this rock as a pebble in the Cambrian conglomerate is most significant when considered in connection with the fact that it occurs *in situ* in the immediate neighbourhood as an old lava current. The presence of conglomerate itself raises the presumption that we are not far from an old shore line, while the occurrence of this particular rock, both *in situ* and as a pebble in a later deposit, renders it almost certain that the rock *in situ* formed a portion of the land surface of the period to which the conglomerate belongs. This point I shall again refer to in dealing with the former changes in the physical geography of North Wales.

The third rock that we have to consider is the one composed of quartz and felspar. It is especially interesting because, like the quartz-felsite, it occurs *in situ* at no very great distance. It may be seen at Caernarvon, only five or six miles away, and possibly it occurs even nearer than this.

In introducing the conglomerate, I mentioned that the size of the included fragments is liable to considerable variation, and the rock, for instance along the shores of Llyn Padarn, may be found almost shading off into a grit, this again into a still finer grit, and this again into a slate. I propose now to consider the origin of these grits and slates.

The finer conglomerates and the coarser grits consist mainly of quartz fragments embedded in a matrix of finer particles; some of these fragments have a beautiful opaline appearance, while others closely resemble common vein quartz. They show the usual evidence of water action, and were certainly transported to the position where the rock was formed, not its present position be it remembered, by the agency of currents. The finer grits which require the agency of a magnifying glass or microscope to enable us to distinguish their constituent particles, give still more conclusive evidence of water action. They show distinct traces of banding or lamination, and here and there the most beautiful indications of ripple drift. The most interesting case of this occurs in a quarry, about half way along the lake and on the northern side. The rock is a fine banded grit. The ripples are exposed in section, and are about two inches from crest to crest, and three quarters of an inch high. Owing to the peculiar character of the section, we are able to study the process which led to the formation of the ripples; the particles which form them are seen to be arranged in layers running roughly parallel with that slope of the ripple which points away from the direction in which the current flowed. At present the dip of the beds is seen to be about 55° to the W.S.W. If we suppose the beds to have been simply tilted, we may infer from the structure above described, that the current flowed from the S.E. or thereabouts. The same banded structure may be found in the finer grits and gritty slates, and in all cases the origin must have been the same. The alteration in colour and size of the constituent particles must be regarded as evidence of alteration in the strength and direction of the currents transporting the sedimentary material. I was particularly struck with the regularity of this banded aspect. Let me read some extracts bearing on this point from the notes I made on the spot:—"Just before the line of shore bends round to the right to form a small bay, a greenstone dyke, four yards wide, runs right up the face of the cliff, altering the purple slate through which it passes for some little distance from the junction. Beyond the bay are some curious banded slates. They are greenish grey in colour, banded with narrow dark green strata; these bands are about two inches apart, and occur with marked regularity throughout a thickness of many yards. Further on is a banded grit, passing occasionally into a conglomerate. In some places the bands of finer material are about three-quarters of an inch thick, and separated by gritty beds of about the same thickness."

Why do these bands succeed each other with such marked regularity? Evidently on account of some periodical change in the nature of the current. Does the space between similar bands represent the interval between two tides, a year, or a series of years? If we could answer this question we should then be able to determine the time represented by the series of banded slates and grits with just as much certainty as we can tell the time taken to form a block of wood by counting the rings of annual growth.

The next rock claiming our attention is one that forms a very large portion of the surface of North Wales, viz., slate. It is extremely fine in texture, the separate particles being too minute to be distinguishable by the eye, even by the aid of a hand glass. The whole mass has a tendency to split into layers of indefinite thinness, the surfaces of which are strictly parallel. Here and there are greenish patches in the purple slate; when exposed on the surface of a cleavage plane they are slightly elliptical, but when exposed on the surface of a plane, at right angles to the cleavage planes, they are seen to be enormously drawn out, with their longer axes in the direction of the cleavage planes. There can be little doubt that the original shape of these green spaces was spherical, and that their present shape has been produced by flattening in a direction at right angles to the cleavage planes, and expansion in the direction of these divisional lines. Experiment and observation both combine to establish the theory that slaty cleavage is due to pressure, and this distortion of what were originally green spheres enables us to estimate roughly the amount of compression which has taken place. The slates worked in the neighbourhood of Llanberis are usually of a purple or green colour. The same band is worked at Moel Tryfan, near Bettws Garmon, and at the celebrated Penrhyn quarries, in the valley of Nant Francon.

We pass now to the consideration of a class of rocks very different from those just described. The exact determination of the origin of many of these rocks is extremely difficult, owing to the enormous alteration they have undergone during the lapse of ages.

The adjective "Felspathic" is usually applied to this class, owing either to the actual presence of felspar crystals, whether perfect or fragmentary, or to the similarity in chemical and physical aspect between the rocks of this class and the felspar group of minerals. When the rock is fine grained and compact it is frequently termed a felstone, but there is no guarantee that all rocks to which this term is applied have been produced in the same manner. These felspathic rocks are of great thickness and extent. The more mountainous districts, including of course the great Snowdon group, are almost entirely composed of them, and owe their rugged grandeur to the resistance which they offer to the agencies of waste. Although a vast amount of research will have to be expended on these rocks before anything like a complete account of their origin can be given, still I think the main conclusion of Professor Ramsay, as stated in Vol. III. of Survey Memoirs will hold true. These conclusions may be stated as follows:—

(1) That these felspathic rocks are mainly the products of volcanic action.

(2) That they belong to three distinct classes:—

a Fragmental volcanic rocks.
b True lavas.
c Intrusive rocks.

(3) That the ashes and lavas were poured out for the most part beneath the sea.

(To be continued.)

ON THE OCCURRENCE OF FORAMINIFERA IN THE CARBONIFEROUS LIMESTONE OF DERBYSHIRE.*

BY E. WILSON, F.G.S.

The only evidence hitherto adduced of the occurrence of Foraminifera in the Carboniferous Limestone of Derbyshire and Stafford is supplied by two or three micro-rock-sections, belonging to Dr. Sorby, F.R.S., that show the tests of three recognisable forms of that group. Very lately, with the help of my friend Mr. J. H. Jennings, of Nottingham, I have been able to determine a much more numerous and widely spread Foraminiferal fauna in the Mountain Limestone of Derbyshire. Several years ago, when geologizing in the neighbourhood of Castleton, I noticed at one point (near Oxlow House, above the Winnatts) a very peculiar rock in the Carboniferous Limestone, apparently a light oolitic limestone containing waterworn pebbles of a more compact and darker coloured limestone. Two feet six inches only of this rock were exposed, but its base was not visible. The pebbles, which varied in size from a pea to a bean and upwards, were usually more or less flattened, and lay with their flat sides roughly parallel with the bedding. Some twelve months ago Mr. Jennings made micro-sections of this rock, which, while displaying the coarse oolitic and crystalline character of the matrix, and the fine grained argillaceous character of the contained fragments, proved of great interest to us from the fact of their disclosing the presence of Foraminifera both in the oolitic rock and its pebbly contents. From sections of this and other beds of limestone in the neighbourhood of Castleton, we were able to determine, with certainty, the presence in these rocks of three species of Foraminifera, viz.:—*Valvulina palæotrochus*, *Endothyra Bowmanni*, and *Archædiscus Karreri*. It then occurred to us that Ticknall, (S. Derbys.,) a locality peculiar for the thick seams of shale that are there interstratified with the upper beds of the Carboniferous Limestone,* would be a favourable hunting ground for Microzoa. On revisiting this spot, and examining with a lens the weathered surfaces of the flakes of earthy limestone that plentifully strew the waste heaps in these quarries, I was soon rewarded by finding abundant evidence of the great prevalence of Foraminifera—the ground literally teeming with *Endothyras*, *Valvulinas* and *Textularias*; *Endothyra radiata* in particular was excessively numerous. The result of washing down and sifting the shales, and making a single section of a limestone flake, has been to yield already sixteen of the forty-four known species of Carboniferous Foraminifera, and I believe that a more systematic examination of the material than I have yet been able to make will somewhat amplify the list of these here given. Dr. Brady, F.R.S., one of the highest authorities and author of the monograph in the Palæontographical Society's publications on the Carboniferous and Permian Foraminifera, has very kindly determined

* Read before the Natural Science Section of the Nottingham Literary and Philosophical Society, 7th April, 1880.

† These are the same beds as those described by me on a former occasion as containing the remains of a varied piscine fauna. (*Ante* page 172.)

the species for me. Mr. G. R. Vine, junr., Sheffield, also helped me in the same direction. The identification of species at Ticknall is difficult, except to an experienced hand, on account of the very generally crushed and somewhat disintegrated condition of the tests of these minute fossils. Dr. Brady informs me that he has found among the Challenger dredgings, which are under his examination, a form scarcely differing from the Carboniferous species, *Climacammina antiqua*. He says that the forms figured *Bigenerina patula* in his valuable monograph are only regular varieties of *Climacammina*. I am also given to understand that *Textularia* is now removed from the *Globigerinida* and put close to *Climacammina*, under the *Lituolida*, and therefore class it accordingly.

	Derbyshire.			
	Ticknall.	Bakewell.	Castleton.	North Staffordshire.
IMPERFORATA.				
Lituolida.				
Trochammina incerta	..			
Valvulina decurrens	..			
„ palæotrochus	..	..	..	
„ „ var. compressa	..			
„ Youngi	..			
„ „ var. contraria	..			
Endothyra Bowmanni	..	..	..	..
„ crassa	..			
„ globulus	..			
„ obliqua	..			
„ ornata	..			
„ radiata	..			
Textularia globulus	..			
„ eximia	..	..		..
Climacammina antiqua	..			
PERFORATA.				
Nummulinida.				
Archædiscus Karreri	..		..	

A LIST OF THE QUADRUPEDS FOUND IN THE PARISH OF BODICOTE, OXFORDSHIRE.

BY OLIVER V. APLIN.

In this list I have been able to include twenty-one species. The Badger is no longer found, but in some parts of the district around it is not unfrequently met with; on Tadmarton Heath, for instance, they are frequently taken; I have also seen the young from there, and was informed that there was a litter this season. The Black Rat (*Mus rattus*, Linn.) is also a thing of the past; an old ratcatcher, who has worked this district for many years, tells me he has never come across it. The Harvest Mouse may be found, but I have not been able to obtain satisfactory evidence of its occurrence. There is a great difficulty in examining the Bats; doubtless more species might be discovered.

ORDER CHEIROPTERA.

PLECOTUS.

Plecotus auritus, Geoffroy, (Long-eared Bat.) Fairly numerous, it inhabits roofs of houses and old buildings, in company with the common species.

SCOTOPHILUS.

Scotophilus murinus, Gray, (Common Bat or Pipistrelle.) Very numerous. I have seen them in January, in the daytime, when the weather has been mild.

Scotophilus noctula, Gray, (Great Bat or Noctule.) Not at all common. This species flies high and straight, without the butterfly twistings of the Pipistrelle. It continues out late in the season, at which time it is very fat.

ORDER INSECTIVORA.

ERINACEUS.

Erinaceus Europæus, Linn., (Hedgehog.) Plentiful. It is here killed for the sake of its fat, which is said to be a remedy for baldness.

SOREX.

Sorex araneus, Auct., (Common Shrew or Erd Mouse.) Numerous. I have once or twice observed a Shrew, which seems to be the one described by Macgillivray as *S. tetragonurus*, but I am not sure about it.

Sorex fodiens, Auct., (Water Shrew.) Mr. C. Matthew Prior informs me that he has met with this species twice, and each time in a running stream; it is very rare.

TALPA.

Talpa Europæa, Linn., (Mole.) Plentiful. Their numbers vary very much according to the seasons. Dry weather is fatal to numbers of them.

ORDER CARNIVORA.

MUSTELA.

Mustela putorius, Linn., (Polecat or Foumart.) Very rare. I have heard of only one occurrence lately. This animal is far from shy at times; I met with one whilst fishing in the Sorbrook a few years ago, which, instead of running away, sat up on its hind legs and "barked" at us. It was on the opposite side of the stream, apparently hunting for rats.

Mustela erminea, Linn., (Stoat or Ermine,) and
Mustela vulgaris, Erxleb, (Weasel,) are both common. The latter is often caught in traps set for moles.

LUTRA.

Lutra vulgaris, Erxleb, (Otter,) is still met with, but very rarely; the last was in 1875. The year before, the otter hounds carried the scent along the Sorbrook.

VULPES.

Vulpes vulgaris, Briss., (Fox.)

ORDER RODENTIA.

SCIURUS.

Sciurus vulgaris, Linn., (Common or Red Squirrel.) May often be seen, but exists in no great numbers. We have no woods. I have once or twice met with it in the middle of the village.

MYOXUS.

Myoxus avellanarius, Desmar, (Dormouse.) I believe this has occurred, but it is doubtful. It is very rare in the neighbourhood.

MUS.

Mus decumanus, Pall., (Brown or Hanoverian Rat.) Many of these go during the summer months to the streams, where they are mistaken for Voles, than which they are much more numerous.

Mus musculus, Linn., (Domestic or House Mouse.) I have met with a pied variety in the wild state.

Mus sylvaticus, Linn., (Wood Mouse or Long-tailed Field Mouse.) Very common, and found almost everywhere. I have trapped them with all kinds of bait; they even used to get into our bird-traps.

ARVICOLA.

Arvicola amphibius, Desmar, (Water Vole or Water Rat.) Common.

Arvicola agrestis, Flem., (Field Vole, Campagnol, or Short-tailed Field Mouse.) May often be met with; it is, however, far from being plentiful.

LEPUS.

Lepus timidus, Linn., (Hare,) and

Lepus cuniculus, Linn., (Rabbit,) of course depend chiefly on the amount of protection afforded them.

Bodicote, July, 1880.

MIDLAND UNION OF NATURAL HISTORY SOCIETIES.

ENTOMOLOGICAL PRIZE OFFERED BY THE PRESIDENT.

The Hon. Secretaries of the Union have issued the following notice to the various Societies in the Union:—

"The President, Sir Herewald Wake, Bart., has instructed us to announce that, at the next Annual Meeting of the Union, he will give a Prize of Books of the value of £5, for the best Original Essay on the Life History of any one Genus of Insects indigenous to the Midland Counties, written by a member of one of the Societies in the Union.

"Essays, to be eligible for 'The President's Prize,' must embody the results of original observation, and not be mere compilations. All quotations introduced into them must be clearly marked, and the authorities from whose works they are taken accurately cited, with full references to volume and page. The illustrations and diagrams, if any, need not necessarily be the works of the competitors as to drawing or colouring. Each Essay, written on small quarto paper, on one side of the paper only, must be signed by a *nom de plume*, and sent, addressed to Sir Herewald Wake, Bart., Courteen Hall, Northampton, not later than the 1st of May, 1881, accompanied by the author's real name and address, in a sealed envelope, with the *nom de plume* written on the outside.

"The Essays will be submitted for adjudication to an eminent Naturalist, chosen by the President, and his award will be made known at the next Annual Meeting of the Union.

"The President will reserve to himself the right to send the Prize Essay for publication in the 'Midland Naturalist.'"

METEOROLOGY OF THE MIDLANDS.

THE WEATHER OF JULY, 1880.

BY W. JEROME HARRISON, F.G.S.

STATION.	OBSERVER.	RAINFALL. Total for Mt.	Greatest fall in 24 hours.		No. of rainy d.	TEMPERATURE. Greatest ht.		Great'st cold	
		In.	In.	Date.		Deg	Date.	Deg	Date.
GLOUCESTERSHIRE.									
Cheltenham	R. Tyrer, Esq.	5·08	·79	14	24	74·0	15 & 25	41·2	5
Stroud	S. J Coley, Esq	4·94	·67	27	18	74·0	21 & 23	45·0	5
Adderley Rectory	Rev. A. Corbet	7·62	1·00	26	27				
SHROPSHIRE.									
Haughton Hall, Shifnal	Rev. J. Brooke	5·40	·22	6	26	74·0	23	45·0	5 & 11
Woolstaston	Rev. E. D. Carr	5·42	·63	26	24	73·5	17	45·0	31
More Rectory, Bishop's Castle	Rev. A. Male	5·29	·74	17	24	80·0	15	42·0	5
Larden Hall	Miss F. R. Boughton	5·39	·78	28	23				
Bishop's Castle	E. Griffiths, Esq.	5·13	·62	12	19	80·0	17	44·0	5
Cardington	Rev. W. Elliot	6·09	·82	6	21				
HEREFORDSHIRE.									
Stoke Bliss	Rev. G. E. Alexander	4·91	·72	26	21	72·0	6, 15, 17, (22	46·0	4 & 30
WORCESTERSHIRE.									
Orleton, Tenbury	T. H. Davis, Esq	5·08	·61	25	23	74·5	17	42·5	5
West Malvern	A. H. Hartland, Esq.	6·39	92	26	24	76·5	26	44·0	30
Pedmore	E. B. Marten, Esq.	5·72	·90	26	24	76·0	15 & 27	39·0	30
Longlands, Stourbridge	J. Jeffries, Esq	5·49	·56	6	27	76·0	15, 17, 25	46·0	4
Dennis, Stourbridge	Mr. C. Webb	5·8[illegible]	·81	15	25	75·5	17	43·0	4
Evesham	T. J. Slatter, Esq	4·89	97	14	26	75·5	23	47·0	5
STAFFORDSHIRE.									
Beacon Stoop, Weaver Hills	C. L. Wragge, F.R.G.S.	4.69	·78	17	25	65·3	23	44·6	31
Dudley	Mr. J. Fisher	5·70	·86	26	24				
Kinver	Rev. W. H. Bolton	6·09	·82	3	23	80·0	18	44·0	4
Walsall	Mr. N. E. Best	5·95	·79	3	24	75·0	25	46·0	30
Grammar School, Burton	C. U. Tripp, Esq.	5·75	·89	26	21	79·0	23	46·0	2, 5, 11
Weston-under-Lyziard R'tory	Hon.and Rev.J. Bridgeman	5·80	·66	28	27	78·0	15, 20, 23,	44·0	5 & 31
Wrottesley	E. Simpson, Esq.	4·78	·65	6	25	74·2	18 (25	43·4	5
Heath House, Cheadle	J. C. Philips, Esq	6·12	1·30	17	25	70·0	23	46·0	2, 11, 31
Farley, near Cheadle	C. L Wragge, Esq.	5·73	·92	17	26	70·5	21	45·8	21
Oakamoor	E. Kettle, Esq.	5·82	1·04	17	24	71·1	23	40·1	2
WARWICKSHIRE.									
Coventry	J. Gulson, Esq.	5·12	·78	26	25	75·0	22	48·0	Several
Coundon, Coventry	Lieut.-Col. R. Caldicott	5·73	1·04	13	23	75·0	15, 17, 23	48·0	30
Bickenhill Vicarage	J. Ward, Esq.	6·01	·97	28	20	74·0		51·0	
St. Mary's College, Oscott	Rev. S. J Whitty	4·63	59	26	24	74·0	25	46·4	5
Henley-in-Arden	T. H. G. Newton, Esq.	5·31	·30	29	23	77·0	23	45·0	5
Rugby School	Rev. T. N. Hutchinson	8·31	2·20	13	27	73·2	23	39·6	5
Snitterfield, Stratf'd-on-Avon.	J. Goodacre, Esq.	5·86	·91	14	26	76·8	25	41·6	4
DERBYSHIRE.									
LinacreReservoir, Chesterfild.	C. E. Jones, Esq.	5·27	1·10	26	24				
Spondon	J. T. Barber, Esq.	5·91	·87	26	24				
Duffield	W. Bland, Esq.	6·17	1·00	26	23				
Fernslope, Belper	F. J. Jackson, Esq.	5·31	1·10	26	26	74·0	17, 23, 25	47·0	2 & 21
Stoney Middleton	Rev. U. Smith	5·48	1·07	17	17	73·0	31	39·0	31
NOTTINGHAMSHIRE.									
Hodsock Priory, Worksop	H. Mellish, Esq.	5·27	·85	13	22	71·8	18 & 25	44·7	2
Tuxford	J. N. Dufty, Esq.	5·57	1·15	15	23	72·0	25	45·0	31
Park Hill, Nottingham	H. F. Johnson, Esq	6·12	1·26	26	26	72·7	21	48·5	30
LEICESTERSHIRE.									
Loughborough	W. Berridge, Esq.	5 38	1·09	14	20	75·6	25	47·1	10
Ashby Magna	Rev. E. Willes	5·88	1·40	14	21	86·0	25	40·0	31
Kibworth	T. Macaulay, Esq.	7·25	2·59	14	24				
Belmont Villas, Leicester	H. Billson, Esq	6·86	1·26	14	25	75·5	23	46·0	2
Town Museum, Leicester	W. J. Harrison, Esq.	6·74	1·21	15	24	73·0	23	47·0	3
Syston	J. Hames, jun., Esq	6·51	1·56	14	25	76·0	18 & 26	45·0	10
Waltham-le-Wold	E. Ball, Esq.	6·85	1·80	13	23	70·0	15	46·0	3
Coston Rectory, Melton	Rev. A. M. Rendell	6·39	1·55	14	27	71·7	23	41.3	5
Dalby Hall	Mr. G. Jones	7·05	2·21	14	26	80 0	21, 23, 25	44·0	5 & 10
Market Harborough	S. W. Cox, Esq	8·40	3·10	14	25	72·0	23 & 25	42·0	10
NORTHAMPTONSHIRE.									
Towcester Brewery	J. Webb, Esq.	5·92	1·08	14	25				
Kettering	J. Wallis, Esq.	4·95	1·09	·14	21	73·0	24	51·0	5 & 31
Althorpe	G. S. Groom, Esq	8·73	2·10	13	26	73.0	25	45·0	9
RUTLAND.									
Uppingham	Rev. G. H. Mullins	6·65	1·28	13	26	74·9	21	46·3	5 & 31
Northfields, Stamford	W. Hayes, Esq	6·18	1·66	14	23	78·0	12	40·0	11
Altarnun Vicarage	Rev. J. Power, M.A.	5·24	1·13	26	22	83·0	18	40·0	16
Oxford	E. J. Stone, Esq	6·49	1·81	15	24	71·8	26	47·0	31
Ventnor	James Collins, Esq	3·38	·65	29	17	74·8	16	50·0	4

The weather of July was in several respects remarkable. The quantity of rain which fell was unusually great, being at most stations about double what usually falls in this month; still the temperature was fairly high, and there were few days without some sunshine. Electrical disturbances were frequent and severe. Thunderstorms occurred on nine or ten days, and are described by several observers as of remarkable intensity, those on the 15th, 17th, and 30th especially. At Kibworth above two inches of rain fell in two hours on the morning of the 15th, and on the same morning, at Market Harborough, 2¾ inches fell between half-past four and nine o'clock, producing the deepest flood in the town on record. Floods occurred very generally in the middle of the month. Solar halos were seen at Stamford on 14th and Loughborough on 25th. Temperature in the sun (black bulb in vacuo) reached 135·4° at Loughborough on 3rd and 24th, 141° at Burton on 18th, and 136° at Leicester on 25th. As last year, insect life appears conspicuous by its absence.

Reviews.

The British Moss Flora. Part I. By R. BRAITHWAITE, M.D., F.L.S., &c. Published by the author, at 303, Clapham Road, London. Price 2s. 6d.

SINCE the publication of "Bryologia Britannica," in 1855, so many new species have been added to our British Moss Flora, that a want has long been felt for a reliable, well-illustrated work on this subject. Dr. Braithwaite's excellent skill as a delineator, together with his thorough knowledge of Bryology, eminently fits him for the great work he has undertaken. In Part I. of the above work we have a monograph of the Andreæaceæ, illustrated by two plates drawn from authentic specimens, giving all the details of cell structure, leaf form, habit of plant, &c., all drawn by a master hand, and with the very perfection of finish. The text consists of the preface, the families of Acrocarpous mosses, description and history of the Andreæaceæ, and terse but ample descriptions of the five species and their varieties, given in language which fully conveys to the reader a word-picture of the plant described, and is at the same time sufficiently simple to be understood by the veriest tyro in botany. A full list of the synonyms of each species is also given; and, as the synonyms of one species alone occupies nearly forty closely-printed lines, it will be seen that this important portion of the work has been thoroughly and efficiently carried out, and that the author has spared neither time nor trouble in the production of the work. The arrangement of the families and orders is principally in accordance with the recently published views of Professor Lindberg, "the most natural which has yet appeared; in this, the Cleistocarpous mosses, (Phascum, &c.,) as in Mr. Mitten's system, are regarded as imperfectly developed forms of various Stegocarpous families, with which they agree in everything but a separable operculum, and the genera are framed on a broader and more rational basis, just as our best botanists now deal with the Phænogamous plants." This work, when finished, will be the most valuable one that has yet been given on British Bryology, and we heartily wish the author leisure and health to finish his great undertaking.

J. E. BAGNALL.

Notes of Observations of Injurious Insects. Report 1879. London: W. Swan, Sonnenschein, and Allen. Price 1s.

Miss Ormerod has laid the entire nation under great obligations by her successful efforts to collect, systematise, and present in an accessible form accurate information respecting the insects which are hurtful to the human race by their depredations among field and garden crops, and to timber and fruit trees. She reports that the unusual cold of the winter 1878-9, and the depth to which the frost penetrated the ground, did not have the effect which the world at large supposes always follows severely cold weather—viz., great destruction. All observant entomologists have long been aware that a continuously severe winter is rather favourable to insects than otherwise, and Miss Ormerod fully sustains the correctness of this view. Some of the injurious lepidoptera are reported to have been excessively plentiful last year in various localities, as also the surface caterpillars. A like statement is made as to other insect pests. With the pamphlet is issued an observation sheet, in which a list of insects is given, on which observations are desired from all who are willing to help in this useful work. The list is as follows:—

Injurious to Field and Garden Crops.

1. Plusia Gamma, Silver Y Moth.
2. Otiorhynchus sulcatus, Black Weevil.
3. Sitones lineatus, Pea Weevil.
4. Agriotes lineatus, Wire-worm Beetle.
5. Tipula oleracea, Crane Fly.
6. Tipula maculosa, Spotted Crane Fly.
7. Anthomyia ceparum, Onion Fly.
8. Tephritis onopordinis, Celery Fly.
9. Psila rosæ, Carrot Fly.
10. Aphis rumicis, Bean Aphis, *Collier.*

To Cabbage and Turnips.

11. Pieris brassicæ, Cabbage Butterfly.
12. Mamestra brassicæ, Cabbage Moth.
13. Agrotis segetum, Turnip Moth.
14. Phyllotreta undulata, Turnip Fly.
15. Athalia spinarum, Turnip Sawfly.
16. Aphis rapæ, Turnip Aphis.

To Corn.

17. Cephus pygmæus, Corn Sawfly.
18. Cecidomyia tritici, Wheat Midge.
19. Chlorops tæniopus, Corn Fly.
20. Aphis granaria, Wheat Aphis.

Injurious to Timber Trees and Fruit.

21. Cossus ligniperda, Goat Moth.
22. Zeuzera æsculi, Leopard Moth.
23. Bombyx neustria, Lackey Moth.
24. Yponomeuta padellus, Small Ermine Moth.
25. Abraxas grossulariata, Magpie Moth.
26. Anthonomus pomorum, Apple Weevil.
27. Eriocampa adumbrata, Pear-tree Slug.
28. Nematus ribesii, Gooseberry Sawfly.

To Pine Trees.

29. Sirex gigas, Giant Sirex.	31. Hylobius abietis, Fir Weevil.
30. Retinia turionana, Pine-bud Tortrix.	32. Hylurgus piniperda, Pine Beetle.

The observations should be sent to Miss E. A. Ormerod, F.M.S., Dunster Lodge, near Isleworth, from whom the proper form on which to report them may be obtained on application. E. W. B.

Zoological Classification. A handy book of reference, with tables of the sub-kingdoms, classes, orders, &c., of the animal kingdom, their characters, and lists of the families and principal genera. By Francis P. Pascoe, F.L.S., &c. Second edition, with additions and a glossary. London: John Van Voorst. Price 12s.

The title of this book accurately describes its contents. It is what it purports to be, "a handy book of reference to the classification of the animal kingdom," and its aim, "to bring the contents of the various groups under the eye in the most concise and simple form," is successfully achieved. The works of Schmarda and Claus have been made abundant use of, embodying, as they do, the most recent views of German Naturalists. An excellent glossary distinctively adds to the value of the book, and, though the definitions are brief, they are terse and clear. The index, too, is a most useful one; so far as we have tested, it is full and accurate. It gives us great pleasure to commend this book most warmly; it deserves a place in every Naturalist's library. E. W. B.

Santorin et ses Eruptions. Par Fouque. Paris, G. Masson, 1879. Price 72s., 438pp., and sixty-one large plates, 4to.

In this splendid work Professor Fouqué gives an excellent account of modern volcanic action as exhibited in the island, or rather group of islands, called Santorin, in the Grecian Archipelago. The appearances presented by Santorin are precisely those which would be seen if Vesuvius were sunk below the sea till only the central cone and the rim of the old crater (Monte Somma) stood above the water. The eruptions at Santorin are now confined to the central cone, which stands on an island in the centre of a great circular bay, whose vertical cliffs show magnificent sections of ash beds and lava flows. The illustrations of this work are very fine, and give a graphic idea of the scenery and geology of the district. Professor Fouqué has given great attention to the microscopical examination of the rocks, and his observations and beautiful drawings of magnified rock-sections will be of great value to all students of igneous rocks. W. J. H.

Tenth Annual Report of the Wellington College Natural Science Society, 1879.

This volume contains a great amount of valuable and interesting matter, and reflects very much credit on the members of the above Society. It is very pleasing to see Natural History studies receiving so much encouragement in an important educational institute. Besides a very fair *resumé* of the lectures delivered at the open meetings, an account is also given of the places visited and the work done on the field days. Full lists of the Flora and Entomology of the district are also given, with an excellent map of the district, which enables the reader to see at once the whereabouts of any of the rarer species. There is also a list of the Fossils of the district properly and systematically arranged, a useful Meteorological report, a very able Zoological Report, and lastly an Ethnological Report. All these bear the marks of able work and able workers, and give satisfactory evidence of true zeal and patient industry on the part of the members of the Wellington College Natural Science Society. We wish them good speed. J. E. B.

Correspondence.

NOTES FROM WALES.—On a walk in Wales during the month of June, I found *Vicia Orobus*, the Wood Bitter Vetch, near Dolgelly. It was new to me. I also observed the Green Sandpiper, the Gray Wagtail, and the Pied Flycatcher in the same district.—O. M. F., Frankton.

ANCIENT ROMAN PAVEMENT IN WOODCHESTER CHURCHYARD.—This interesting pavement is figured only in part in the drawings in Mr. Lysons' book on the Roman Villa, published in 1797. It having recently been re-opened, it would be a subject for regret that it should be again covered up without a correct copy having been made of it. A coloured drawing has been made from careful studies on the spot, which faithfully represents the whole of the pavement as it is at the present time. This drawing will be eighteen inches square, the same size as Plate X. in Lysons'. It will be sold, with a letter-press description, at 1s. 6d. per copy, and is expected to be ready September 1st. As the cost of printing will be considerable, it is requested that all interested in the subject will help by ordering one or more copies. Post Office orders on Nailsworth, payable to Chas. Playne, or stamps, are requested in payment.—CHARLES PLAYNE, Nailsworth, Stroud.

CENTUNCULUS MINIMUS (L.) IN WARWICKSHIRE.—The first record I find of the occurrence of this plant in Warwickshire is a M.S. note in a copy I have of "The Botanist's Guide," 1805, from which I quote the following:—"*Centunculus minimus*. Bull's Field, and near Moor Hall, Sutton Coldfield. J. P., Cottage, Atherstone." The volumes formerly belonged to a Mr. Power, who was, I am told, a professor at Cambridge. The second record is from Oversley Wood, near Alcester, where it was found by Mr. J. T. Slatter, during a visit we made to that locality, August, 1878. At that time I was unaware of Mr. Power's previous discovery, and, therefore, credited Mr. Slatter with being the first recorder of this plant in Warwickshire. During the present month (August) I have had the pleasure of finding it abundant in a wood near Combe Abbey, Coventry. In both Oversley Wood and in Combe Abbey Wood the plant occurs in damp, sandy, neglected drives; and it will, probably, be found far more frequent than it is commonly supposed to be, if such habitats are keenly searched. I may mention that its associates in both the above localities are *Peplis Portula* and *Sagina apetala*.—J. E. BAGNALL.

Phenological Observations.—It is necessary to remind some of the contributors of these that the record of an observation is worse than useless, unless the species to which it refers is unmistakable. To identify a species with certainty, the *scientific name* must be given accurately. The English names may be added or not, at pleasure; but those who are aware how loosely many of these are used will be chary of employing them, except when they are very well known. Another point is worthy of attention: When we read "*Rosa canina* flowered" on a certain date, we wonder which of the numerous varieties is meant. It is obvious that any difference which may very possibly exist between the times of appearance of these varieties will be obscured by such a record. On the other hand, no one who has not specially studied these varieties could venture to indicate which particular form he has observed.—Eds. M. N.

Botanical Notes from South Beds.—Earliest Observed Dates of Flowering in 1880:—

Name.	Date.	Aspect.	Situation, &c.
Triglochin palustre	June 2nd.	Open.	Boggy soil.
Orchis pyramidalis	,, 26th.	N.W.	Chiltern Hills, on chalk.
Campanulata glomerata..	,, 26th.	N.W.	Chiltern Hills, on chalk.
Œnanthe fistulosa	,, 27th.	Open.	Marshy meadow.
Scabiosa succisa	,, 27th.	Open.	Marshy meadow.
Potentilla Comarum	July 3rd.	Open.	Marsh.
Carduus palustris........	,, 3rd.	Open.	Marsh.
Carduus arvensis	,, 5th.	Open.	Waste ground.
Jasione montana	,, 3rd.	W.	Sandy soil.
Galeopsis Tetrahit	,, 4th.	S.	Hedge bank.
Hypericum perforatum ..	,, 12th.	W.	Hedge bank.
Verbascum nigrum	,, 12th.	W.	Railway cutting.
Galium palustre	,, 5th.	Open.	Bog.
Galium uliginosum	,, 12th.	Open.	Bog.
Senecio aquaticus........	,, 12th.	Open.	Bog.
Tilia europæa	,, 11th.	Open.	
Erythræa Centaurea	,, 15th.	W.	Riding of a wood.
Alisma Plantago	,, 15th.	Open.	Still water.
Epilobium hirsutum	,, 15th.	Open.	Side of a brook.
Eupatorium cannabinum	,, 15th.	Open.	Side of a brook.
Campanula rotundifolia ..	,, 15th.	W.	Bank.
Campanula latifolia......	,, 15th.	W.	Edge of coppice.
Origanum vulgare........	,, 15th.	W.	Edge of coppice.
Artemisia vulgaris	,, 17th.	Open.	Waste ground.
Chlora perfoliata	,, 15th.	W.	Chalk hills.
Clematis vitalba	,, 24th.	Open.	Hedge.
Hyoscyamus niger	,, 24th.	W.	Waste ground.
Gentiana Amarella	August 4th.	N.E.	Chiltern Hills, on the lower chalk escarpment.
Parnassia palustris	,, 2nd.	N.E.	
Pimpinella saxifraga	,, 2nd.	N.E.	

Latest observed dates of flowering:

Pyrola minor............	July 19th.		Wood.
Ophrys apifera	,, 20th.	S.	Chalk hill.
Gymnadenia conopsea ..	August 5th.	N.W.	Lower chalk escarpment
Orchis ustulata..........	,, 5th.	N.W.	Lower chalk escarpment
Listera ovata............	,, 5th.	N.W.	Under trees.
Sanicula europæa	,, 15th.	S.	Coppice.

J. S., Luton.

Phenological Observation.—On July 30th, in a garden in Upper Mary Street, Balsall Heath, Birmingham, I saw an apple tree with several bunches of flowers out in full bloom, the tree being covered at the same time with apples of a good size. Is this a common occurrence?—J.M.

[In wet summers such as the present the abnormal production of flowers on fruit trees and other plants is very common. We were in a garden ten days ago, (August 20th,) where we saw two pear trees in bloom, an apple tree bearing fruit and flowers, also the male aucuba, several kinds of spring-blooming primulas, auriculas, &c., in full bloom. —Eds. M. N.]

Botanical, &c., Memoranda from the Cotswolds.—Thinking the record of some plants seen during a walk over the Cotswolds (or that part of them called Leckhampton Hill) during the month of August, 1879, would prove interesting to Midland botanists, I have written the following notes. Climbing over most of the hedges may be found two plants scarce in some districts, (particularly the one in which I had been botanising for the past two years, South Herefordshire,) *Clematis vitalba* and *Bryonia dioica*. Crossing a field, in which properly speaking I had no right, I found *Chlora perfoliata* and the lovely *Ophrys apifera*. The commensalism existing between these two plants was apparent here, and I had also noticed it in my last botanical district. Among the rocky débris *Echium vulgare* was found plentifully; and, expanding its limp, yellow corollas in the warm sunshine, *Helianthemum vulgare*. A little further on I gathered some fine heads of *Anthyllis vulneraria*. On the top I found *Scabiosa Columbaria*, *Orchis pyramidalis*, *Campanula rapunculus*, and the lovely *Gentiana Amarella*. On Cleeve Hill I have found what I take to be *Ophrys aranifera*. In a fir wood on the side of Leckhampton Hill were some fine specimens of *Epipactis latifolia;* at the foot *Centaurea Scabiosa*. I may add, for the benefit of Midland conchologists, that *Helix pomatia* was plentiful on the stone walls at the foot of Leckhampton Hill.—George T. Harris.

The Mammoth.—A few weeks ago, some workmen engaged at the ballast pit at Helpston, near Melton Mowbray, Leicestershire, belonging to the Midland Railway Company, dug out a fine tusk of the Mammoth. The tusk was 5ft. 6in. long and 12½in. in diameter, and was found lying on the shales of the neighbourhood, and beneath sixteen feet of drift. It is now in the possession of the engineers' department at Derby Station.—Another tusk of this gigantic elephant is stated to have been found since the one just described, embedded in the clay that forms the beach at Herne Bay. It was discovered by some fishermen at low tide, and was found to be nearly 8ft. in length and 20in. in circumference.—J. Shipman, Nottingham.

[I saw the Helpston tusk, and endeavoured, but without success, to obtain it for the Leicester Museum. The place at which it was found—Helpston—is in Northamptonshire, half way between Stamford and Peterborough. The pit is being worked for sand and gravel, and the tusk was at the base, resting on oolitic strata. The specimen was very perfect, and showed the double curvature extremely well; it was very narrow, compared with its length, and I fancy the amount named—12½ inches—must be the *circumference* and not the diameter.—W.J.H.]

Note on the Young of the Swift.—On the 28th of last month, a boy brought me two young Swifts, which he had taken from the roof of a house. They were full fledged but quite unable to fly; however, I found they could crawl about and climb a little, using the tail as a support. When crawling, their legs seemed incapable of supporting them, so that they could only push themselves along on their breasts. During the night they were restless and noisy, and at times uttered a faint squeak. I fed them with raw meat, egg, and bread. When the food was offered them they took no notice, but, on having it put into their mouths, they swallowed it greedily. They showed their hunger by shuffling about and flapping their wings. After food I fancy they slept. Occasionally a whirring noise was produced by rapidly shaking the feathers of the wing. On the 30th one of them flew across the room on being thrown up; and on the evening of the 31st it raised itself and flew round once. I then caught it, when it screamed almost like the old ones. I took them out on to the lawn and threw them up; one went off immediately, flying round low down at first; the other fell once, but went off well the next time, and I saw them no more. Thus, in three days from being almost helpless, they were able to fly strongly and well. —Oliver V. Aplin, Bodicote, Oxon, August 10th, 1880.

A Dog's Hundred Mile Journey.—A correspondent sends the following anecdote:—A Mr. Donovan, of Richmond Street, Toronto, recently forwarded by rail to a friend living a hundred miles away north, a valuable dog. On its arrival it was kept chained up until it was thought to be thoroughly familiar with the place and people. On being released from its fastening, the dog made for the road, and was seen no more in that section of the country. The disappointed owner made Mr. Donovan acquainted with the fact, and the dog was supposed to be lost. One week after the receipt of the letter conveying the news, the dog made his appearance in front of Mr. Donovan's house, and his delight on gaining his old familiar quarters knew no bounds. The wanderer had never been out of the city before, and, as his journey northward was made by rail, it is a matter of wonder how he ever found his way back.

New Meteorological Station.—By the kind permission of Colonel Bromley Davenport, to whom my best acknowledgments are due, I established, on July 1st, under the auspices of the Meteorological Society, a meteorological and climatological station on the top of Beacon Stoop, Weaver Hills, 1,205ft. above mean sea level, and the highest point in Staffordshire. This new station is chiefly for investigating the increase of temperature, in some cases with altitude; and for elucidating the peculiarities of climate existing at and between hill and valley stations. Hence it "works with" the climatological readings and observations at my meteorological observatory at Farley, 643ft. above the sea, from which it is distant two miles north-east, and with my climatological station at Oakamoor, in the Churnet Valley, 350ft. above sea level, and barely a mile west by north from Farley. The elements of observation on Beacon Stoop are, of course, exactly similar to those of the same set at Farley and Oakamoor, and comprise the maximum and minimum temperatures by self-registering instruments, and hygrometrical readings from dry and wet bulb thermometers, just received, verified from Kew, and exposed in Stevenson's screen 4ft. above the grass; also rainfall, earth temperature from surface to 2ft., wind, cloud, hydrometeors, and ozone. I am working Farley and Beacon Stoop with my assistant, and therefore we take turns in walking to the Weaver Hills for nine A.M. daily observations, (local time,) in rough weather an arduous undertaking. The climatological values on Beacon Stoop, at Farley, and Oakamoor, are taken at the same instant, and the plan of exposure at each place is precisely the same. Mr. E. Kettle, the station-master, is my observer at the latter place, and for his kind co-operation I have also to express my best acknowledgments. The temperature of the Churnet is taken at nine A.M., and that of the rivulets (tributaries of the Churnet) between Farley and the Weaver Hills is "meaned" to nine A.M., taken at fixed times on the way to the hill station, and again on the return journey. Thus is ensured, if only for a few months, I venture to think, a perfect system of climatological observation of the highest interest from a scientific, sanitary, and practical point of view; and especially as regards rainfall, earth and air temperature, and hygrometrical conditions, will the farmer, by publication of reports and synopses, be benefited. The values of atmospheric pressure taken from the barometer at Farley are duly considered; and observations of the sun are also made in connection with the climatological readings. The results already obtained are of considerable value.—Clement L. Wragge.

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—General Meeting.—August 3rd. Mr. T. Bolton exhibited *Argulus foliaceus*, living specimens from Kingswood; medusal gonophores of marine Hydrozoa, and zoea stage of larval shore crabs, (*Nymphon gracilis*,) from Aston Aquarium. Mr. J. E. Bagnall exhibited *Campanula patula*, from Shustoke; *Catabrosa aquatica*, from Mancetter; section of stigma of *Mimulus luteus*, to show pollen tubes, also the mixture of pollen on same stigma, the stigma having been dusted with the pollen of Œnothera, Mimulus, and Tropæolum. Mr. W. H. Wilkinson exhibited *Corydalis claviculata*, from the Lickey Hills. Mr. J. H. Pumphrey exhibited *Genista tinctoria* and *Hypericum Androsæmum*, from near King's Norton. August 10th.—This meeting was made special for the election of trustees. August 17th.—Mr. Bagnall exhibited for the Rev. W. H. Painter, *Dianthus cæsius*, from Cheddar; and *Trinia vulgaris*, from Clifton; for the Rev. J. Caswell, of Oscott, *Habenaria bifolia*, *Ophrys mucsifera*, and *Monotropa Hypopitys*; for Mr. Harris, of Atherstone, *Atropa Belladonna*, from Oldbury, Warwickshire; and *Ceterach officinarum*, from near Atherstone; and, to illustrate Dr. Braithwaite's second part of the British Moss Flora, he exhibited *Buxbaumia indusiata*, very rare; *B. aphylla*, very rare; *Georgia pellucida*, local, in fruit; and *G. Brownii*, very rare. Mr. Bagnall exhibited on his own behalf, *Centunculus minimus*, (a note on which will be found at page 228,) very rare in Warwickshire; *Sagina apetala*, *Arundo Epigejos*, and *Mentha arvensis*, all from near Combe Abbey; and *Rubus foliosus*, a rare bramble, at present only recorded from Devonshire and Warwickshire; and *Spergularia rubra*, both from Hartshill. Mr. Wright Wilson exhibited six Ligules, or immature tape-worms, which were found in three small roach, (*Cyprinus rutilus*,) brought to him for examination by a local Naturalist. They were all alive, although the fishes had been dead many hours.

DUDLEY AND MIDLAND GEOLOGICAL SOCIETY AND FIELD CLUB.—The fourth field meeting of this season was held on Wednesday, the 28th July, at Church Stretton, for the purpose of examining the Cambrian rocks, which are so well developed in this typical district. The party numbered upwards of thirty, including Mr. A. Freer (president) and many ladies. The weather was very unsettled, and prevented the whole of the programme from being carried out. On arriving at Church Stretton, the party walked up the Carding Mill and Light Spout Valleys to the pretty little waterfall, and in the course of the walk observed the remarkable manner in which the rocks are tilted up, almost perpendicularly, and in some places strangely contorted. It was stated that these beds attain here a thickness of 26,000ft., consisting of slates, schistose flags, and grits; and they are remarkable as containing the earliest evidences of animal life known in this country, consisting of the burrows of marine worms, (Arenicolites,) thus showing that these were littoral deposits. The vast length of time it must have taken for the deposition of beds of this enormous thickness, (nearly equal to the loftiest Himalayas,) and the regular depression of the land surface during that long period, are subjects of great geological interest and importance. The party ascended to the pole at the top of the hill, (1,674ft. above the sea,) and were just able to get a brief glimpse of the surrounding country, with its numerous hills, when the rain came on and necessitated a hasty retreat to the shelter of the hotel, where an acceptable dinner was provided, after which the party returned home.

Plate VIII

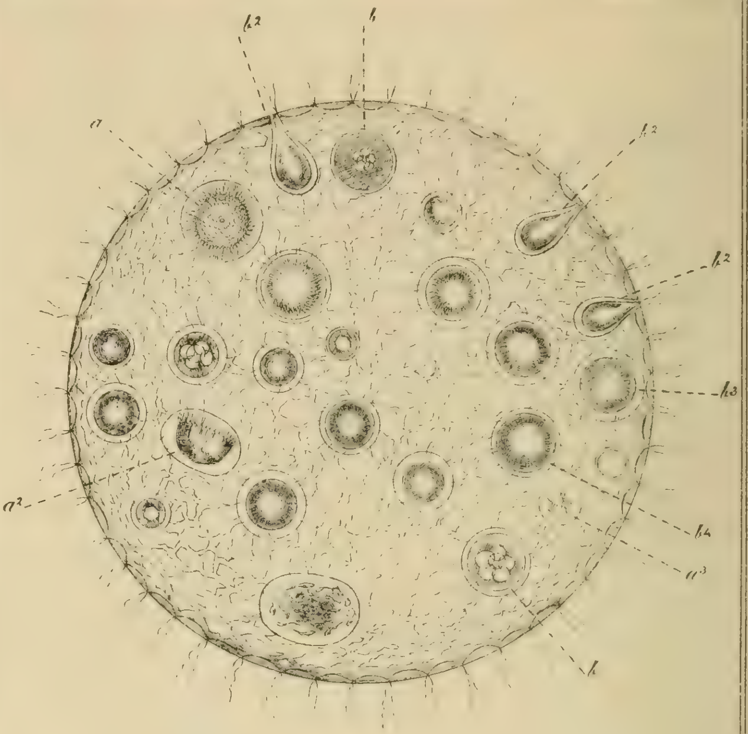


Fig. 1.

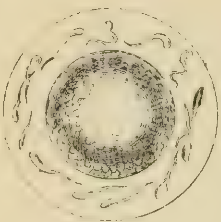


Fig. 3.

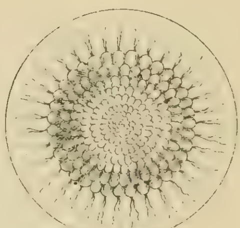


Fig. 2.

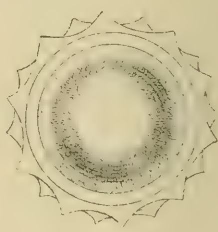


Fig. 4.

Fig. 5.

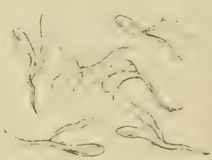


Fig. 6

O.W. Wells del.

Whiteman & Bass, Phot.-Litho London

ON THE STRUCTURE AND LIFE-HISTORY OF VOLVOX GLOBATOR.

BY A. W. WILLS, F.C.S.

(Continued from page 214.)

We must now revert to the minute structure of the mature parent-sphere, which has been exhaustively studied by Cohn, Busk, and Williamson.

In the outset it should be stated that the last-named observer believes that there are two distinct forms of Volvox, in one of which the peculiar structure which I am about to describe exists, while it is absent from the other. Busk disputed the the accuracy of Williamson's observations on this point, but, in an appendix published subsequent to the body of his essay, he states that he has detected this same structure in specimens from Manchester, but *not* in his own.

I have failed to develop it by the means recommended by Williamson, but have succeeded in making it evident enough in a great number of specimens from Sutton, by the use of other re-agents, and especially by the application of aniline purple, an invaluable auxiliary in the examination of minute vegetable cell-structures.

This substance stains the protoplasmic elements of such structures to a colour which appears deep purple by direct light, and crimson by dark back-ground illumination, and reveals details which are wholly invisible without its use.

The colour is, however, greedily absorbed by some of the materials used by the microscopist, so that a judicious choice of these is necessary to ensure success. Objects stained in this manner are, for instance, rapidly bleached if mounted in gold size cells, and I have for the present adopted zinc-white in its place. Among other re-agents which I have used are eosin, iodine, iodised glycerine, carmine solution, potassium permanganate, nitrate of silver, and other salts, some of which bring into view various parts of the minute structure of plants; but aniline colours, applied with due precautions, produce the most rapid and striking effect.

References to Plate VIII.

[The figures in this plate are drawn from a paper by A. W. Bennett, Popular Science Review, July, 1878.]

Fig. 1.—Monœcious Colony of Volvox. showing *a*, *a*2, Antheridia; *a*3, Antherozoids; *b*,*b*2, Gynogonidia; *b*3, *b*4, Oospheres.

Fig. 2.—Complete Antheridium.

Fig. 3.—Oosphere penetrated by Antherozoids.

Fig. 4.—Fertilised Oo-sphere, or Oo-spore.

Figs. 5, 6.—Antherozoids.

Professor Williamson describes the structure in question as a network of lines dividing the whole surface into hexagons, in the centre of each of which is seated one of the gonidia.

The delicate "protoplasm-threads" proceeding from each of these to its six surrounding neighbours never pass through the angles of the hexagons, but always through the side of each hexagon to the next gonidium. (Plate VII., Figs. 1, 3.) Hence it appears that "the points of adhesion are chosen prior to the development of the outer cell-membrane," in which light Williamson regards the hexagonal division. In his specimens this structure was developed by immersion in glycerine for some time. I have failed to obtain more than the faintest suggestion of it by these means, but it is often brought out by the application of aniline purple, as is also an important detail shown in drawings made from his preparations, viz., that at the angles of the contiguous hexagons there is sometimes a distinct doubling or separation of the lines, whence he concludes that each side of the figure is really formed by two delicate cell-walls in close juxtaposition, the duality of which is only made evident by the action of re-agents. (Plate VII., Fig. 2.) He regards the globe of Volvox as a "hollow vesicle, the walls of which consist of numerous angular cells, filled with green endochrome, &c., the intercellular spaces being more or less transparent," and the ciliated zoospore as representing the endochrome of a cell having two walls, the *internal* one being separated from the outer cell-wall, except at a few points where it is retained in contact by the connecting filaments, and the *external* one forming the hexagonal divisions on the surface. He further holds that the periphery of the sphere, when seen in section, has an appreciable thickness, its inner margin being definite and parallel to the outer one; and that the sides of the hexagons being continued downwards through the thickness of the outer membrane, the appearance of all these structures, if they could be seen simultaneously, would be that shown in Plate VII., Fig. 5.

Even in deeply-stained specimens I have never been able to detect the existence of these hexagons as other than an entirely *superficial* structure, and at present my impression is that the hexagonal structure has a different significance.

In the very early stage of Volvox-life, the embryo gonidia are encased in a distinct transparent outer-sphere. (Plate VII., Figs. 4*e* and 6.) At a later period, owing to the more rapid growth of the gonidia than of the case, the latter closely invests the former, which are, in fact, embedded in it. In the next stage, if not in the earlier condition, by the continued growth of the gonidia at a *greater rate* than that of the containing sphere, they are so closely appressed as to assume the hexagonal form, and the interstices must, of necessity, consist of a thin film of the substance of the containing spherical envelope, moulded, so to speak, into corresponding forms. But now the diameter of the young Volvox, which is, by this time, sent forth on its independent career, rapidly increases, the gonidia assuming their spherical or pyriform shape, as their mutual pressure diminishes, and being hourly separated by greater intervals. If now the actual formative matter of the sphere receives no further, or only a disproportionate increment, but is gradually attenuated by continued expansion, as a soap bubble is distended by blowing into it, the hexagonal lines into which it has been moulded by the previous mutual pressure of the embryo gonidia will be gradually stretched in all directions into finer proportions; and just as this figure is that which is *necessarily assumed* by a number of spherical bodies under mutual pressure, *so* the most economical disposition of this particular part of the Volvox-structure will necessitate its constant attenuation into hexagons of ever-increasing delicacy. (Plate VII., Figs. 1, 3, 7.) If the process be continued long enough, it may finally result in the structure becoming too filmy to be detected by any microscopical observation; and it is worth noticing that it is usually in spheres of small or medium diameter that the hexagonal divisions can be developed, and not in those of the largest size. Such appears to me at present to be the rationale of the formation of this structure.

The internal cavity of the sphere is said to be filled with a "mucilaginous fluid." If a Volvox be ruptured under a cover-glass, and aniline purple introduced by capillary attraction, the colour seems to be for awhile repelled at that part which is in front of the rupture, and to flow round it on either side. It is only after a considerable time that it gradually penetrates this space, and brings out, by staining it of a deep purple tint, a mass of hazy matter, from which proceeds streaks or lines, radiating more or less regularly from its south pole. (Plate VII., Fig. 6.) This structure, to which I do not think attention has been hitherto called, is also sometimes developed in deeply-stained specimens within the slightly ruptured sphere, and seems to show that there is a denser layer of thick matter, whatever its nature may be, disposed in a somewhat regular manner, being concentrated near the south pole of the axis of rotation, whence it spreads over the inner surface in streaks resembling the lines of longitude on a terrestrial globe.

Both from its position and from the rapidity with which it is stained by aniline purple—without which its existence is apparently absolutely undemonstrable—(in which respect it is in marked contrast to the outer cell-wall, which latter is only faintly tinted by somewhat prolonged application of the re-agent, and then only where the hexagonal structure exists,) I have no doubt that this inner layer is the true "primordial utricle" of the cell, and possesses that character of vital and formative matter which distinguishes this element of cell-structure from the outer wall, which, on the other hand, probably consists of cellulose or some similar compound. Probably the arrangement of this inner layer in radiating lines or ribs contributes to the elasticity of the fabric, whereby it it enabled to open at a given point for the escape of the young, and to contract again after their emission.

The increase of individuals by the means already described is strictly an instance of subdivision.

But Volvox Globator also affords an instance of true alternation of generations. As may probably be affirmed of all living organisms, its life-history would be incomplete without a process of sexual reproduction, and accordingly, after a long sequence of asexual generations, a strictly sexual process intervenes, from which result certain spores destined to lie dormant for awhile, and, like the zygospores of the Conjugate Algæ, to resist vicissitudes of condition and climate through the rigours of winter, and then to reproduce the parent-form in the succeeding year, when external conditions again favour its development.

Cohn first fully traced the various stages of this process, and described them in the " Beiträge zur Biologie der Pflanzen," 1875, Vol. I., Heft 3, and in the " Annales des Sciences Naturelles," 4 ième Ser. Bot; Tom. V. 323; and his observations have been more or less confirmed by other investigators, especially by Carter, Ann. Nat. His., 3rd Ser., Vol. III., 1859, p. 1, and more recently, in 1877, by a French botanist, M. F. Henneguay.

Cohn and Carter both hold that there are two varieties of Volvox, one monœcious, the other diœcious, and the latter maintains that Sphærosira Volvox is the male form of the diœcious sub-species. Be this as it may, the reproductive process in the monœcious form is as follows:—The sexual reproductive cells, male and female, occur in spheres of unusual size in the autumn, and are few in proportion to the number of sterile cells, and the reproductive process does not occur simultaneously with, but as a climax to a long series of asexual generations. On their first appearance the gynogonidia or female cells are about three times the size of the sterile ones, of a deep green colour, and of a frothy consistency from abundance of vacuoles; they are easily distinguished from the parthenogonidia by their never subdividing. (Plate VIII., Fig. 1*b*.) They next become flask-shaped, their narrow end touching the periphery of the sphere, and the broader end hanging free in the internal cavity. (Plate VIII., Fig. 1, *b*2.) Finally they assume a spherical form, and become oo-spheres, each enveloped in a gelatinous membrane. (Plate VIII., Fig. 1, *b*3, *b*4.)

The androgonidia or male cells at first closely resemble the parthenogonidia, but, undergoing division in two instead of three directions, develop into *plates or discs of cells*, *not* into spheres, and ultimately resolve themselves into bundles of naked elongated cells, in which the chlorophyll is transformed into a reddish pigment, each with a long colourless beak, with a red " eye-spot" and two cilia. (Plate VIII, Fig. 1, *a*, *a*2.) About the same time that the oo-sphere is mature these antheridia begin to move from the combined action of their cilia, (Plate VIII., Fig. 2,) and then break up into separate antherozoids, which finally become free and move rapidly within the cavity of the sphere. (Plate VIII., Fig. 1, *a*3.) Assembling round the oo-spheres, they penetrate the envelopes of the latter, (Plate VIII., Fig. 3,) coalesce with their contents, and the *oo-sphere* thus fertilised becomes an *oo-spore*, which soon develops a cell-wall covered with conical stellate projections, and a second smooth internal membrane. (Plate VIII., Fig. 4.) The chlorophyll now gradually disappears, and is replaced by an orange red pigment. In this condition the oo-spore constitutes the *Volvox stellatus* of Ehrenberg. It is liberated by the decay of the parent-cell, and sinks to the bottom of the water to hibernate. The subsequent history of these bodies has been traced by Cienkowski, and more recently by Henneguay, ("Journal de Micrographie," Vol. II., p. 485, Bull. Soc. Philomath, Paris, July, 1878.)

Cohn believed that they must be dried up before germination was possible. Henneguay has now observed that this is not so. In spring the outer case of the spore (exospore) is ruptured, and the swollen contents (endospore) project through the opening. The contents then divide gradually into two, four, eight, sixteen, or more small cells, which become bright green, each meanwhile acquiring two vibratile cilia while still contained within the inner membrane of the spore. The cells, at first in close apposition, separate further from one another by interposition of gelatinous hyaline matter, the outer membrane disappears, the cilia become active, and the young Volvox, already containing some elements larger than the others and destined, in due course, to produce daughter-spheres, moves freely through the water. "The spores of Volvox, therefore, germinate in water, and each of them produces a single colony by a process of segmentation identical with that which gives rise to a daughter-colony at the expense of a cell of the mother-colony."

The sequence of asexual generations is repeated for many months, and in the following autumn the alternation of generations is again completed by the intervention of the processes just described.

There are other phenomena of more or less exceptional occurrence and of lesser interest in the history of Volvox, to which I might allude did space permit, but those which I have traced constitute the essential elements in the structure and life-history of this singularly beautiful and interesting plant. I trust that I have succeeded in presenting to my fellow-students a somewhat more complete and life-like account of them than is accessible in ordinary text-books, and in showing how amply this organism will repay careful and systematic observation.

ORIGIN OF THE ROCKS AND SCENERY OF NORTH WALES.

BY J. J. HARRIS TEALL, M.A., F.G.S., ETC., LATE FELLOW OF ST. JOHN'S COLLEGE, CAMBRIDGE.

(Continued from page 219.)

Having discussed the origin of the more important varieties of Welsh rocks, I will now give a brief sketch of their distribution over the surface of the country, of their order of arrangement, and of the order of their formation. The facts I am now going to communicate are taken almost entirely from Vol. III of the Survey Memoirs, and from the Survey maps. Although the work recorded in these publications will have to be remodelled, and in many important particulars entirely recast, yet it will always command the greatest respect of all geologists.

The order of succession in its main features had, however, been determined by Sedgwick before the surveyors examined the district. He found that the conglomerate beds and banded slates of Llyn Padarn are inferior to the purple slates of the Llanberis and Penrhyn quarries, and that these again underlie the great mass of felspathic rocks of which the Snowdon group is composed. That this succession is correct, any visitor to the beautiful district of Llanberis may verify in a few hours by first working along the northern shores of the lake, from the quartz felsite to the purple slates of Yr-Alt-Wen, and then by crossing the stream joining the two lakes by the bridge, and continuing the section up the pass of Llanberis, casting a glance now and then to the heights of Derwyn and Yr Tryfan on the right, to keep the eye familiar with the general dip of the beds. Sedgwick, however, did more than this. He examined the rocks on the south-east of Snowdon, and proved that the average dip was exactly opposite to that on the north-west; that Snowdon, in fact, like many other mountains, forms the centre of a great synclinal trough.

The Survey verified Sedgwick's conclusions, and also mapped the district, so that the exact distribution of every important rock is represented on their maps. By comparing the dip of the beds with their surface distribution they have succeeded in constructing sections along certain lines which represent the arrangement of rocks beneath the surface.

An examination of these maps and sections shows at once that the prevalent trend of the various beds of rock is N.E. and S.W.; that this trend is determined by the folding of the beds along axes running in the same direction; that the most important of the foldings in the district we are considering is the synclinal which runs from Moel Hebog through Snowdon to Carnedd Llewellyn and Carnedd Davyd; and that this great synclinal is not simple in structure, but contains in itself, so to speak, a number of minor anticlinal and synclinal folds, examples of which may be actually seen in the almost vertical cliffs of Lliwedd, and inferred from the peculiar oval outcrop of certain well marked beds of igneous rock in the valley above Capel Curig, and in the neighbourhood of Llyn Ogwen.

The courses of all the more important faults are also indicated on these maps, and the actual extent of the disturbances, amounting in some instances to thousands of feet, are shown in the sections.

The structure of the district, as thus determined, enables us to trace the history of events in North Wales. Within the last two or three years some most important additions to the early history of North Wales have been made by Profs. Hughes and Bonney and by Dr. Hicks. The Geological Surveyors believed that there was no satisfactory evidence of any rock older than the conglomerate, described at the commencement of this paper. This opinion you will find recorded in the maps and publications of the Survey, and it has been again reiterated by Prof. Ramsay in his most philosophical book on the Physical Geology and Geography of Great Britain, published only last year. Thus on page 67, speaking of the conglomerate, he says:—"The country from which these pebbles were derived must indeed have physically resembled North Wales of the present day, but, except these pebbles, no trace of that land remains in or near North Wales." And again on page 59, "No visible trace remains of this more ancient physical geography, except the pebbles in the conglomerate."

This view has now been proved erroneous. There can be no doubt that we have in North Wales actual fragments of an old Cambrian land surface composed of Pre-Cambrian rocks. On the Survey map these rocks are represented by a deep red* colour, indicating an intrusive rock. One district extends from Llanllyfin to St. Ann's Chapel, the other from Caernarvon to Bangor; both are narrow in comparison with their length, the direction of the longer axis being N. E. and S. W.

Now, embraced within this region we have rocks of the most variable character. In the Llanberis neighbourhood they are quartz-felsites, and Professor Bonney has shown them to consist of old lava flows. This rock has been already described.† At Caernarvon two varieties are known, one a good unmistakeable conglomerate, which the veriest tyro in geology would recognise in a moment, and the other a crystalline rock composed of quartz and felspar, which might easily be mistaken for an intrusive rock, but which is probably metamorphic.

At Bangor another and undoubtedly bedded rock, of a fine compact texture, and greenish-grey colour may be observed. Other varieties occur in the areas coloured red on the map, but these are perhaps the most abundant, at any rate I quote them as having come under my own notice.

When the arrangement of these rocks is examined, most decided traces of stratification may in many cases be made out; thus, to quote instances from a paper by Dr. Hicks, in the "Q. J. G. S.," Vol. XXIV., page 149:—"About Pen-y-groes there are good indications of lamination and bedding, and the rocks are composed of ashy materials subsequently altered. A little further east bedding was clearly seen, the dip being to the N.W. at an angle of 75°."

The same general fact has been established by Prof. Hughes with regard to the rocks in the Caernarvon and Bangor area. Thus, "Q. J. G. S.," Vol. XXXIV., page 140, he says:—"Under the grit and conglomerates which seem to form everywhere the basement bed of the Cambrian, we have a series of stratified rocks, many of which are of a very marked character, easy to identify and trace, others variable and not very characteristic." Then follows a detailed account of these rocks in the neighbourhood of Bangor. Speaking of their origin, he says:— "The series can be matched almost bed for bed among the green slates and porphyries of the Lake district, and like these may be referred to an original volcanic action, and some subsequent metamorphism."

*It must not be supposed that all the rocks represented by this colour are Pre-Cambrian.

†Prof. Hughes holds the opinion that this conglomerate is of Cambrian age, and that it is brought against the Pre-Cambrian granitoid rock by means of a fault.

Many of the rocks show a brecciated character, and Prof. Hughes regards them as consisting of volcanic agglomerates and ashes.

The full working out of these Pre-Cambrian rocks will require much labour and perseverance. At present, however, we may make the following statements with regard to them. The areas coloured as intrusive rocks on the Survey maps in the county of Caernarvon consist largely of stratified formations, partly of aqueous and partly of volcanic origin. The volcanic rocks are partly of the nature of ashes and agglomerates, as determined by Prof. Hughes in the Bangor area, and partly true lava flows, as determined by Prof. Bonney for the Llyn Padarn district.

The Cambrian conglomerate, hitherto regarded as the oldest rock in North Wales, was formed along the shore line of a land surface composed of these older foundations. This is proved by the occurrence of fragments of the older rocks, as pebbles in the Cambrian conglomerate and by evidence of unconformability.

These newly-recognised Pre-Cambrian rocks furnish the first chapter, in the geological history of our country. Whether they belong to one epoch, or to three as Dr. Hicks maintains, I am not prepared to state; but one thing is clear, they were produced by the destruction of still older rocks by aqueous and igneous agencies. Speaking of the Cambrian conglomerate, Professor Ramsay states that it must have been derived from the destruction of pre-existing land, of which we have no trace, except the pebbles in this rock. We have now discovered a fragment of this old land. We may stand on the surface of quartz-felsite hills about the lake of Llyn Padarn and feel sure that we are on a land surface which existed before one fragment of the rock that now forms the majestic range of Snowdon and the Glyders had been laid down. But has this discovery given us a definite halting place in our attempts to trace back the history of our globe? Not in the least; for the materials of which this old land surface is composed are but the fragments of an earlier world, of which Professor Ramsay's remarks may be again repeated, to be again proved erroneous, it may be, by a race of future geologists.

But to continue our geological history. The Pre-Cambrian rocks were formed and then fashioned into a land surface before the deposition of the conglomerate commenced. Of the real extent and character of this land surface we know very little. It probably formed an extensive continent having its surface diversified by high mountain ranges and deep valleys. Into the sea of that period the river drainage of this continent ran, carrying down immense quantities of sand and silt. The sand would fall to the bottom in the neighbourhood of the shore, while the mud would be carried further out to sea, as it is at the present day. From these materials the grits and slates of the Cambrian period have been formed, and the ripple drifts in these deposits give evidence of the currents that flowed in this ancient sea.

The entire thickness of the sedimentary deposits is many thousand feet, and since we cannot suppose that any portion of this series was deposited in very deep water, it is necessary to assume depressions during the formation. Towards the close of this great period a remarkable development of igneous action took place. Huge volcanoes were produced somewhere in the district, and great masses of fragmental rocks and crystalline lavas were formed.

Professor Ramsay divides the igneous rocks of Snowdon into three groups :—

1. Columnar felspathic trap, 200ft.
2. Ashy beds, 1,200ft.
3. Basement, slaggy and brecciated lavas, 1,700ft.

This lowest series, north of the Pass of Llanberis, is divided into three groups separated by grits and slates. The volcanic material must have been derived from the interior of the earth, and accordingly we find numerous dykes, veins and necks of igneous rock, traces of the ducts by which communication was established between the exterior and the interior.

With this volcanic episode our account of the geological history of North Wales, as far as regards the formation of rocks, must cease. Some time after this, how long we cannot say, the whole mass of rock formed during the Cambrian period must have been subjected to lateral pressure, acting from the N.W. and S.E., and the folds and contortions now seen in the strata of North Wales, together with the slaty cleavage, owe their origin to these disturbances. These folds affect both the igneous and sedimentary rocks alike, and cannot therefore be connected with the volcanic action which produced the former.

(To be continued.)

BRITISH LICHENS: HOW TO STUDY THEM.

BY W. PHILLIPS, F.L.S.

(Continued from page 199.)

In the home study of Lichens, not the least important subject we have to dwell upon is the application of chemical tests for the determining of species.

That certain Lichens contained colouring matter which could be made available for dyeing cloth is a fact that has been made known for many years, indeed some authors have gone so far as to say there are allusions to the blue and purple colours procured from them for this purpose in the Bible, (Ezekiel xxvii., v. 7,) but it is only within the last twenty years that Lichenologists have sought to turn this character of Lichens into a means for distinguishing species. A solution of iodine was found, when applied to the hymenium of certain species, to yield a blue reaction, while in other species it merely yielded a vinous brown colour. The blue colour is attributed to the presence of starch in minute quantity in the gelatinous matter pervading the hymenium, called by Nylander the *gelatina hymenia* ; or if the colour be produced in the membrane of the ascus and the cell walls of the paraphyses it is attributed to the presence of cellulose in these bodies. The medullary layer of the thallus of some species also gave this blue reaction. At one time this reaction was not only considered of service in separating species, but was even thought to afford a certain criterion by which to distinguish a Lichen from a fungus. Dr. Nylander, however, pointed out in 1865 that many fungi belonging to the section *Discomycetes* gave a similar reaction. Although it thus proved fallacious for this latter purpose, it has continued to this day to be used as an auxiliary help in determining species. Apart from the reaction iodine occasionally gives, it is found to be a most useful substance as a staining fluid for the purpose of bringing out points of structure under the microscope that without some such aid would be invisible. The mode of using it is to place a drop close to the margin of the covering glass under which a section lies on the glass slide, when it will immediately spread by capillary attraction through the whole of the section. Care should be taken, however, that the section has been moistened by pure water only, as any other chemical may interfere with the result.

In 1866 Dr. Nylander proposed two chemical substances capable of affecting the colouring matter of Lichens, as a test by which to distinguish certain closely-allied species, of far greater value for this purpose than iodine, namely, hydrate of potash and hypochlorate of lime. The Rev. W. A. Leighton, and other leading Lichenologists both in this country and on the Continent, at once accepted them as affording most important criteria. Their employment at the present time is all but universal, and hence it is absolutely necessary the student should be put in possession of such information as will enable him to apply them. We will take them in order.

Hydrate of potash is composed of equal weights of caustic potash and water, and should be kept in a stoppered bottle of green glass. For the sake of brevity, in describing its effects, the symbol K is used to represent it, and this letter should be conspicuously written on the label in addition to the name of the mixture.

Hypochlorate of lime is formed by mixing chloride of lime—the common bleaching powder of commerce—with water. The water takes up but a very small quantity in solution, the surplus falling as a sediment to the bottom of the bottle. As this solution will lose its effect if kept for many days, it is best to make a fresh solution every week. The symbol for this is C, which, as in the case of the preceding mixture, should be conspicuously written on the bottle containing it.

For each of these chemicals a separate small brush made of spun glass, procurable at any analytical chemist's, must be used when applying them to the Lichen, and a small quantity of each must be poured from the stock bottles into separate concave watch glasses, small egg cups, or any suitable vessel made perfectly clean for the purpose. Apply with the glass brush to the thallus of the Lichen to be tested a drop of hydrate of potash, and note the resulting colour, if any, then immediately apply in the same manner to the same spot a drop of hypochlorate of lime, and observe the effect. Proceed in the same manner to test the medullary layer of the thallus, for which purpose a small portion of the cortical layer should be carefully removed by scraping it with a knife. The results should be recorded on the paper bearing the specimens by the aid of the following symbols.

The hydrate of potash may produce a yellow colour, the symbol for which is K + ; or it may only be a faint yellow, in which case it should be written K f +. If the yellow tint changes almost immediately into red, the symbol is K yellow then red. Should the yellow produced by the hydrate of potash change into a *deeper* yellow when the hypochlorate of lime is added it will be denoted thus—K yellow, C deep yellow. Sometimes, however, the addition of hypochlorate of lime produces a red colour, which must be written thus—K yellow, C red. Should the hydrate of potash produce no colour, but, by the addition of the hypochlorate of lime, a red colour is produced, the symbol is K—C + red; but if a yellow is produced it is K—C + yellow. Should neither re-agent produce a reaction it is indicated thus—K—C—. Let us suppose, however, that a reaction takes place in the medullary layer, but not in the cortical layer, it will be then shown thus—K $\mp$, that is, the effect on the cortical layer, which in this case is negative, is indicated by the upper sign; and that on the medullary layer, which is positive, by the lower sign. Every possible chemical reaction given with these two re-agents may be thus expressed in a brief and convenient form, facility in the use of which can be acquired in a very short time.

The next important step is to ascertain the microscopical characters of the apothecium. The number, size, shape, and internal structure of the spores; the presence or absence of paraphyses; the colour of the hypothecium, if it be a Lecidea, together with any striking feature that can be detected, should be carefully noted. Diagrams of the spores and their micrometrical dimensions are of great value, and if made on the paper bearing the specimens, it obviates the necessity of repeating the work when subsequently referring to the specimen, as will often have to be done in the course of future investigations. An excellent plan pursued by some botanists is to prepare a microscopic slide of each specimen, to be placed in a cabinet of convenient form for holding a series, arranged in the same order as the specimens in the herbarium. Such a collection will save an infinitude of trouble, for, although a diagram of spores, &c., will be of great use, the inspection of a well-prepared slide will satisfy the mind of a critical worker on points that no diagram can adequately represent. When we say a well-prepared slide, we do not mean to convey the idea that it should of necessity be such a slide as would satisfy the fastidious taste of a *dilettante* microscopist, though there is no objection to such slides, but we mean that it should clearly display the essential parts of the object under examination, a quality that may co-exist with a certain rudeness of finish in varnish and ornament. We will here lay before the student a few practical directions for preparing his slides, as in so doing we shall be able to convey incidentally some information on other practical points in examining specimens.

Cutting Sections is a delicate and difficult operation, on which much depends in seeing clearly the structure. The excellence of a section consists in two things—first, being sufficiently thin to allow of transmitted light passing easily through all parts, so as not to require so much pressure as would derange the relative position of the various parts; and second, it should embrace the whole, or as much as possible, of what is required to be seen, so as to render unnecessary a second section being made. If the object were to mount a large number of slides, a good section-cutter should be obtained from some respectable optician. All, however, that is required where a single section is to be made can be accomplished with a small dissecting knife, having a thin, penknife edge, with a fine point. A watchmaker's eye-glass, having a lens of 1in. focus, held to the eye by contracting the muscles of the face, or, when this cannot be done, supported by an elastic band passing round the head, will be found convenient in making a section, as the two hands are left at liberty for work. Should it be the apothecium of a Lichen that is to be examined, the Lichen is held in the left hand, and a clean perpendicular cut is made near the middle of the apothecium, and the portion nearest the eye is removed, so as not to obstruct the sight, when a second cut is made parallel with the first, by which the thinnest possible section is obtained. Success will not reward the student till several apothecia are destroyed. He must practice, therefore, on some common species. When a sufficiently thin section is obtained, let it be placed on a glass slide, if for present examination only, in a drop of hydrate of potash, which loosens the parts to be examined, making them more transparent; but if for mounting permanently, in a drop of clean water, as the "medium" used for mounting would be injuriously affected by hydrate of potash. Placing the covering glass over the section, and subjecting it to moderate pressure, it is now ready for examination. The magnifying power best adapted for Lichens is, as already stated, one of about 350 to 400 times linear.

A Medium for Mounting Specimens should be at hand in case the section is exceptionally good, or the specimen too valuable to admit of more than one section being taken from it, in which case it can be at once permanently mounted. A very useful medium is that prepared by P. Aylward, of Manchester, which requires to be warmed to render it liquid; and on cooling is sufficiently firm to admit of the surplus being washed off from around the covering glass, which is held in its place by a light clamp. One serious defect of this medium is that it does not preserve the colour of the chlorophyll in the gonidia. The slide should now be finished off, as directed in the ordinary works on microscopic mounting.

Microscopic Measuring of spores is such an important clue to the identification of species that it cannot be altogether passed over here, although, for fuller details, we must refer the student to works treating specially on the use of the microscope. Several methods are in use, and each worker will prefer his own; but, if the student is starting *de novo*, we would recommend the method we ourselves use, which is as follows:—Procure a stage micrometer, ruled for one-thousandths of an inch, or of a millimetre, whichever is intended to be adopted, and, placing it on the stage of the microscope, under the object glass, place at the same time a sheet of white paper at an equal distance from the eye, which will be about nine or ten inches, on a board adjusted for the purpose. Having done this, look down the tube at the micrometer scale with one eye and at the sheet of paper with the other simultaneously, when the image of the micrometer will be thrown on the paper, and lines may be made on it corresponding with those of the micrometer. The first will be a rough copy, and should be revised, by accurately ruling the divisions on the margin of a piece of white cardboard. When this scale has been successfully made, the stage micrometer can be dispensed with as no longer necessary. The scale will be kept close at hand, and will be used as follows:—Supposing the object to be measured be a spore under observation, a diagram should be made in precisely the same manner as the scale was made, namely, by looking with the disengaged eye on a blank piece of paper, and sketching the image thrown on it. When the sketch is completed, and ascertained by repeated trials to correspond with the apparent size and shape of the spore, the scale can be applied to it with ease, and the dimensions ascertained. A separate scale must be made for each power used.

The scale usually adopted in this country is the divisions of an inch, while the rest of Europe adopts the divisions of a millimetre. We prefer the latter, as most Lichenologists use it, besides which fewer figures are required to denote the quantities; thus, if we require to write the dimensions of the spore of *Placodium murorum* (Hffm.) in millimetre, we do it thus:—·011 – ·014 × ·007 – ·008 mm.; while, if written in divisions of an inch, it is written thus:—·00033 × 00045 × 00027 – 00031in.

Supposing the student to have mastered any difficulties he may have thus far met with, he will have acquired so complete a knowledge of the plant he may have under examination at this stage, that he will be in a position to assign it to its place, and append to it its proper generic and specific name. That he will meet with difficulties there can be little doubt, but we advise patience, diligence, and care, before which the most formidable must disappear, and without which nothing worth doing in this world can be accomplished.

THE BIRDS OF GLOUCESTERSHIRE.*

BY EDWARD E. EVANS.

I do not propose to give a description of the whole catalogue of birds, but I shall refer only to such as I have verified as having been found in Gloucestershire, and shall give such particulars concerning some of the rarer species as I have thought would be generally interesting. Birds

* Read before the Stroud Natural History and Philosophical Society, Nov., 1879.

are divided into five orders, viz.:—1st, Raptores or Prey-catchers, such as the Hawks and Owls; 2nd, Insessores or Perchers, as Finches and Sparrows; 3rd, Rasores or Scratchers, such as pigeons, game birds, and our domestic fowls; 4th, Grallatores or Waders, as the Heron and Plover; 5th, Natatores or Swimmers, as the Ducks and Gulls. These are again divided and sub-divided into groups and families.

First, then, let us take Raptores, at the head of which is the Eagle, the king of birds. As far as I have been able to ascertain, this grand bird has never visited Gloucestershire; but of his relatives we can number no less than eight Falcons, besides Owls. Chief of these is the Osprey. This bird was shot on October 21st of last year, (1878,) near Wimberley Mills, at the Bourne. It spent some time in the valleys, generally keeping near the head of the stream, at a pond called "Baker's Pond." Its range was very great, but, after being shot at by every gunster in Chalford, it finally succumbed under a broken wing to the prowess of a man at the Brimscombe Gas Works, and soon afterwards came into my hands. It is a fine male specimen, measuring 5ft. 3in. across the wings, and, had it been a little better stuffed, would have been very valuable. It has a crest, and is the only member of this order that has it. Its claws are very long and sharp, and are well fitted for firmly grasping the slippery bodies of the various fishes on which it feeds. In taking its prey it hovers like the Kestrel, and plunging into the water, often being quite submerged, rises again with the greatest ease, and, if successful, with its prey in its claws. It then flies off to some suitable place, where it is not likely to be disturbed, and there devours it. Sometimes it mounts high up in the air to play with its prey as a cat does a mouse. It exclusively feeds on fish, hence one of its names, "Fishing Hawk." There were a pair of them, as usual with hawks, for having once paired, they never separate, and the female has several times been seen. Once it hovered over our own pond at Brimscombe, and actually alighted in the meadow, thence it flew slowly down stream. I hope it will find another mate, and visit Gloucestershire again, when I trust it will be suffered to remain unmolested, for, now-a-days, directly a rare bird is reported, a whole army of gunners do their best to destroy it. I always deprecate such a way of welcoming a stranger, as so many of our beautiful British birds are, I fear, rapidly becoming extinct.

Of the other members of this order the Peregrine Falcon is, perhaps, the most interesting, as it is the bird used in falconry. A pair of these were seen, and one shot, some time ago, at Frampton Mansel. I believe they were genuine specimens, as they had no bells and bore no trace of any training. The Kite was, at one time, fairly abundant on the hills above Wotton-under-Edge, and used to breed in a wood at the head of the Wotton stream. It is now very rare. The Common Buzzard is sometimes seen, and a most remarkable occurrence of large numbers of this beautiful bird is recorded at Coleford, Dean Forest, by Mr. Morris, in his "History of British Birds." A hen Harrier was shot at Nymphsfield last year. Hobbies I have twice observed, while the Kestrel and Sparrow Hawk are as common here as elsewhere, the former distinguished by the manner it has of hovering over its prey or while in search of prey, and the latter by its bold, headlong flight. It is a very courageous bird, and one of my favourites. I have seen it dash into a flock of Larks, and, without halting, seize one of them and top the next wall before they were scarcely aware of the presence of the much-dreaded intruder; and plunge through a pane of glass in pursuit of a poor little Tit. It is a brave parent, and does not hesitate to attack anyone who tries to rob its nest. Of the Strigidæ, or Owl kind, we have only three species, viz.:—The Long-eared Owl, the Barn Owl, and the Tawny Owl. The first-named is easily distinguished by the two tufts of feathers on its head, much like horns, but called ears. It is now very rare. The Barn Owl is, like the Jackdaw, an ecclesiastic, being very fond of churches and old places, and "in whose ivy mantled tower doth to the moon complain," and there securely rears its brood. But the bird that sometimes makes "night hideous," and fills the mind with horrors by its dolesome noise, is the Tawny or Brown Owl, called in Gloucestershire phraseology "Ooter or Screech Owl." Most of us know the story of Billy, the weaver, who was lost in the wood, and how he answered the Owl; nor shall I ever forget a much-respected relative of mine throwing open his window in the dead of the night and crying out "What's the matter! What's the matter!" and was only answered by the dismal "hoot" of the Owl, nor was he set at rest until assured that it was only an Owl in a neighbouring tree. It certainly is a most distressing carol to break upon the ear, after you have been vainly endeavouring to get to sleep, but, nevertheless, he is a much-abused bird, and does a lot of good in catching mice.

The second order, Insessores or Perchers, is the most numerously represented in this county, and we can number eighty-four of them out of a possible 110. The Great Grey Shrike is now a rare bird, and is migratory. It frequents hedgerows and groves, and is a very courageous bird, often attacking birds larger than itself. At Thornbury and Prestbury they are seen during summer, and breed there annually. The Red Backed or Common Butcher Bird is fairly common, and breeds with us. It is this bird that sticks insects and sometimes even toads on the thorns of the hedgerows near its nest and so betrays it. The Spotted Flycatcher, the little bird that from a convenient post or rail patiently watches for passing insects, is to be seen everywhere. It is remarkably quick in catching its prey, bringing its bill together with quite a snap, and then returning to the same post.

We are assured that we do not lack Thrushes or Blackbirds by the way our cherries disappear, and by the often-heard sweet song of praise and thanksgiving to the great Giver of All with which these charming songsters make melodious the sweet morning air, and, although when food is scarce they may help themselves to some of our fruit, yet who would like to banish from our land the song of the boisterous Blackbird or the mellow Thrush? Far rather let us protect them, for in their songs we gladly recognise them as harbingers of returning life after our long, cold winter. "The early bird catches the worm," says the proverb, and at the first break of dawn numbers of Thrushes and Blackbirds hop quietly over our grassy lawns, attentively listening for the upheaving of the worm, which is no sooner perceived than with a few vigorous pecks it is brought to the surface, and either devoured there or taken home to wife and family; while under a neighbouring laurel bush you hear a tap, tap, tap, which is nothing less than a clever Blackbird cracking the shell of a snail upon a convenient stone. These stones are continually resorted to, and I have often seen quite a pile of shells cracked to pieces in this way.* The Fieldfare, Redwing, and Missel Thrush are common enough during most winters, while that beautiful bird with the white collar, the Ring Ouzel, is sometimes seen, and I once found its nest near a pond at Toadsmoor. The little Dipper, or Water Ouzel has occurred once to my knowledge at Brimscombe.

Of the Sylviadæ, or Wood-bird kind, we have nineteen; viz., Hedge Sparrow, Robin, Redstart, Blackstart, Stonechat, Whinchat, Fallowchat or Wheatear, Grasshopper Warbler, Sedge Warbler, Reed Wren, Nightingale, Blackcap, Garden Warbler, Whitethroat, Lesser Whitethroat, Wood Wren, Willow Wren, Chiff-chaff, and Gold-crested Wren. The first and second are known to everyone. The Blackstart, which is a very rare bird indeed, was shot while flying with some Stonechats some-time ago. The Redstart, Stonechat, and Whinchat are common, and I seldom cross the common without seeing a pair or two of Wheatears. A noise like a grasshopper, only much exaggerated, puzzled the good folks round where I live a good deal. One said it was a Nightingale, another a Landrail, while a third declared it was a Toad. We ultimately discovered that a Grasshopper Warbler had its nest there, and was singing an evening lullaby to its sitting mate. It is a very shy, and also a very rare bird. The incessant warble of those two exceedingly pretty and interesting little birds, the Sedge and Reed Warbler, is to be heard at most ponds where rushes grow thickly. The male bird perches on a twig, near where its mate is carefully going through the trying period of incubation, and keeps up a ceaseless and very pretty warble both night and day. Anyone who has seen these little birds cannot but be charmed both with their pretty, yellow plumage and pleasing song. The Nightingale I have heard in a thicket near Mr. Fawke's farm at the Clay Pits, also in the park wood above the Thrupp, where a nest with four eggs was shamefully robbed last spring. The rambler among our woods often hears the Blackcap's warble; and all the remaining seven are fairly plentiful. The little Gold-crested Wren, the smallest of our English birds, is often seen running along the branches of trees in search of food.

We can boast no less than six of the Paridæ or Titmouse kind. Everybody knows the Tom Tit, at least every gardener does, as it sometimes plays sad havoc, but in my opinion it does infinitely more good by clearing the trees of insects. It puts itself in the most curious attitudes in its search for food, often hanging by one leg to a twig. The Blue Tit is as common and as useful, and they are generally found not far off each other. The Cole Tit and Marsh Tit are sometimes seen, but the latter must rank among our rare birds, as must also the Bearded Tit. The

*This I have since found out to be wrong. It is the Thrush and not the Blackbird.—E.E.E.

pretty little Long-tailed Tit, only a trifle larger than the Goldcrest, is plentiful, especially in fir woods. At one time several pairs of these birds used to build on some poplar trees in our ground, using as materials skeletonised leaves, and lining the nests with feathers or wool. They were very beautiful indeed, and I always regret not having kept one of their nests.

In February, 1874, there was shot at Burleigh that very rare bird the Bohemian Waxwing, or Chatterer. This very elegant bird, the silky texture of whose plumage resembles that of the Jay, has severa times been shot in England, but never before, as far as I can ascertain, in Gloucestershire. I have no doubt they were to have been seen last winter, as at that period of the year they leave the cold polar regions for more genial climes. Last winter brought us many strangers, and it is more than probable they came likewise. Of the Motacillæ or Wagtails we have three representatives. The Pied and Grey Wagtails I have observed here during winter and summer, whereas some ornithologists maintain that they migrate ; probably some do, but many remain. Ray's Wagtail I have seen once or twice.

The Tree and Meadow Pipits are fairly common, and breed with us. The Rock Pipit I saw when at Aust Cliff last year. Early in January on many a bright frosty Sunday morning have I listened to the Skylark's cheering song ; and while heard almost everywhere it is still more common in the country districts. The Wood Lark is found, as its name implies, in or near woods, and, I think, in most woods. Of the Bunting family, I have once or twice seen on the tops of the hills that beautiful bird the Snow Bunting, while the Common Bunting is by no means rare, and the same may be said of its relatives the Yellow Hammer and Cirl Bunting, generally near barns, especially in winter time. The Black-headed Bunting I have seen occasionally.

A family of thirteen members represent the Finch kind ; viz., Chaffinch, House Sparrow, Greenfinch, Linnet, Brambling, Tree Sparrow, Hawfinch, Goldfinch, Siskin, Lesser Redpole, Twite, Bullfinch, and Crossbill. Of the first four there is an absolute abundance. The Brambling and Twite are winter visitors, and, when beech mast, hips, haws, and berries are plentiful, so are they. The Tree Sparrow, being very much like the House Sparrow, is, I think, more common than is usually supposed, as it is easy to mistake them for each other, while the Goldfinch and Bullfinch are fairly abundant, but as they are very much sought after by bird-catchers, they do not stand much chance of becoming more plentiful. The Siskin and Hawfinch are winter visitors, and, I believe, were both fairly abundant last winter, as I know for certain that several were seen. A Crossbill was shot by a friend of mine in a firwood, in Toadsmoor Bottom. It is a rare bird. The upper and lower mandibles cross each other in a most curious manner. The crossed bill of this bird is well adapted to crack open apples and fir-cones for the kernels inside. Their bills are marvellously strong, and will split an apple with the greatest ease.

[*To be continued.*

METEOROLOGY OF THE MIDLANDS.

THE WEATHER OF AUGUST, 1880.

BY W. JEROME HARRISON, F.G.S.

STATION.	OBSERVER.	RAINFALL.				TEMPERATURE.			
		Total for M.	Greatest fall in 24 hours.		No. of rainy d.	Greatest ht.		Great'st cold	
		In.	In.	Date.		Deg	Date.	Deg	Date.
GLOUCESTERSHIRE.									
Cheltenham	R. Tyrer, Esq.	·49	·15	6	5	79·1	11	44·2	3
Stroud	S. J Coley, Esq	·43	·18	6	3	74·0	6 & 29	44·0	3
SHROPSHIRE.									
Haughton Hall, Shifnal	Rev. J. Brooke	·81	·44	7	6	76·0	11	46·0	(24 9, 10, 20)
Woolstaston	Rev. E. D. Carr	1·29	1·02	7	5	76·0	11	47·0	1, 8, 24
More Rectory, Bishop's Castle	Rev. A. Male	1·29	·94	7	4	79·0	11, 13, 27	46·0	3 & 7
Larden Hall	Miss F. R. Boughton	·54	·45	7	4				
Bishop's Castle	E. Griffiths, Esq.	1·12	·85	7	4	80·0	14 & 27	46·0	10 & 24
Cardington	Rev. W. Elliot	·97	·75	7	4				
HEREFORDSHIRE.									
Stoke Bliss	Rev. G. E. Alexander	·27	·14	1	4	76·0	12 & 26	50·0	2, 6, 8
WORCESTERSHIRE.									
West Malvern	A. H. Hartland, Esq.	·25	·09	7	4	83·0	10	47·0	23
Pedmore	E. B. Marten, Esq.	·50	·13	5 & 7	6	91·0	10	39·0	23
Longlands, Stourbridge	J. Jeffries, Esq	·59	·20	6	5	79·0	10	47·0	2, 9, 23
Dennis, Stourbridge	Mr. C. Webb	·64	·26	6	5	80·0	11	46·0	9
Evesham	T. J. Slatter, Esq.	·43	·27	6 & 7	9	78·8	12	47·0	24
STAFFORDSHIRE.									
Beacon Stoop, Weaver Hills	C. L. Wragge, F.R.G.S.	3·40	1·46	7	6	72·1	11	46·9	7
Dudley	Mr. J. Fisher	·46	·13	5	4				
Kinver	Rev. W. H. Bolton	·34	·11	7	5	77·0	11	46·0	8, 9, 23
Walsall	Mr. N. E. Best	·62	·20	7	8	77·0	11	47·0	23
Grammar School, Burton	C. U. Tripp, Esq.	1·39	·56	6	6	83·0	10	46·0	10 & 24
Weston-under-Lyziard R'tory	Hon.and Rev.J. Bridgeman	1·23	·77	7	7				
Wrottesley	E. Simpson, Esq.	·47	·19	1	5	79·1	12	46·0	7
Farley, near Cheadle	C. L Wragge, Esq.	2·78	1·52	7	6	78·8	11	47·2	1
Oakamoor	E. Kettle, Esq.	3·84	1·80	7	6	78·7	11	41·3	10
WARWICKSHIRE.									
Coundon, Coventry	Lieut.-Col. R. Caldicott	1·23	·50	7	7	77·0	11	51·0	2, 9, 10, (23
Bickenhill Vicarage	J. Ward, Esq.	·90	·48	2	6	86·0		50·0	
St. Mary's College, Oscott	Rev. S. J Whitty	·99	·33	7	7	77·6	11	47·2	24
Henley-in-Arden	T. H. G. Newton, Esq.	·76	·25	6	5	84·0	11	46·1	24
DERBYSHIRE.									
Stoney Middleton	Rev. U. Smith	1·74	1·54	7	4	77·0	10, 11, 14, (15	39·0	1
LinacreReservoir, Chesterfild.	C. E. Jones, Esq.	2·31	1·26	7	11				
Spondon	J. T. Barber, Esq.	2·72	1·12	29	9				
Duffield	W. Bland, Esq.	3·06	1·47	7	8				
Fernslope, Belper	F. J. Jackson, Esq.	3·26	1·59	7	8	77·0	11	47·0	1 & 10
NOTTINGHAMSHIRE.									
Hodsock Priory, Worksop	H. Mellish, Esq.	2·56	1·32	7	13	78·2	11	41·7	1
Park Hill, Nottingham	H. F. Johnson, Esq.	2·27	·76	29	7	76·9	11	50·0	9
Tuxford	J. N. Dufty, Esq.	1·45	·82	7	8	76·0	5	47·0	2
LEICESTERSHIRE.									
Loughborough	W. Berridge, Esq.	1·51	·61	7	6	80·8	11	46·9	24
Ashby Magna	Rev. E. Willes	2·84	1·72	29	5	84·0	11	42·0	7, 8, 24, (25
Kibworth	T. Macaulay, Esq.	·99	·53	7	7				
Town Museum, Leicester	W. J. Harrison, Esq.	1·66	·66	7	10	78·2	11	48·6	7
Syston	J. Hames, jun., Esq.	1·82	·68	6	7	86·0	12	48·0	7, 10, 24
Waltham-le-Wold	E. Ball, Esq.	1·79	·82	7	9	75·0	12	42·0	5
Coston Rectory, Melton	Rev. A. M. Rendell	1·57	·90	7	8	75·0	11	44·4	1
Dalby Hall	Mr. G. Jones	1·73	·97	7	9	82·0	12, 13, 14	43·0	1
Market Harborough	S. W. Cox, Esq.	1·13	·46	7	7	75·0	10	45·0	3, 7, 9
NORTHAMPTONSHIRE.									
Towcester Brewery	J. Webb, Esq.	·64	·27	29	6				
Kettering	J. Wallis, Esq.	1·04	·40	7	8	75·0	12	52·0	3
Althorpe	G. S. Groom, Esq.	1·08	·28	29	8	74·0	11	45·0	23
RUTLAND.									
Uppingham	Rev. G. H. Mullins	1·58	·58	7	8	78·4	11	47·9	1
Northfields, Stamford	W. Hayes, Esq.	2·12	1·27	7	7	83·0	3	48·0	1
Altarnun Vicarage	Rev. J. Power, M.A.	1·03	·32	26	8	81·0	15 & 28	45·0	31
Oxford	E. J. Stone, Esq	·60	·24	6	5	75·5	29	46·9	3
Ventnor	J. Codley, Esq	·70	·33	2	8	76·4	15	51·7	1

The first week of the month proved a continuation of the dull and damp weather of June and July. However, the heavy rainfall of the 7th saw the end of this state of things, and the remainder of the month was extremely dry and fairly hot, effecting a considerable and most beneficial change in the condition of the harvest. On the 10th and 11th the temperature rose generally to above 80 degrees; the wind then changed to the north-east, and continued from this direction for more than a fortnight, with a very steady barometer and little or no bright sunshine. The end of the month was marked by a terrible thunderstorm on the night of the 29-30th. An aurora borealis was seen on the 12th at Oxford (10 30 P.M.) and at Loughborough, and on the same evening (8 15 P.M.) a splendid meteor at Kettering, passing from east to west, and visible for six seconds.

Thunderstorm of August 29th.—The following graphic description of this severe electrical disturbance is by Mr. J. T. Barber, of Spondon, near Derby :—" On the night of 29-30 occurred a thunderstorm of the first magnitude, being, as respects the lightning and thunder, of an awful character. Lightning was seen at eight P.M. on the 29th, and thunder heard at 10 15, after an interval of 92·2 seconds from the flash, being the longest interval but one that I have ever recorded, and due beyond doubt to the unusual and fearful potency of the discharge. From 1 40 A.M. of the 30th till 2 30 A.M. the storm was of alarming violence, the number of discharges immediately near being very frequent and followed by tremendous thunder, resembling a battery of ordnance. So near was the lightning that a loud hissing was heard two, three, and four seconds before the flash, which intensified the appalling magnificence of the phenomenon. The storm moderated for three short intervals, but was renewed again and again until it at last passed off to the north-west. Some idea may be formed of the violence of the rain by stating that a Crossley's gauge, 20½″ high, had been placed above soil in the garden, and the soil was dashed over the rim of the gauge and clogged up the conducting tube till liberated again. The gauge showed ·05 in excess of the other two on grass, w ich was no doubt caused by splashing up from the ground. To find a parallel to this storm, I should have to go back to 1852, and then it would not be equalled in the great number of discharges in immediate propinquity. One flash of a yellow colour, about two A.M., was specially remarkable for its blinding brilliancy and extraordinary density and volume, equalling anything of the kind seen in Germany and Italy. The storm finally ceased at 5 15 A.M., after lasting seven hours."

Natural History Notes by Observers. — *Nottingham.*—In almost every case this grand month has brought grand crops; wheat was led on the 21st. *Stroud.—Epipactis latifolia* in blossom on 8th. *Shifnal.*—Wasps most abundant, and destructive to all fruit, ripe or unripe; not a coloured butterfly yet, only white. Swifts gone on 9th, detachments of Swallows depart on 16th and 27th. *More Rectory.*—All the crops are excellent in this neighbourhood; much disease, however, existing amongst the potatos. There are almost no apples or pears, and the wasps, being unusually abundant, fiercely attack the crops of grapes, which in some vineries are completely destroyed by them. *Altarnun.*—A most satisfactory month for the farmers; crops good and well secured.

The best turf and corn harvests for many years. Barley a late but good crop. Pastures on light soils as brown as possible on the 31st. *South-west Counties.*—Wasps have been most abundant in the south-west counties this summer, almost amounting to a plague in some districts. During the month of August no less than 128 wasps' nests were destroyed in the grounds and park at Menabilly, near Towey, Cornwall. The effect of the severe winter of 1878-9 and 1879-80 are visible this summer in many a Devon and Cornish orchard. Many fruit trees appear to have been killed, while some apple trees only came into leaf in July. Many have shown no blossom at all, and great numbers have borne little or no fruit. Similar effects were noticed after the winters of 1859-60 and 1860-61.

Correspondence.

Beacon Stoop.—At page 231 I gave Beacon Stoop as the highest point in the county of Stafford. Its elevation has since been found to be 1,216ft. above the sea. The Roaches and Morridge are both higher, and the mistake arose through trusting to an old map of the district.—Clement L. Wragge.

New Infusorian.—On the 4th of August last, I found in one of the swags of the mines, near Bolton, an Infusorian which I did not recognise, so I sent it to Mr. W. Saville Kent for identification, and I am pleased to find that Mr. Kent takes it to be a new one allied to Bursaria. He proposes to call it a Bursarella. Mr. Kent intends to give a figure and description of it in his new manual of the Infusoria.—Thomas Bolton, 17, Ann Street, Birmingham.

Foraminifera in the Carboniferous Limestone of Derbyshire.—On reading Mr. Wilson's article in last month's number, (p. 220,) on the above subject, I was surprised at the paucity of Foraminifera found by him in the limestone of North Derbyshire, (Castleton,) in comparison with the number from the southern part of the county, (Ticknall.) At Ticknall Mr. Wilson finds sixteen species, (*i.e.*, with two varieties,) but at Castleton, including "other beds of limestone in the neighbourhood," only three species. I have lately been making some sections of a limestone from Miller's Dale, with the somewhat unusual appearance of which I was particularly struck; and as the locality, although in the neighbourhood of Castleton, is more easily accessible than that picturesquely situated little town, some of your readers may be desirous of knowing it, so that they may obtain specimens. Judging, too, from Mr. Wilson's results, this limestone is unusually rich, for, on a single slide, I have succeeded in making out not only *Valvulina palæotrochus* and *Endothyra Bowmanni*, but also *E. globulus* and *Textularia eximia*, the former being only given for South Derby. I may add that the same slice is considered to contain *Trochammina incerta* and *Archædiscus Karreri*, but as I am not sure of these, and especially of the former, I have not included them. Like Mr. Wilson, I am indebted to Mr. G. R. Vine, jun., of Sheffield, for assistance in naming. The actual spot in Miller's Dale where I obtained this limestone is marked by a small waterfall, not far from which is an outcrop of much-decomposed toadstone (volcanic ash?)—A. H. Scott White.

Camberwell Beauty.—I have to record the appearance in my garden of a specimen of the Camberwell Beauty on Saturday afternoon last. It was in perfect condition. Not having a net with me, I failed to capture it.—Edward Cornford, Cheltenham, August 30th.

Botanical Note.—I have found lately in several fields in this neighbourhood a clover which is new to me. It is very like *Trifolium procumbens*, but is more upright, and usually not so straggling in its growth. The flowers, however, are deep yellow, almost orange. I have been told it is *Trifolium agrarium*, a Continental plant, and is, I suppose, introduced with foreign seed, but not observed in previous years. I should like to know if it has been observed in other localities, and how long ago, and whether it has as yet naturalised itself anywhere.—O. M. Feilden, Frankton, Salop.

Botanical Notes from Evesham.—In the list of plants given in May's History of Evesham, as occurring in the vicinity, I was struck with the mention of *Samolus Valerandi*, as being found some thirty-five years ago in two localities near the River Avon. Curious to know whether a plant, which I had before found only near the sea, survived, I lately visited one of the spots indicated, and was not a little pleased to see two vigorous specimens. Amongst other plants recorded by May I have found the following, at or near the habitats assigned to them by him:—*Butomus umbellatus*, *Cichorium Intybus*, *Erigeron acris*, *Lathyrus Aphaca*, (now almost eradicated, only one plant found this year,) *Lathyrus Nissolia*, *L. sylvestris*, *Linaria spuria*, *L. Elatine*, *Lythrum salicaria*, *Lysimachia vulgaris*, *Ophrys apifera*, *Orchis pyramidalis*, *Paris quadrifolia*, *Sagittaria sagittifolia*, *Saxifraga granulata*, *Spiræa Filipendula*, *Thalictrum flavum*, *Viola hirta*, *Bupleurum rotundifolium*, which has been found again this year by Mr. Doeg, of this town; and this gentleman has also met with *Dipsacus pilosus* and *Meconopsis cambrica*. *Monotropa hypopitys* is common at Woodnorton, and near that place I have found *Carlina vulgaris*, *Geranium columbinum*, and *Nepeta cataria*. Bredon Hill affords *Cerastium arvense*. Besides the above, I wish to record as occurring near Evesham, *Hesperis matronalis*, *Cardamine amara*, *Thlaspi arvense*, *Saponaria officinalis*, *Silene noctiflora*, *Medicago lupulina*, *Myriophyllum spicatum*, *M. verticillatum*, *Lycopus europæus*, *Chenopodium rubrum*, *Daphne Laureola*, *Zannichellia palustris*.—S. S. R.

Botanical Notes from the Cotswolds.—As you so strongly urge your readers to send you notes of their "personal observations," I am encouraged to add my botanical experience on the Cotswold Hills to that of your correspondent, Mr. George T. Harris, as recorded at page 230. On 10th July last, when walking hurriedly (to escape a thunderstorm) over these hills, at a point some twelve miles to the north-east of Leckhampton, I found the following plants in blossom or seed, viz.:—*Asperula cynanchica*, *Anemone pulsatilla*, (seed,) *Arabis hirsuta*, *Thlaspi perfoliatum*, (seed,) *Hippocrepis comosa*, *Anthyllis vulneraria*, *Carduus eriophorus*, *Carduus acaulis*, *Carduus nutans*, *Carlina vulgaris*, *Senecio campestris*, *Leontodon hispidus*, *Silene inflata*, *Calamintha Acinos*, *Orchis conopsea*, *O. maculata*, (seed,) *Habenaria bifolia*, *Listera ovata*, (of gigantic size,) *Epipactis grandiflora*, &c., &c. *Campanula glomerata* grows commonly along the escarpment, and in the woods the graceful *Vicia sylvatica* is abundant. Wild Marjoram *(Origanum vulgare)* too, and *Specularia hybrida* may be gathered. The lesser Snapdragon *(Linaria minor)* and *Valerianella auricula* are common in the cornfields thereabout. Then, in their season, *Polygonatum officinale*. *P. multiflorum*, *Convallaria majalis*, *Neottia Nidus-avis*, *Ophrys aranifera*. *Epipactis lati-*

folia, *Cephalanthera ensifolia* flourish in the hanging woods, which make the slopes of the Cotswolds so beautiful. I gathered *Habenaria viridis* in a pasture-ground; on the hill-top *Spiræa Filipendula* and *Scabiosa Columbaria*, and in the hedgerows of the vale below, *Smyrnium Olusatrum*. I could, no doubt, add many others to the above list, if I were not troubled with a treacherous memory, and had I not, as usual, mislaid the notes I made at the time.—S. S. R.

PHENOLOGICAL OBSERVATIONS MADE IN THE VICINITY OF FARLEY, NEAR CHEADLE, STAFFORDSHIRE, DURING JULY AND AUGUST, 1880.—July 1st.—Elder *(Sambucus nigra)* first seen in full flower in the Churnet Valley. 3rd.—Black Bryony *(Tamus communis)* first seen in flower. 4th.—Nipplewort *(Lapsana communis)* first gathered in flower, in narrow, deep lane, on bank-side; gathered first flowers of Rough Hawkbit *(Apargia hispida.)* 5th.—Meadow-sweet *(Spiræa ulmaria)* in full bud at Farley; first in flower, however, in Churnet Valley, about 340 feet above the sea, near the river; Black Knapweed *(Centaurea nigra)* first in flower at Farley, meadow-land. 7th.—First flowers of *Spiræa ulmaria* at Farley, at a point about 285 feet above the valley, by hedge side, open to S.E. 13th.—*Campanula latifolia* first in flower by River Churnet. 14th.—Gathered first Harebell *(Campanula rotundifolia)* on the slopes of Beacon Stoop. 15th.—First gathered Sheep's Scabious *(Jasione montana)* and Yarrow *(Achillea millefolium)* by moorland waysides, near Cheadle. 21st.—Woodsage, *(Teucrium Scorodonia,)* by now in flower. 24th.—Wild Chamomile *(Matricaria inodora* or *Chamomilla)* said to have been first seen in flower by wayside. 25th.—Yellow Bedstraw *(Galium verum)* first noticed in flower on the slopes of Weaver; *Stachys Betonica* first noticed just in flower, pasture ground in valley, near rivulet. 26th.—Gathered Common Ragwort *(Senecio Jacobæa)* by wayside, near Alton. 27th.—First flowers of Great Hairy Willow Herb *(Epilobium hirsutum)* gathered in Churnet Valley, near the river. August 8th.—Field Scabious *(Scabiosa arvensis)* first seen in flower by wayside; Musk Mallow *(Malva moschata)* first seen by wayside, near Farley; Golden Rod *(Solidago virgaurea)* first noticed in flower. 13th.—First saw flowers of Burdock, *(Arctium Lappa,)* near the banks of the Churnet. Latter part of month Yellow Gorse and Ling in full flower on moorlands—a fine sight.—CLEMENT L. WRAGGE.

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—GEOLOGICAL SECTION.—August 24th.—Mr. Short exhibited some fossils from near Ledbury, Herefordshire. Mr. Bagnall exhibited *Arctium intermedium* and *Leucobryum glaucum*, and a portion of the cuticle of the leek. Mr. Waller exhibited *Diphyscium foliosum*, a rare moss, from near Llanberis. Mr. Chase exhibited *Motacilla flava*, the blue-headed wagtail, very rare; *Motacilla Raii*, the common yellow wagtail; and *Melizophilus Dartfordiensis*, the Dartford warbler. GENERAL MEETING.—August 31st.—Mr. J. E. Bagnall exhibited *Arctium majus*, *A. minus*, *Papaver Lecoqii*, *Verbena officinalis*, and other plants from Shipston-on-Stour. Mr. J. Levick exhibited *Melicerta tyro*, *M. ringens*, *Æcistes crystallinus*, *Floscularia campanulata*, and *Batrachospermum moniliforme* attached to *Limnæa stagnalis*, all from the pond in his garden. GENERAL MEETING.—September 7th.—Mr. T. Bolton exhibited a mounted specimen of *Carchesium polypinum*, showing the spirally-coiled pedicle with enclosed muscle; also *Bicellaria ciliata* and *Tubularia indivisa* from Bangor.

BIOLOGICAL SECTION.—September 14th.—Mr. Thos. Bolton exhibited *Lacinularia socialis* from the Hyde Pool, and *Perophora Listeri*, one of the most transparent of the Ascidians or Sea Squirts from Ventnor, Isle of Wight; also a fragment of living Sertularia, to which were attached an Ascidian, a mussel, two species of Polyzoa, *Pedicellina cernua*, Bowerbankia, Campanularia, Vorticella, Acineta, Actinophrys, and two species of rotifers. Mr. H. E. Forrest exhibited on behalf of Mr. T. J. Slatter, a specimen of *Atropa Belladonna*, deadly nightshade, in fruit, from near Evesham. Mr. J. Levick exhibited *Nassula ornata*. MICROSCOPICAL GENERAL MEETING.—September 21st.—Mr. H. E. Forrest exhibited *Vaginicola crystallina*, *Limnias ceratophylli*, *Fredericella Sultana*, *Alcyonella fungosa*, *Paludicella Ehrenbergii*, and several species of infusoria and rotifers, all from the River Avon at Evesham.

BIRMINGHAM AND MIDLAND INSTITUTE SCIENTIFIC SOCIETY. —The eighth annual meeting was held on September 22nd, in the Council Room of the Institute, the President (Mr. C. J. Watson) in the chair. From the annual report it appeared that fourteen papers on scientific subjects had been read, with an average attendance of 26 members; and twelve excursions had been made—average attendance, 22. The Librarian reported that 764 volumes had been issued during the past year. The finances showed a balance in hands of Treasurer. The report having been adopted, votes of thanks were passed to the retiring Officers and Committee; also, the Council of the Institute for granting use of room for the Society's meetings. Mr. R. Hipkiss was elected President for the ensuing year; Mr. C. B. Caswell, F.C.S., Vice-President; C. R. Robinson, Treasurer; W. J. Morley, Librarian; and W. H. Cox, Hon. Sec.—The retiring President (Mr. C. J. Watson) then delivered an address, in which he urged the members, one and all, to do their utmost for the welfare of the Society, saying that it was insufficient for the Committee to frame rules, however perfect, unless they had the hearty co-operation of the members. He advocated the formation of sections for the study of subjects too large for treatment in ordinary papers; and also invited members to give practical papers connected with their daily occupations, as frequently matters well known to them would be very interesting to others. He showed that the advantages of the Society were twofold. It enabled members, who were most advanced, to impart knowledge to their younger brethren; but its great use was to enable workers, in different branches of science, to assist each other. In these days science has become so extensive in its grasp, so abounding in its facts and laws, that it was impossible for any man, who aims at original work, to take in hand more than one small branch. It was universally recognised that the different branches of science are so intimately connected that, to know one of them thoroughly, it was necessary to know something of them all. But to persons with only a limited amount of time at their disposal for study, this was impossible; and here it was that such a Society plays a useful part. Each member, when he meets a difficulty out of his own especial line, has only to appeal to another member who has studied that subject, to be at once helped on his way. In this way the principle of the division of labour can be applied to science, and one's exertions made to bear more useful fruit than if each one had to bear the whole burden.

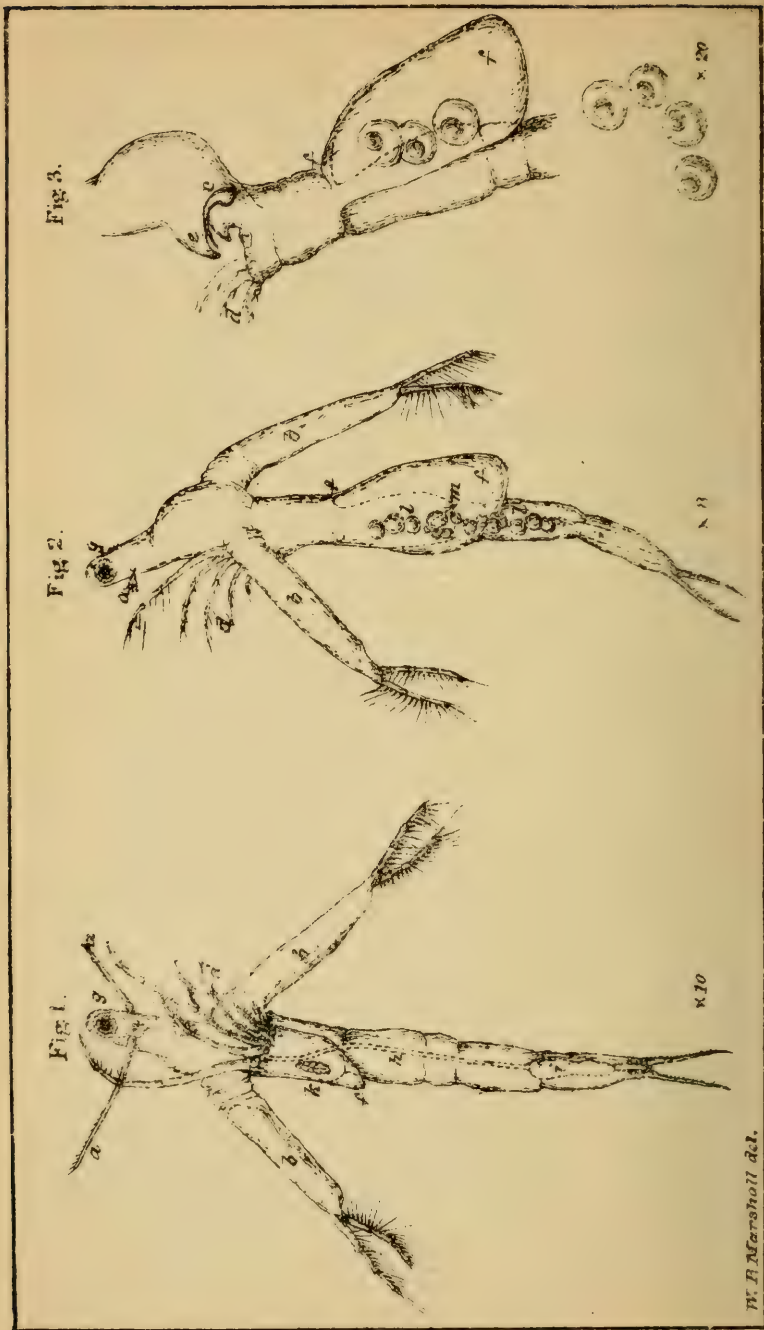
CARADOC FIELD CLUB.—The third Field Meeting was held at Linley, on August 26th—"a ladies' day." The party drove from Lydham Heath Station to the White Grit Mine. From this point they ascended to the druidic circle of "Mitchel's Fold," on the slope of Corndon Hill. Returning through the picturesque grounds of Linley Hall, they spent some little time at this latter place, where tea and other refreshments had been kindly provided by R. J. More, Esq., and Mrs. More, and dined in the evening at the Craven Arms Hotel, near the station of that name.

DUDLEY AND MIDLAND GEOLOGICAL SOCIETY AND FIELD CLUB.—This Society held the last field meeting of this season at Bromsgrove Lickey, on Saturday, the 28th of August. The members started in a break from Dudley, passing through Stourbridge, and from thence a pleasant, rural drive through Hagley, Clent, and Bell End brought them to the New Rose and Crown Inn. They then walked to the new Borough Lunatic Asylum, which is being erected at the foot of Rubery Hill, for the purpose of seeing some interesting excavations for the foundations of part of the buildings. A small patch of coal measures lies here, deposited on the altered Llandovery sandstone, and in the foundation for the large chimney was exposed one of the most interesting and instructive sections that can be observed anywhere. At the bottom of the excavation was seen the Llandovery rocks. altered from a coarse-grained sandstone to compact quartz, and on this was a bed of fire-clay, about 15in. thick, on which was a seam of coal about eighteen inches thick, surmounted by another bed of fireclay. The junction of beds, widely separated in geological age, and so clearly developed, is a sight which all geologists should take an opportunity of visiting. The party afterwards walked to several of the quarries, remarking the dip of the beds, and the remarkable manner in which the quartz rock is in some places contorted, and broken up into sharp, angular fragments.

EVESHAM FIELD NATURALISTS' CLUB.—The excursions for this season have now come to an end, the last having taken place on Saturday, the 28th August. Owing to the politically disturbed state of the town, very little has been done in the Club this season, and only few excursions have taken place. The first was held on the 1st May to Oddington Wood, Addlestrop. The next, on the 22nd May, to Stanway, when the following flowers were found :—*Habenaria viridis*, *Polygonatum vulgatum* *Convallaria majalis*. The third, on the 31st July, to Snowshill, when the following plants were found :—*Spiræa filipendula*, *Campanula glomerata*, *Orchis conopsea*, *Senecio campestris*, *Thlaspi perfoliatum*, and *Anemone pulsatilla*. And the last, as above stated, on the 28th August, to Oversley Wood, near Wixford, when the following were amongst the plants taken :—*Viola canina*, (several plants in bloom,) *Spergularia rubra*, *Hypericum humifusum*, *Lotus corniculatus*, var. *hispidus*, *Vicia hirsuta*, *Vicia tetrasperma*, *Alchemilla arvensis*, *Fragaria vesca*, *Peplis portula*, *Carduus acanthoides*, *Campanula rapunculoides* (?), *Centunculus minimus*, and *Calamagrostis Epigeios*.

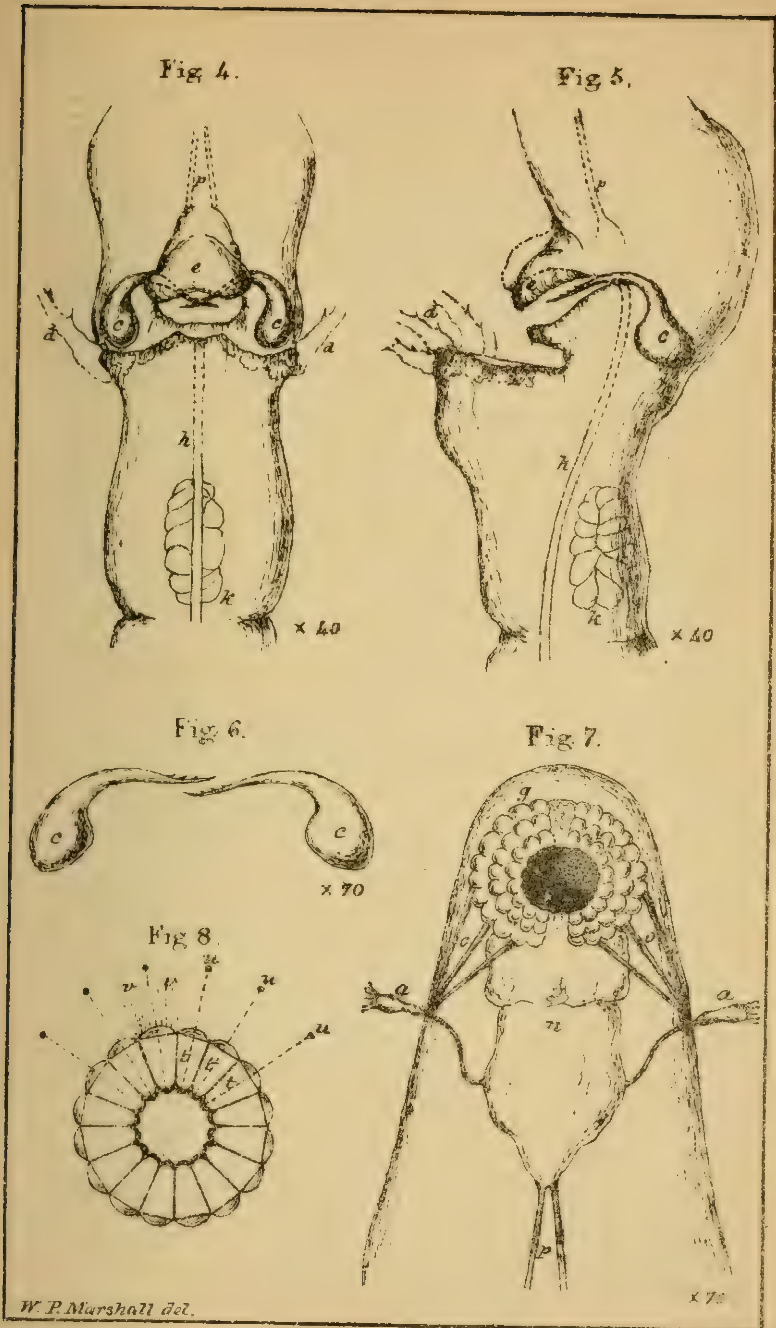
OSWESTRY AND WELSHPOOL NATURALISTS' FIELD CLUB AND ARCHÆOLOGICAL SOCIETY.—The fourth excursion for 1880 took place on Monday, September 6th, when the members and their friends met at Arddleen Station, and then proceeded to Llwyn. Here they were most hospitably invited to luncheon by Mrs. Manford, who also obtained permission for the party to visit the Old Hall at Penrhôs, formerly the residence of Sir John Owen, but now divided into cottages. It was built in the reign of James I., in the gabled black-and-white style of that period ; and the rooms inside are wainscotted with oak. Although it was once the residence of one of the chief families of Montgomeryshire, it is not at all in accordance with the modern ideas of comfort. On the way to Penrhôs another picturesque old house was visited, called "Tredderwen," covered by a very fine pear tree. After seeing Penrhôs Church, the party proceeded over Cefn Rhowniarth, (from which they obtained a grand view of the Meifrod valley and hills over Llanfyllin,) to Gaer Fawr. There is a very fine old camp with a commanding view of the surrounding country, embracing the plain of Shropshire, the valley of the Severn, and the Breidden range beyond, and then westward extending to the Arans and Cader Idris. They then descended to Guilsfield, and saw the church in its beautiful restored condition. It has a new oak chancel screen of great beauty, but it seems a pity that the dormer windows, which were such a picturesque feature of the old church, could not have been kept. After being refreshed with tea at the vicar's, they visited Trelyden Hall another fine black-and-white house, and arrived at length at Gungrog, whither they had been kindly invited to tea by Mr. Morris Jones, F.S.A. After doing ample justice to his hospitality, and having admired his rich collection of carved oak, the party separated, having had a most successful and enjoyable excursion. The weather was all that could be wished. Among the plants found, we may mention *Mentha rotundifolia*. *Carduus nutanti-crispus*, (a hybrid between the musk and welted thistles,) *Hieracium boreale*, and *Agrimonia odorata*.

Plate IX.



Leptodora hyalina.

Plate X.



Leptodora hyalina.

ON LEPTODORA HYALINA.*

BY W. P. MARSHALL, C.E.

This very interesting Entomostracon has attracted special attention from the circumstance that it has been entirely unknown in this country until the present year, having been previously found only on the Continent; but it has now been found in great abundance in the neighbourhood of Birmingham, at Olton Reservoir and Edgbaston Pool, the only places in this country where it has at present been met with. This little creature is also interesting from its remarkable transparency, which renders the internal structure unusually clear for examination; but this transparency and the absence of colour cause the object to be easily overlooked, notwithstanding its comparatively large size, extending to one-third of an inch in length. The circumstance of its not having been found here before may be partly due to this cause, as well as to the unusual depth below the surface of the water, four feet or more, at which it is found.

Fig. 1, Plate IX., is a drawing of the male Leptodora; and Fig. 2 the female, showing the eggs in the ovary. Fig. 3, drawn to a larger scale, shows the eggs in the external incubating chamber.

The singular modification in form and structure that is shown in Leptodora from the ordinary Entomostraca is of much interest. The most striking difference in its appearance from such Entomostraca as

References to Plates IX. and X.

a.—Anterior pair of antennæ, or antennules.
b.—Posterior pair of antennæ, or swimming arms.
c.—Pair of mandibles.
d.—Six pairs of limbs, or foot-jaws.
e.—Labrum, or upper lip, shown in its raised position by the dotted lines in Fig. 5.
f.—Carapace, forming the incubating chamber in female.
g.—Compound eye.
h.—Alimentary canal, or æsophagus.
i.—Intestine, or stomach.
k.—Heart.
l.—Ovaries.
m.—Oviduct, external opening into incubating chamber.
n.—Brain.
o.—Muscles giving rotation to the eye.
p.—Pair of nerve cords from the brain to ganglia situated above the mouth.

Fig. 1.—Male Leptodora, partly ventral view, showing the eye, brain, heart, alimentary canal, and stomach.
Fig. 2.—Female Leptodora, partly dorsal view, showing the two ovaries, external opening of oviduct, and incubating chamber.
Fig. 3.—Enlarged view of female showing mandible and mouth, and showing eggs deposited in the incubating chamber.
Fig. 4.—Front view of mouth, further enlarged, showing pair of mandibles and heart.
Fig. 5.—Side view of the same.
Fig. 6.—Pair of mandibles detached.
Fig. 7.—Eye further enlarged, showing division into two hemispherical eyes, muscles giving rotation to the eye, brain, and nerves branching to the two antennules.
Fig. 8.—Diagram illustrating the construction of the eye.

* Read before the Birmingham Natural History and Microscopical Society, November 18th, 1879.

Daphnia is that the carapace, which in Daphnia is so large as to enclose the entire body like a bivalve shell, is so much reduced in Leptodora as to present only a small incubating chamber in the female, only partially covering the body, and not more than one-fourth of its length ; and in the male this appendage almost vanishes, and is represented by a mere rudimentary projection. The first segment of the general integument, namely, the head covering, instead of lying close down, and terminating in a pointed beak as in Daphnia, is prolonged upwards in Leptodora, as a tapering pedestal, on the top of which is placed the large single eye. From the next segment of the integument, namely, the covering of the thorax, there is developed the enclosing casing of the incubating chamber, which is the same in structure and origin as the large enclosing casing of Daphnia, being a fold of the chitinous or horny integument which is doubled in upon itself, forming a double hollow wall to enclose the incubating chamber, as shown by the dotted line in Fig. 3. The eggs, when in this chamber, are entirely outside of the body, being between two walls, both of which are external surfaces of the general integument. In Daphnia this double fold is extended so far as to cover the entire body, but in the male Leptodora the fold is shortened so much as to become only a short projecting pouch, not covering the body, as seen in Fig. 1.

The swimming arms, or posterior antennæ, are greatly enlarged and prolonged in Leptodora, and have a remarkable development of powerful muscles. The extreme transparency of the object allows the form and attachments of these muscles to be seen very clearly, and with polarised light they present a singularly beautiful view.

The eye is a large spherical group of lenses, as shown enlarged in Fig. 7, Plate X. It is seated directly upon the brain mass, from the lower portion of which two nerves branch laterally to the anterior antennæ, and a pair of diverging nerve cords pass down to ganglia situated immediately above the mouth. The anterior antennæ, or "antennules," are very short in the female, terminating abruptly with a fringe of knobbed hairs, but in the male these antennæ are long and tapering to a point. The single eye of Daphnia and other Entomostraca was considered by Swammerdam (as quoted by Baird) to be a pair of ordinary hemispherical eyes united into one, but this view was not entertained by subsequent authorities. From the structure of the eye in Leptodora there however appears good reason to conclude that Swammerdam's view was correct; and it will be seen on consideration that such a view has a strong support from analogy. The eye in Leptodora is divided into two lateral halves by an interval at the base, where it is seated upon the brain, and also by a gap left open at the top, but the division at the top does not show in most specimens, and the impression is consequently given that, when the division is shown, as in the specimen from which Fig. 7 was drawn, it is a case of incomplete development, reverting to an earlier type of separate eyes.

The eye has a partial rotation round its centre, as in the case of Daphnia, and the three muscles shown on each side of the eye serve to give this motion. The general structure of the eye, as represented in the elementary diagram, (Fig. 8,) consists of a set of radiating conical tubes or "telescopes," $t\ t$, furnished each with a lens at the outer end, and a layer of black pigment to receive the image at the inner end; this pigment extending partly up the sides of each tube to separate them from one another, and giving the appearance of a black centre to the whole eye. Now, each of these "telescopes," if it were stationary, would be only suited for seeing distinctly an object in the one direction of the axis of the telescope, as shown by the dotted centre lines, $u\ u$, in Fig. 8; and other objects that were lying between these directions would be only imperfectly seen, or not at all visible. But, if each telescope, instead of being stationary, is given a range of lateral motion sufficient to take in that space, as shown by the shorter dotted lines, $v\ v$, there will be a direct vision of every object in succession, and this is exactly the motion that is possessed by the eyes of Leptodora and Daphnia, which constantly roll about through a small range of motion, by an apparently involuntary action. It is now suggested that this is an explanation of that singular motion of the eye, which is only needed in such cases as Leptodora and Daphnia, in which the head is rigidly fixed by the stiff armour-casing that does not admit of any lateral movement of the head for shifting the direction of sight of the fixed eye. In the numerous cases of insects with fixed hemispherical eyes studded with separate lenses, the neck is sufficiently flexible to allow of the head with its fixed eyes being moved about as required for obtaining complete vision in different directions.

The thorax of Leptodora is furnished with six pairs of limbs or "foot-jaws," ranged on each side of the mouth, for bringing food to the mouth; these diminish successively in size from the back pair, which are long and four-jointed, to the front pair, which are reduced to simple palpi. The mouth (drawn enlarged in the front view, Fig. 4, and the side view, Fig. 5) is surrounded by the foot-jaws, and covered by a large hood that moves up and down, forming the labrum or upper lip; the alimentary canal leads direct from the back of the mouth, and passes down in a straight uninterrupted line through two-thirds of the length of the abdomen, and then opens into an enlarged intestine or stomach. There has not been any trace of food observed to remain in this alimentary canal, which appears to act throughout simply as an æsophagus. At each side of the mouth is a curved pointed mandible, (drawn separately in Fig. 6,) each armed with three short barbs near the point, and the base of the mandible is bedded upon a mass of muscle. The pair of mandibles have a transverse movement in the mouth, their barbed ends crossing one another and then separating alternately, with an action similar to the mandibles of caterpillars and other larvæ; the barbs are on the upper side only of the mandibles, and do not interfere with their rubbing together in this movement. This pair of mandibles form in position a continuation of the line of limbs or foot-jaws, and they are to be looked upon morphologically as a greatly modified pair of limbs; in the same way as in the large crustacean, the lobster, one pair of limbs are modified in the opposite direction into the large crushing-claws.

The heart (shown in Figs. 4 and 5) is a large contractile vessel, situated at the back of the thorax, and consisting of a singular ribbed structure, formed in several lobes externally, but not having any divisions internally. It has a regular pulsation of about 150 beats per minute, each contraction appearing to flow upwards as a wave upon the surface of the vessel. The heart has an aperture at each end, but no circulating vessels have been traced from it, nor in any other portion of the body. Although, however, there is not any system of circulating vessels, the circulating particles do not travel promiscuously through the body, but appear to flow in tolerably definite channels in the different parts of the body, in which they can be observed.

The ovaries occupy a great length of the abdomen, extending from near the under side of the mouth to the commencement of the stomach, as shown in Fig. 2. There are two ovaries, one occupying the upper and the other the lower half of that space, and meeting in the centre, where the external openings of the oviducts are situated, at the third segment of the abdomen from the tail end, and corresponding with their position in Daphnia. The eggs are laid in the incubating chamber, formed by the enclosing carapace, (as shown in Fig. 3,) and have the appearance of being secured by means of some adhesive material to the inner wall of that chamber. In a living specimen that I frequently examined under the microscope during several successive days, although the rapid movements of the animal caused the tail end of the abdomen to be violently jerked in and out of the front of this chamber, there was not any motion perceptible in the eggs within the chamber, which remained quite stationary in their original position, appearing to be attached in their places within the chamber. In Daphnia the eggs remain loose and freely floating in the corresponding space of the incubating chamber, but they are prevented from escaping by the tail end of the animal blocking up the open bottom of the chamber, until the time when the hatched young are matured, and these are then allowed to escape by the tail being jerked forward, leaving the chamber open at the bottom. In one mounted specimen (drawn in Fig. 3) that was lent to me by a friend, there were originally seven eggs in the chamber, but four of these have subsequently become detached, and are now floating freely about the cell in which the specimen is mounted, three eggs alone remaining fixed in the chamber; and in this instance it may be supposed that the action of the mounting fluid in the cell has gradually loosened the attachment of the eggs by softening the adhesive material that held them in their places.

Leptodora, though only now discovered in this country, has been known for twenty years on the Continent. It was first discovered in 1858, in a moat round Bremen, by a chemist named Kindt and Dr. Focke; then in 1867 it was found both in Denmark and Norway; and in 1868 in a lake near Kasan in Russia, in Lakes Constance and Geneva in Switzerland, and in Lago Maggiore in Italy. There seems to have been now an interval of eleven years without any record of Leptodora being found elsewhere,* until the discovery of it in this country in the present year by the Birmingham Natural History and Microscopical Society.

* Since the above paper was read, the discovery of Leptodora in twenty-one different lakes of Italy has been announced by Professor Pavesi, of Pavia.

THE BIRDS OF GLOUCESTERSHIRE.

BY EDWARD E. EVANS.

(Continued from page 249.)

Starlings chatter from every vantage ground, whether on the tree top or the pine end of a house, and in the winter time gather into large flocks, and, settling on the arable land, prove themselves the farmer's best feathered friend. A Raven was shot near the Severn a little while since while feeding on a dead sheep, and is now in the hands of Mr. Webb, of High Street. It is a rare bird anywhere, but has been seen two or three times in the county, and is thought to breed in Dean Forest. A few pairs of Carrion Crows are to be seen at certain places up the Brimscombe and Chalford Valley, while the Jackdaw, Magpie, and Jay are all well-known birds and common enough. The "cawing" of the "noisy rooks in the tall elm trees" which they have made their home, is always a pleasant sound to me, as they are noisiest during the pairing season, which means that a new year has come, that the time of the singing of birds will soon begin, and with it longer days and bright, warm sunshine "to glad and cheer the heart of man." When strolling in a neighbouring wood we may be pretty sure to hear the "tap tap" of a Woodpecker, as it pecks away the rotten bark in search of insects, or laboriously works a hole in the solid trunk, where it may lay its eggs. The Green Woodpecker, Spotted Woodpecker, Lesser Spotted Woodpecker, and Wryneck or Cuckoo's Mate, are all to be found in our larger woods. The Wryneck is a very curious bird, and if disturbed in its nest puffs itself out, at the same time making a curious hissing noise something like that made by a snake, hence its name, "Snake Bird." I fear it is rapidly getting less common in our land. The Creeper, Wren, Nuthatch, and Hoopoe are all closely allied to the foregoing. The little Wren is to be seen everywhere, hopping inquisitively into our very doors and greenhouses in quest of flies, and when its family, which often reaches sixteen in number, requires its utmost exertion, it is very bold and pert. The Creeper and Nuthatch are sometimes seen, while that very magnificent bird the Hoopoe, with its splendid crest, was shot near Gloucester some time ago. The "Cuckoo's monotone" is heard everywhere, making the valleys echo with its well known but welcome cry. I don't know why it should be so plentiful in Gloucestershire, but it is very common. I once remember no less than four at one time in a large elm on our lawn, what the matter was I could not well make out, but they certainly made a tremendous noise, probably hen birds were scarce that year and the males were quarrelling over one poor hen. It was never my good fortune to find a nest with a Cuckoo's egg in it, but still it does breed here as I frequently hear of it in Wagtails' nests. The common Kingfisher is fairly plentiful up the Brimscombe Valley, and it is but few seasons in the year that I cannot be sure to see one at a certain place in our mill yard. A hole in a wall in the tail of a water-wheel was its breeding place for several years. It is beautiful when stuffed, but still more beautiful does this rainbow bird seem when alive and within two yards of you, as I have often watched it from a window. It will dive into the water and seize a minnow and be off in an instant, returning again soon after to the same twig. Those glorious birds of summer, the Swallows, whose arrival here we long for and hail with delight, are represented with us by four species, viz., the Common Chimney Swallow, Martin, Sand Martin, and Swift. They are easily distinguished by a little careful observation. Those with the long tail feathers and an almost black back are the Swallows, who are generally the first to arrive. Those with purple back and a white patch over the tail are easily distinguished as the Martins, while the little Sand Martin and the Swift can be readily recognised by their small size and brown colour, and the rapid speed with which the latter cleaves the air. This spring I saw two Swallows on the 2nd April, on the 3rd saw at least fifty, on the 10th the Martins and Sand Martins had also arrived, and on the 20th came the Swifts, who are always the last to arrive and the first to go. Nearly the whole time they are here is occupied with the process of nesting. In the latter end of September I saw young Martins still in the nest. By September 9th the Swifts were gone, the second week of October was enough for the Martins, while the Swallows were not all gone until the 24th of October. One more bird belonging to this great order and I will pass on to the Rasores. The Nightjar is fairly common, especially on the borders of woods and plantations. As it is always about at dusk and therefore not often seen, except by those who are on the look out for it, it is perhaps thought to be more rare than it really is.

Order 3.—Rasores or Scratchers.—The Queest, Stock Dove, Rock Dove, Turtle Dove, and Passenger Pigeon head this order, and are fairly abundant. The Passenger Pigeons, which we read of as occcurring in myriads in America, breaking the branches with their weight, sometimes also pass over Stroud in immense flocks. They settle on open lands for the purpose of feeding, retiring to the larger woods as night draws near to roost. The Pheasant is well known to most of us, both on the table and in most plantations. The Common Partridge is abundant, while the Red-legged Partridge, or Frenchmen as they are sportingly called, are also found in the less frequented districts. The Quail has been shot near Frampton Mansel, and I have myself several times heard it around Brimscombe, though I have never had the pleasure of seeing it. The Grouse and Capercailie belong to this order, but as in Gloucestershire we cannot boast grouse moors, these fine birds cannot be entered in our list. This is the least numerous of the five orders, only seventeen in all.

Order 4.—Grallatores or Waders.—The Golden Plover is to be found on Frocester Hill, and very probably many other similar localities, especially in arable fields; while large flocks of the Lapwing or Peewit, looking very beautiful as they whirl about in the sunlight, are by no means uncommon. The Stone Curlew, the last of this family, has also been seen. The Heron, with its long neck, small body, and still longer legs, is often met with. They are certainly most curious looking creatures, whether flying or standing on one leg, watching for an unwary fish, but still very fine, handsome birds withal, especially a full-grown, ten-year-old bird, for as they grow older they get lighter in colour, and the crest and neck feathers grow longer. They are constantly to be seen flying up the valleys, and only the other day one flew up our stream not a hundred yards up in the air. This bird was shot at Chalford, and is probably three or four years old. At Aust Cliff last year I saw several Curlews on the mud.

The exceedingly rare bird the Spoonbill, now almost extinct in our islands, has been seen in the county, though I don't know where. The Spotted Redshank, Bartram's Sandpiper, and the Avocet, have also been found. Bartram's Sandpiper was shot on the banks of the Wye some time ago, while the Avocet or Cobbler's Awl (so-called from the curious shape of its bill) used at one time to frequent the Severn, whose muddy banks are well suited to its habits. It is now, as are also the other two, very rare indeed, scarcely a single specimen of either having been found for years. The Common Sandpiper, Woodcock, Great Snipe, Common Snipe, Jack Snipe, and Temminck's Stint, have all been seen in this district. A Woodcock's nest with four eggs was found by a keeper of a neighbouring wood about the latter end of March of this year. I mention this as it is a rare occurrence. Temminck's Stint, another very rare bird, was shot at the Dark Mill at the Bourne last year, and is now in my possession. There is one very noteworthy feature about the members of this family; on the end of their long bills there is a very tender, sensitive membrane. When wading on the mud in search of food they push their bill down into the mud, and by the aid of this membrane are enabled to discover the worms, small shell-fish, insects, and larvæ on which they subsist.

The "scrape, scrape" of the Landrail is heard from many a corn and grass field. This year a pair nested twice in our grass, which was up for mowing. I don't know how or when the male bird rests, but I counted that their peculiar scraping call was repeated from 100 to 112 times per minute, and this, without stopping, for hours together. Much as I liked him for coming so near to me, I really should have liked him much better had he not kept me awake on several occasions by his unceasing rattle. I did not notice, what many others have, the ventriloquial powers of this bird, though I succeeded in calling both the birds within a couple of yards of me by drawing a nail over a horse comb, and so imitating the call of the male bird. The call, when heard quite close to, is accompanied with a peculiar drumming sound. The Water-rail is sometimes to be seen. Last winter I saw three on our own premises, and at one time it used to nest with us. The Moorhen is familiar to most of us, for there is scarcely a pond anywhere without its pair or two of these birds. The Coot also is seen on larger ponds, and those more remote from civilisation. Both these birds fly about a good deal at night, changing their feeding grounds, and a Coot was once brought to me which had dashed itself against a window in the Brimscombe Wesleyan Chapel, breaking not only the glass but its own neck and falling inside. I cannot say why it was not able to see where it was going, unless it had been frightened by something. The Coot and the Grey Phalarope, are the only members of the lobe-footed kind we have. They have peculiar half-webbed feet. The Moorhen has no web, and consequently does not get along very well in the water, but when in danger takes to flight or dives. This brings us to our last order, which embraces the sea birds, and although many of them, I have no doubt, are to be seen on the Severn, yet I have never had the opportunity of noting them.

Order 5.—Natatores or Swimmers.—First in this large order come the Geese. Large flocks of Geese fly over during winter to feed on the young corn on the top of the hills, and where, notwithstanding all the vigilance of the old ganders, many are shot. The Grey Lag Goose, the original of our domestic goose, I know for certain has been shot, and I have no doubt many others are to be obtained with a suitable weapon by careful watching, but it is rather cold work to spend hour after hour on the common waiting for them. They inhabit the borders of ponds, lakes, and inland seas, and are very shy and wary. As the flock rises from the ground or water it forms into a V, the oldest gander leading. As the birds fly to and from their feeding grounds they utter loud cries, which may often be heard during winter. The Wild Duck or Mallard, the original of our common duck, is the commonest of all, while next to it comes the Widgeon. On the 26th December last I had the pleasure of seeing nine Widgeon whirl round and round, finally settling in our pond; after staying a short time they flew away. I believe these two kinds comprise a chief part of the vast flocks of ducks which visit us every winter. The Shieldrake, Shoveller, Pintail, Teal, Tufted Duck, Pochard, and Scaup Duck are also found; the two latter having been shot in Woodchester Park. The Little Grebe, Dabchick, or Diedap, is plentiful, and may be seen on most large ponds. It is a highly interesting little bird, being very quick, and a most expert diver, but it plays sad havoc with the trout spawn, and, consequently, is set down by keepers as vermin. But it does not exclusively live on spawn, as I know that a stickleback was taken from a bird shot on our pond this fall. It has the power of sinking itself in the water, leaving only the head and tail out, and can remain under an incredible time. The Great Crested Grebe, of which ladies' muffs were made a little while ago, is at the head of this family, though I do not know of its having been seen here. One of the most handsome of our British birds is the Great Northern Diver. It is a truly grand bird, often weighing 14lbs. and reaching 2ft. 6in. in length. Two of these birds have been shot in the Berkeley Canal, near Purton.

A Cormorant was shot in the Brimscombe Basin during the winter of 1876 or 1877, and is now, I believe, in the possession of Mr. Kingdom. A Gannet or Solan Goose was caught by a shepherd in a field on the borders of Wiltshire and Gloucestershire, near Rodmarton. I can only account for it being there by it having been driven inland by a storm, as they generally inhabit the well known Bass Rock. The Kittiwake, Arctic Tern, and Common Tern have all been shot here, while flocks of the Common Grey Gull and Herring Gull are seen in the winter on the tops of the hills, generally foreboding stormy weather. A Glaucous Gull was shot on the Severn some years ago. It is a large and beautiful bird, and is also very rare. The last bird I have to mention is, perhaps, the rarest of all. The Fork-tailed or Leach's Petrel is the only one of Mother Carey's Chickens that has ever favoured our county.

Colonel Montagu, in his History of British Birds, gives the total number of species as 380, Morris 360, Yarrell 355. Of these at least eighty are either extinct or so rare as scarcely to be considered regular British birds, leaving a total of 280. Towards this number I have been able to record 146 species, or rather more than half. At first sight this may seem rather a small proportion, but when we remember that nearly all of them have been seen within the last four years, it is by no means a poor proportion. Again, there are numbers of the various species of Geese, Ducks, Shore Birds and Gulls which I have no doubt are found on the Severn, but which I have had no opportunity of verifying. I shall endeavour to look them up at some future time. Fifty of them are comparatively rare and nineteen very rare.

Such then is our list of the "Birds of Gloucestershire," and though our British birds are not so gaudy as those of warmer climes, yet they are none the less beloved nor any the less interesting for being dressed in sombre hues, which are, however, more harmoniously distributed, while their songs are unrivalled throughout the world.

LIST OF DESMIDIEÆ FOUND IN SUTTON PARK, WARWICKSHIRE.

[*The Species given in italics have not hitherto been recorded in England.*]

Hyalotheca dissiliens.
,, mucosa.
Didymoprium Borreri.
,, Grevillei.
Desmidium Swartzii.
Sphærozosma excavatum.
Micrasterias Americana.
,, ,, β.
(1) ,, *angulosa.*
,, crenata.
,, Crux-Melitensis.
,, denticulata.
,, fimbriata var.
,, Jenneri.
,, papillifera.
,, rotata.
,, truncata.

Euastrum ansatum.
,, binale.
,, Didelta.
,, elegans.
,, oblongum.
,, rostratum.
,, verrucosum.
Cosmarium bioculatum.
,, biretum.
,, Botrytis.
,, Brebissonii.
,, conspersum.
,, Cucumis.
,, ,, β.
,, Cucurbita.
,, margaritiferum.
,, pyramidatum.

(1.)—Micrasterias angulosa. Hantsch in Rabh. Alg. Eur., No. 1,407. Archer, Mic. Journ., 1876, (Ireland.)

(2) Cosmarium *pseudo-pyramidatum*
,, Ralfsii.
,, tinctum.
,, undulatum.
Xanthidium armatum.
,, cristatum.
Arthrodesmus convergens.
,, Incus.
Staurastrum asperum.
,, dejectum.
,, dilatatum.
,, hirsutum.
,, margaritaceum.
,, muricatum.
,, muticum.
Staurastrum orbiculare.
,, polymorphum.
,, punctulatum.
,, sexcostatum.
,, spinosum.
,, spongiosum.
Tetmemorus Brebissonii.
,, granulatus.
,, lævis.
Penium Brebissonii.
,, closterioides.
,, Cylindrus.
,, Digitus.
,, interruptum.
,, Jenneri.
,, margaritaceum.
(3) ,, *Nägelii.*
(4) Penium *Navicula.*
Docidium clavatum.
,, Ehrenbergii.
,, nodulosum.
,, truncatum.
,, ,, var.
Closterium acerosum.
,, acutum.
,, attenuatum.
,, Cornu.
,, costatum.
,, Dianæ.
,, didymotocum.
,, ,, var. [Baileyanum.
(5) ,, *directum.*
,, intermedium.
,, juncidum.
,, Leibleinii.
,, lineatum.
,, Lunula.
(6) ,, *Pritchardianum.*
,, rostratum.
,, setaceum.
,, striolatum.
Spirotænia condensata.
,, obscura.
Pediastrum Boryanum.
,, Tetras.
Scenedesmus obliquus.
,, obtusus.
,, quadricauda.

September, 1880.

A. W. WILLS.

ORIGIN OF THE ROCKS AND SCENERY OF NORTH WALES.

BY J. J. HARRIS TEALL, M.A., F.G.S., ETC., LATE FELLOW OF ST. JOHN'S COLLEGE, CAMBRIDGE.

(Continued from page 241.)

We turn now to the second portion of our subject, the origin of the existing scenery. That the hills and the valleys are not directly due to the disturbances which have affected the district is proved beyond the shadow of a doubt by a glance at any accurate geological section. Snowdon, for instance, lies in a synclinal, so that if no material had been removed the land surface to the N.W. and S.E. would be

(2.)—Cosmarium pseudo-pyramidatum. Lundell, Desm. Suec., 1871. Archer, Journ. Bot., 1874, (Ireland.)
(3.)—Penium Nägelii. Bréb. in Prit. Infus., 1861. Näg, Ein. Alg., 1849, (Ireland.)
(4.)—Penium Navicula. Bréb. Liste Desm., 1856, (Ireland.) Archer, Nat. His. Rev., 1858, (Ireland.)
(5.)—Closterium directum. Archer, Mic. Journ., 1862, (Ireland.)
(6.)—Closterium Pritchardianum. Archer, Mic. Journ., 1862, (Ireland.)

vastly higher than Snowdon itself. But this is not all that an accurate section proves. By completing the curves we can estimate roughly the amount of material removed, and in this way prove that thousands of feet of solid rock have been completely swept away. The only agent with which we are acquainted, capable of performing this work, is moving water, whether in the form of rain, rivers, glaciers, waves, or oceanic currents, and we are, I submit, driven to conclude that this is the agent which has effected the removal. We need have no hesitation in granting the truth of this when we remember that the stratified rocks themselves are evidence of the potency of this agent.

But how has the existing distribution of hill and dale been brought about? A careful examination of any valley, such an one for instance as the Pass of Llanberis, is quite sufficient to convince any unprejudiced person that the rocks on either side were once continuous; that the valley, in fact, at one time did not exist. It is further sufficient to prove that the formation of the valley was not due to the cracking and opening of the earth's crust, but to the removal of the material formerly occupying the valley; for the rocks on either side and in the bed of the valley (I am thinking now more especially of that portion of the Pass of Llanberis in the neighbourhood of the old village of Llanberis) bear to each other a relation similar to that which the two sides and bed of a newly-made railway cutting bear to each other.

What is the agent which has hollowed out the valley? I answer again without hesitation, moving water. The stream now flowing down the valley tends in many places to deepen it, and this represents the process by which the valley has been formed. In looking at the enormous size of a valley such as the one we are considering, and comparing this with the power of the existing stream to deepen its bed, we are struck with the utter insignificance of the latter, and we experience a great difficulty in believing that such a cause could produce such an effect. Nevertheless, when we reflect that the amount of denudation represented by the formation of this valley—and indeed all the valleys of North Wales put together—is absolutely insignificant when compared with the denudation which is proved to have taken place by the geological sections, when viewed on the large scale; and when we reflect further that the stratified rocks, of which the earth's crust is composed, give unmistakeable evidence of having been formed by water action, our difficulty vanishes, and we find ourselves firm in the faith that valleys owe their origin to this agency.

If we imagine the valleys of North Wales filled up, as they must have been, before the existing streams began their work of denudation, we see that the country instead of being characterised by rugged mountains, jagged ridges, and steep precipices would really be tame and uninteresting. Under this state of things a person might walk without let or hindrance from Moel Hebog to the high land overlooking the sea near Conway, without ever rising far above, or sinking far below, a height of 2,500 feet. To the left of his line of march the country would sink towards the N.W., while on his right it would stretch for many miles at nearly the same level. A geological map of such a surface would not differ materially from the present geological map, for the same rocks would crop out in the same order. Out of such a surface we believe the existing scenery to have been carved by the action of rain and streams, frosts and glaciers, through many geological epochs. Three factors, then, have to be considered in determining the origin of the existing scenery. Firstly, *the direction of the water courses as determined by the original form of the ground ;* secondly, *the character of the rocks of which the country is composed;* and, thirdly, *the time during which denudation has been in operation, and the nature of the climate during that time.*

The due consideration of any one of these facts would require a paper as long as the present one. I can, therefore, only call your attention to one or two points. No traveller in North Wales can fail to be struck by the marked influence of rock structure on scenery. Many a vertical precipice is seen to be due to the coincidence between the direction of the valley and the direction of the joint planes in the rock; and many a jagged ridge shows a continued repetition of similar outlines, due also to the influence of joints. Then, stratification frequently produces a characteristic appearance. When it is horizontal, or nearly so, it presents the appearance of cyclopean masonry in ruins. More frequently it dips in a definite direction, and at a high angle, scoring the face of the precipice with parallel lines ; occasionally, as in the frightful precipice overhanging the dark and gloomy Llyn Llydau, it takes the form of a series of graceful curves. On all sides we find abundant evidence of the connection between rock structure and scenery. Indeed, it is not too much to say that, just as the work of a sculptor is determined as much by the character of the material in which he works as by the tools he uses in fashioning it; so the scenery of a country is determined as much by the nature of the rocks that compose it as by the denuding agents, the sculpturing tools of nature, that act upon it.

In considering the third factor, time and climate, and its importance in determining the scenery of North Wales, it is necessary to bear in mind two facts. First, the time during which North Wales has been subject to denudation is enormous. Off and on the denuding agents have been at work since the Silurian period, for Cambrian* rocks occur as fragments in Silurian deposits. Secondly, the climate during that time has not been constant. Variations, both in the amount and in the nature of the precipitation have taken place. Fortunately, we have at present in the district, abundant proof of the truth of this latter statement, and also of its importance as bearing on the origin of scenery.

In the course of my rambles I have frequently had the opportunity of noticing the effects of glacial action. I have seen them near the termination of the Rosenlaui and Grindelwald glaciers, on the surface of rocks that have only been exposed to the light of day by the retreat of

* The term Cambrian is used as Sedgwick proposed ; so that it includes the Lower Silurian of many geologists.

the glaciers during the last ten or twelve years. I have seen them on the sides of the magnificent valley of the Aar at a distance of many miles from the termination of the existing glacier, and I have seen them in the valleys of Scotland, and in those also of the west and south of Ireland; but in no place have I been more struck by them than in the valleys of North Wales. The Pass of Llanberis is, indeed, very well adapted to illustrate the effects of a great volume of ice grinding over rocky surfaces, for right in the middle of the valley, and consequently in the path of the ice-stream, are one or two huge mounds* of rock. These have evidently done their best to stop the onward progress of the ice, and in the attempt have been rounded, smoothed, and grooved from base to summit. All their angles have been rubbed off in the most ruthless manner, and now they stand out as great hummocky masses, without any distinctive character, striking proofs that we cannot account for the existing scenery of Wales on the supposition that the climate has always been what it is at present. The ice episode in the history of Wales did not merely produce a rounding and grooving of the rocks; as it passed away the retreating glaciers strewed the surface with perched blocks and morainic *dêbris*. These may be seen on every side, but perhaps nowhere better than on those mounds of rock which project into the centre of the Llanberis valley.

I must now close this paper, notwithstanding the imperfect character of all its parts, and more especially of that part which treats of the origin of Welsh scenery. In conclusion, I should like to say one word on the influence of geological studies, and incidentally of scientific studies in general, on the æsthetic faculty. Some persons have the feeling that it is something like sacrilege to pry too closely into nature's secrets. They have an aversion to geological studies, for instance, because the effect of such studies is to destroy certain emotions which a person ignorant of geology experiences when in the presence of such scenery as that of North Wales. That the tendency of geological studies is in this direction, I do not for one moment deny, but I contend that it would be nothing less than stupid folly to allow such considerations to check us in the pursuit of science, and for the following reasons:—First, the same argument might be used against almost every advance of knowledge. If emotions, which are based on ignorance, are of such a sacred character that they must not be touched, then the savage should make no attempt to raise himself, for he stands in stupid awe and wonderment before the simplest natural phenomenon, and believes it to be the work of some deity as capricious as himself. Secondly, the progress of science, although it destroys certain emotions, does not leave our æsthetic faculty unprovided with nutritious food. It continually leads to the recognition of wider and yet wider truths, and thus while extending the range of our intellectual vision, tends to purify and enlarge the character of the emotions we experience when contemplating natural phenomena.

* These mounds are projections from the left bank of the valley; not isolated masses as might be supposed from the expressions used above.

A SIMPLE MODE OF AERATING SMALL MARINE AQUARIA.

Of the three modes of maintaining the water of an aquarium in good order, viz.—by vegetation; by circulation of the water; or by injecting air; the first generally fails to maintain the balance if the aquarium be at all crowded, whilst the second involves such expense as to generally prevent its adoption. The difficulty which has hitherto prevented the adoption of the injection of air has been the necessity of some mechanism for maintaining it continuously. I have, however, devised a plan which is simplicity itself, and can be constructed, for a few shillings, out of glass and india-rubber tubes. The principle is that known as the "Trompe." A stream of water falls in drops down a tube about ¼in. in diameter, and furnished with a funnel at the upper end. These drops of water falling down the tube carry air with them. The bottom end of the tube enters the top of a cylinder, from the top of which also issues the compressed air, by a tube, and is conveyed by a tube to the aquarium. From the bottom of the cylinder a tube conveys the water, and being bent upwards, discharges the water at a certain height above the bottom of the cylinder. When the apparatus is in working order, the vertical difference in height between the level of the water in the cylinder and the discharging orifice, is exactly equal to the depth at which the air-tube discharges the air into the aquarium. The aquarium being higher than the cylinder, it is impossible that the water used, which may of course be fresh water, should get into the aquarium. A 5ft. fall is sufficient to drive the air to a depth of 6in. in the aquarium, and, as I have found from experiment, six times the volume of water used, though this will, of course, vary according to the depth to which it is injected. In my own apparatus, one gallon of water will keep up a continuous stream of bubbles, rising through the aquarium for from two to four hours, keeping it perfectly clear and bright, and evidently delighting the animals. The small quantity of water used renders it practicable even where the water-works are not at command. It is only necessary to have two receptacles for the water, one above and the other below, and when the water has all run over into the lower one, to change them. In order to use a very slow current of water, it is advisable to insert, just below the funnel, a double syphon, which prevents air rising up the tube, and where the water collects until its accumulated force is sufficient to drive the air down the tube. This air injection may also be used to produce a circulation of the water at the same time as aerating it. Thus, let two vessels, A and B, be connected by a narrow tube below the water level, and let the tube terminate in A, by an inverted funnel. Then, if the discharge of bubbles take place underneath this funnel, they will rise through the tube and carry a certain quantity of water with them. A piece of glass tube bent into a syphon will convey the water back again into A. Any number of vessels can be interposed between B and A by syphons, and the current will be maintained through the whole. I shall be pleased to show the apparatus at work to anyone interested in the subject.—C. J. Watson, 34, Smallbrook Street, Birmingham.

Reviews.

The Land and Freshwater Shells of the British Isles. By RICHARD RIMMER, F.L.S. London: David Bogue, 1880. Price 10s. 6d.

THIS book is dedicated "to those of my fellow countrymen among the working classes who wisely employ their leisure hours in the pursuit of useful and elevating knowledge," and we feel sure that, independently of this graceful compliment, it will speedily be in the hands of very many of them, for it has many commendable points of excellence and originality.

First, it is illustrated by a process new to science and to its literature —the "Albertype"—the plates being printed from photographs, so that we have a veritable reproduction of the shells as accurately beautiful in outline as the originals, making identification comparatively easy, though we will not pretend to say that they will make anyone an expert instanter; experience and comparison of forms alone can do this.

There are evidences in these illustrations of a degree of perfection which greater knowledge and experience will doubtless bring to bear upon the process. The plates illustrative of the larger species of course may be expected to come out well, but take as a crucial example Plate VIII., and we think every conchologist will agree with us that it is a splendid triumph of modern art as applied to this purpose; it is to be expected that the minute forms will not give detail, being life size, but shutting out of this plate the hispid Helices and the minute forms, *Helix rupestris* and *H. pygmæa*, there is not left a picture which the greatest novice could not identify his shells by. So far the illustrations.

Next the matter. This is written in a clear, concise form, unencumbered by technicalities likely to embarrass the learner. There are figures pointing out the various terms used in describing a shell, directions for collecting and mounting the specimens, and at the end of the work—excellent provision—a complete glossary, giving the pronunciation and meanings of the terms used in conchology.

And lastly, we must not forget to mention what strikes us as being worthy of note, as showing the kindly interest the author takes in the spread of that love of nature which he desires to foster. He does full justice to the labours of a large circle of amateur conchologists, the names of nearly every one of whom we are familiar with as collectors, workers, and contributors to various publications. This is as it should be, and we congratulate Mr. Rimmer in having published a book which recognises modest though painstaking labour in this branch of Natural History.

We bear willing testimony to the accuracy of the enlarged drawings of the species of *Vertigo* (Plate X.) by Mr. H. Groves. They are well done, and will be a great help to the identification of this genus of minute shells. We can only add our wish to the author's, that the book may become another means of inducing many who are hesitating on the borderland to enter with us the pleasant ways. It is published at a price that will bring it within the reach of those of modest means, and as Mother Nature is not a fastidious tutor, bestowing her favours—like some of her children—on those only who can show the passport of wealth, we say again "enter thou," and remember, as has been well and truly sung—

> I care not, fortune, what you do deny,
>   You cannot rob me of free nature's grace.
> You cannot shut the windows of the sky,
>   Through which Aurora shows her brightening face.
> You cannot bar my constant feet to trace
>   The woods and lawns by living streams at eve.

G. S. T.

The Crocodilian Remains found in the Elgin Sandstones, with Remarks on the Ichnites of Cummingstone. By T. H. HUXLEY, F.R.S. Geological Survey Memoir, 58pp., and fifteen large 4to. plates. Stanford. Price 14s. 6d. 1877.

THIS work forcibly illustrates the value of palæontological research in determining the age of any series of stratified rocks. In the north of Scotland on the east side of the Moray Firth, the coast between Burghead and Stotfield Head, a distance of nine miles, is composed of yellowish sandstones, which extend inland to the town of Elgin; they rest upon the Old Red Sandstone, which in turn reposes further south on metamorphosed Lower Silurian strata. The Elgin Sandstones have yielded a few organic remains; some of these Agassiz in 1845 referred to a fish which he named *Stagonolepis Robertsoni*; but when better and more complete specimens were afterwards obtained, it was suspected by Dr. Gordon, of Elgin, and others, that the scales and bones which they had found must belong to animals of higher organisation than fishes; many footprints were also noted on the Elgin Sandstones, and undoubted specimens of a small quadrupedal vertebrated animal were found, which Dr. Mantell named *Telerpeton Elginense*. Up to 1858, however, no one suspected that these beds could be of other than Devonian age; in that year all the specimens were entrusted to Professor Huxley for examination, and he not only found that the *Stagonolepis* was really a crocodilian reptile and not a fish, but that there were associated with it bones of at least one other reptile, which he named *Hyperodapedon Gordoni*. From his examination of the last-named fossil, Professor Huxley wrote in 1858: "Its marked affinity with certain Triassic reptiles, when taken together with the resemblance of *Stagonolepis* to Mesozoic *Crocodilia*, leads me to require the strongest stratigraphical proof before admitting the Palæozoic age of the beds in which it occurs." About ten years later, remains of *Hyperodapedon* turned up in the undoubtedly Triassic beds of Coton End, in Warwickshire, in similar beds at Sidmouth in Devon, and in Central India; Sir R. Murchison then wrote in the fourth edition of his "Siluria," (1867,) "to such fossil evidence as this the field geologist must bow; and instead, therefore, of any longer connecting these reptiliferous sandstones of Elgin and Ross with the Old Red Sandstones beneath them, I willingly adopt the view established by such fossil evidence, and consider that these overlying sandstones are of *Upper Triassic* age." But Professor Judd in his admirable researches on the Secondary Rocks of Scotland, (Quarterly Journal of the Geological Society, Vol. XXIX., p. 97,) has been able to show that the evidence derived from the examination of these rocks in the field is also conclusive as to their really being of Keuper age. The district round Elgin is tremendously faulted, and the rocks are so overlaid by drift that no clear sections are there obtainable; but when we cross to Dunrobin, on the north side of the Moray Firth, we find the same yellow sandstones conformably overlaid by the Lias, and resting quite unconformably on the Old Red Sandstone. In the memoir, Professor Huxley describes, in his usually masterly manner, the scutes, vertebræ, teeth, and bones of *Stagonolepis Robertsoni*. It must have been a reptile twelve or fourteen feet long, resembling the existing Nile crocodile, or the caimans or jacares of tropical rivers. The footprints from the Cummingstone quarry near Elgin are not associated with any fossil remains, and the author is not able to refer them certainly to any known form. There can be no doubt but that the Trias is worthy of a far more minute study than it has hitherto received at the hands of Midland geologists; the sandstones both of Lower and Upper Keuper age, such as occur at Inkberrow in Worcestershire, for example, are often covered with markings of most varied forms, and invariably yield evidences of life when carefully examined. This able work of Professor Huxley's should be a help to all workers in such strata; the admirable plates especially will give them a good idea of "what to look for."

W. J H.

The London Catalogue of British Mosses and Hepaticæ. Second Edition. London: David Bogue. 30 pp. Price 6d.

This is a great improvement on the former edition, the addition of a full list of the British Hepaticæ will be a great boon to all collectors of these plants. As it is printed in single columns to a page it will be very convenient for interleaving and will be useful not only as a check list, but also as a note book for the working Botanist.

J. E. B.

A Review of the British Characeæ. By Henry and James Groves London: West, Newman and Co. Price 2s.

This valuable addition to our cryptogamic literature is reprinted from the "Journal of Botany" for 1880, and offers to British botanists a reliable and useful aid to the study of this much-neglected class of plants. A full account is given of the various British botanists who have published their remarks on the genus, from Gerarde down to the latest papers that have appeared in the "Journal of Botany." The synonyms of each species from both British and foreign authors is also given; the value of these will be felt by every student of botany. The monograph is illustrated by four beautifully-executed plates, drawn from authentic specimens, giving the natural size of each species described, together with magnified representations of the critical minutiæ. These plates reflect the highest credit on the authors. The low price at which the review is published will place it within the reach of all working botanists, to whose attention it can be recommended with confidence.

J. E. B.

An Elementary Text-Book of Botany, translated from the German of Dr. K. Prantl, Professor of Botany in the Royal Academy of Forestry, Aschaffenburg, Bavaria. The translation revised by S. H. Vines, M.A., D.Sc., F.L.S., Fellow and Lecturer of Christ's College, Cambridge. With 275 woodcuts. London: W. Swan, Sonneschein, and Allen.

This is, without question, the most valuable elementary text-book of botany in our language. Its learned author wrote it to serve as an introduction to the more voluminous "Lehrbuch" of Sachs, which it resembles in its mode of treating the subject. It is divided into four parts, the first dealing with morphology, the second with anatomy, the third with physiology, and the fourth with classification. It is admirably done, and leaves little to be desired, though, no doubt, a few minor inaccuracies need correction, which the second edition, soon to be called for doubtless, will afford an opportunity of making. The translation is so good, the book reads as though it had been originally written in English. The illustrations, some of which are after Sachs, are excellent.

E. W. B.

METEOROLOGY OF THE MIDLANDS.

THE WEATHER OF SEPTEMBER, 1880.

BY W. JEROME HARRISON, F.G.S.

The main characteristics of the weather of this month are readily indicated; the first nine or ten days were warm and fine, temperature on the 4th rising to between 80° and 90° at most stations and attaining the maximum for the year; then followed ten or twelve days of heavy rain, flooding some districts heavily and spoiling much corn either in the field or the rick; clearing up however about the 22nd, the weather of the last week was fortunately warm and dry, though with foggy mornings Severe thunderstorms occurred on the 14th and 18th. Lunar halos were seen at Oxford on the 11th, and at Loughborough on the 13th and 17th. The most striking feature of the weather of the month is without doubt the high temperature on the 4th; with the exception of 1868, there is no similar record within the last fifty years.

STATION.	OBSERVER.	RAINFALL. Total for M.	RAINFALL. Greatest fall in 24 hours.		RAINFALL. No. of rainy d.	TEMPERATURE. Greatest ht.		TEMPERATURE. Great'st cold	
		In.	In.	Date.		Deg	Date.	Deg	Date.
GLOUCESTERSHIRE.									
Cheltenham	R. Tyrer, Esq.	4·51	·99	14	14	83·5	4	40·1	7
Stroud	S. J. Coley, Esq	3·61	·86	15	11	79·0	5	41·0	20
SHROPSHIRE.									
Haughton Hall, Shifnal	Rev. J. Brooke	8·53	·90	15	18	60·0	4	40·0	19
Woolstaston	Rev. E. D. Carr	2·19	·53	15	17	60·5	4	42·0	19
Leaton Vicarage	Rev. E. V. Pigott	1·73	·37	12	17	75·0	2	36·7	8
More Rectory, Bishop's Castle	Rev. A. Male	2·76	·77	15	14	82·0	4	89·0	7
Bishop's Castle	E. Griffiths, Esq.	2·74	·75	15	14	83·0	4	40·0	8
Larden Hall	Miss F. R. Boughton	3 56	1·10	15	18				
Adderley Rectory	Rev. A. Corbet	2·76	·70	12	16				
Cardington	Rev. W. Elliot	2·82	·79	15	14				
HEREFORDSHIRE.									
Stoke Bliss	Rev. G. E. Alexander	2·80	·59	12	13	80·0	4	43·0	19
WORCESTERSHIRE.									
Orleton, Tenbury	T. H. Davis, Esq.	3·45	·88	14	15	84·8	4	38·3	20
West Malvern	A. H. Hartland, Esq.	4·22	·88	14	14	87·5	4	4?·0	18
Pedmore	E. B. Marten, Esq.	3·70	·85	12	13	90·0	4	35·0	7
Longlands, Stourbridge	J. Jeffries, Esq	3·54	·74	12	15	86·0	4	41·0	7, 19
Dennis, Stourbridge	Mr. C. Webb	3·82	·73	13	13	85·0	4	39·0	7
Evesham	T. J. Slatter, Esq.	4·93	1·33	16	18	83·5	4	47·7	20
STAFFORDSHIRE.									
Beacon Stoop, Weaver Hills	C. L. Wragge, F.R.G.S.	4.13	·94	16	14	76·5	4	40·2	10
Dudley	Mr. J. Fisher	3·41	·88	15	11	88·0	4	44·0	80
Kinver	Rev. W. H. Bolton	3·26	·75	14	15	81·9	4	39·0	7
Walsall	Mr. N. E. Best	3·98	·84	11 & 14	16	81·0	4	41·0	19
Grammar School, Burton	C. U. Tripp, Esq.	3·09	·78	14	14	87·0	4	39·0	8 (21
Weston-under-Lyziard R'tory	Hon. and Rev. J. Bridgeman	2·94	·69	15	16	80·0	4	41·0	8, 19, 20,
Wrottesley	E. Simpson, Esq.	3·10	·55	12	13	82·7	5	40·1	19
Heath House	J. C. Philiips, Esq.	3·41	·73	12	15	81·0	4	41·0	19
Alstonfield Vicarage	Rev. W. H. Purchas	5·45	1·02	15	15	81·7	4	35·6	19
Farley, near Cheadle	C. L. Wragge, Esq.	4·27	·87	12 & 13	14	80·8	4	41·1	19
Oakamoor	E. Kettle, Esq.	4 22	·91	12 & 13	13	81·2	4	36·1	8
Lichfield	Mr. J. P. Roberts	3·46	·83	15	13				
WARWICKSHIRE.									
Coundon, Coventry	Lieut.-Col. R. Caldicott	5·22	1·03	14	15	78·0	4	45·0	19
Bickenhill Vicarage	J. Ward, Esq	5·54	1·25	14	9	70·0		43·0	
St. Mary's College, Oscott	Rev. S. J. Whitty	3·84	1·09	14	14	85·1	4	42·5	20
Henley-in-Arden	T. H. G. Newton, Esq.	5·63	1·48	14	12	87·0	4	42·0	8
Rugby School	Rev. T. N. Hutchinson	4·72	1·32	14	15	84·4	4	42·2	18
Snitterfield, Stratford	J. Goodacre, Esq.	4·59	1·20	14	15	84·3	4	40·9	18
DERBYSHIRE.							(15		
Stoney Middleton	Rev. U. Smith	6·12	·15	15	14	77·0	10, 11, 14	37·0	7, 18, 19
Linacre Reservoir, Chesterfild.	C. E. Jones, Esq.	4·29	1·01	15	15				
Spondon	J. T. Barber, Esq.	3·66	·79	11	13	79·0		44·0	
Duffield	W. Bland, Esq.	3·34	·68	15	12				
Fernslope, Belper	F. J. Jackson, Esq.	3·51	·84	15	14	80·0	5	41·0	19
NOTTINGHAMSHIRE.									
Hodsock Priory, Worksop	H. Mellish, Esq.	4·61	1·23	15	15	84·1	4	39·5	8
Park Hill, Nottingham	H. F. Johnson, Esq.	4·16	1·07	12	13	81·4	4	42·0	19
Tuxford	J. N. Dufty, Esq.	4·75	·96	12	15	76 0	2	40·0	18
LEICESTERSHIRE.									
Loughborough	W. Berridge, Esq.	4·84	1·69	12	12	87·4	4	38·9	8
Ashby Magna	Rev. E. Willes	5·16	1·41	12	14	85·0	4	37·0	8 & 20
Kibworth	T. Macaulay, Esq.	5·18	1·90	14	14	84·0	4		
Town Museum, Leicester	W. J. Harrison, Esq.	5·28	1·39	14	18	84·4	4	43·0	8
Syston	J. Hames, jun., Esq.	5·16	1·73	14	18	83·0	4	42·0	8 & 20
Waltham-le-Wold	E. Ball, Esq.	5·08	1·50	14	12	80·0	4	41·0	80
Coston Rectory, Melton	Rev. A. M. Rendell	4·50	1·07	11	14	82·8	4	39·0	8
Dalby Hall	Mr. G. Jones	4·?8	1·11	14	13	86·0	4	39·0	20
Market Harborough	S. W. Cox, Esq.	4·19	1·26	11	13	80·0	4	40·0	8 & 20
NORTHAMPTONSHIRE.									
Towcester Brewery	J. Webb, Esq.	4·74	1·08	12	12				
Castle Ashby	R. G. Scriven, Esq.	4·26	·99	14	11	83·0	3	45·0	19 & 20
Kettering	J. Wallis, Esq.	3·90	1·09	11	12	79·0	5	46·0	19 & 20
Althorpe	G. S. Groom, Esq.	3·51	·85	12	13	73·0	4	41·0	7 & 18
RUTLAND.									
Uppingham	Rev. G. H. Mullins	4·26	1·03	11	13	83·4	4	42·9	20
Northfields, Stamford	W. Hayes, Esq.	5·42	1·52	11	16	88·0	8	40 0	20
Altarnun Vicarage	Rev. J. Power, M.A.	5·36	1·00	15	16	82·0	4	42·0	29
Oxford	E. J. Stone, Esq	3·59	1·12	12	13	83·2	4	42·9	29
Ventnor	J. Codley, Esq	4·98	1·22	11	13	77·2	4	47·5	20

Natural History Notes by Observers.—*Uppingham.*—Strawberries, Primroses, and Cowslips in bloom. *Orleton.*—The grain crops have been secured in good condition. *Stroud.*—Swallows still seen in this neighbourhood (Oct. 13th.) *Coston Rectory.*—Harvest not completed by end of month. *More Rectory.*—The harvest, though late, was got in fine condition by end of month; Potatos a good crop. There has been a perfect plague of flies here; all summer visitors, including the entire swallow tribe, have disappeared. *Waltham.*—The heavy rains from 13th to 19th spoiled the bulk of the crops in this district. *Shifnal.*—Figs ripe on open wall on 19th, tomatos also on 22nd. Tortoiseshell butterflies in unusual numbers, with a Peacock and two Red Admirals, (first seen); the *Sedum spectabile* their great delight. Only few damsons, and apples scarce. *Nottingham.*—Field sports have been sadly spoilt in September by the heavy rain of June and July, which made terrible havoc with poor young Partridges; nearly all the brave little fellows were drowned, and many of the parents perished also; 1879 was bad enough, but 1880 is the worst partridge year since 1860. Another summer similar to the last, the birds would in many low-lying districts be almost extinct. Very many Hares also were found by the mowers dead in the grass and clover crops, the excessive rainfall being too much for them also. Sir William Harcourt's "Hares and Rabbits Bill" might well have been postponed for a season; Nature has quite satisfactorily thinned poor bunny without his assistance.

Correspondence.

Leptodora hyalina (new locality for.)—As the earliest announcement of the finding of *Leptodora hyalina* in this country was made in your pages, I have thought it might interest some of your readers to hear of a new locality for this interesting and beautiful entomostracan. I spent the last fortnight of September at Keswick, and from the description of the places in which it had previously been found, in England and on the Continent, I thought it very likely that it might also be obtained from Lake Derwentwater. I therefore had a net of fine muslin constructed, about two feet long, gradually tapering to an aperture at the end. In this aperture I inserted the neck of a wide-mouth bottle. This apparatus was towed very slowly behind a boat. The water passed through the net, but all the animalcules were left in the bottle, and to my delight, almost the first haul brought up several specimens of Leptodora. Afterwards we got them more plentifully, but in some parts of the lake the bottle brought none up. They need to be looked for very carefully, for they are so exceedingly transparent, that one very easily misses seeing them. It seems to me very probable that similar lakes would all produce Leptodora if searched in this manner. The ones we obtained were all in the mature stage, but none seemed to have ova. Besides this I got from this lake nine other species of entomostraca alone—viz., *Polyphemus pediculus*, remarkable for its enormous eye and rapid movements; *Bosmina longirostris*, a comical fellow whose superior antennæ have the appearance of two elephant's trunks; *Sida crystallina*, *Daphnella Wingii*, *Alona quadrangularis*, *Chydorus sphæricus*, *Diaptomus castor*, having enormously long antennæ; of this we only saw one male amongst the numerous specimens examined. It is easily distinguished from the female by the thickened joints in one of the antennæ. Also *Cyclops quadricornis*, and a beautiful variety of *Daphnia pulex*, having the carapace terminated by a long tail-like spine—this spine and a portion of the lower edge of the carapace being strongly serrated. Of these all but the last two species were new to me, as they do not occur in any of the ponds, &c., I have examined in this district.—JOHN BOYD, 58, Parsonage Road, Withington, Manchester, Oct. 11, 1880.

WHITE-FLOWERED HERB ROBERT.—I found to-day, October 18th, 1880, a purely white specimen of this plant, *Geranium Robertianum*, still in flower, of which I send some flowers, the rest of the plant being as usual; it was at Hagley, about forty yards from the western lodge on the road towards Stourbridge.—HORACE PEARCE, F.L.S., Stourbridge.

UNFREQUENT PLANTS AROUND ATHERSTONE.—Now that twelve months' pleasant botanical work round Atherstone is drawing to a close, I wish to place on record a few of the more interesting plants I have found. Fresh from a mountainous district, I was not long before I noticed forms wholly new to me; and the sides of the Coventry Canal and banks of the sluggish Anker were diametrically opposed to the banks of the bright, swift mountain stream to which I was accustomed, and in whose waters no aquatic plants could grow owing to their swiftness. I was enchanted with my first sight of *Menyanthes trifoliata*; growing with it were *Alisma Plantago*, *Sagittaria sagittifolia*, *Scutellaria galericulata*, and *Myosotis palustris*. These and many others were found in the Coventry Canal. *Lythrum Salicaria*, from the banks of the Anker, was an old friend; not so, however, *Symphytum officinale*, from the same river. In the bosky glades of the Bentley woods I occasionally found *Convallaria majalis*, but it frequents parts of the woods very inaccessible. *Iris Pseudacorus*, so scarce in my last district, is very frequent here, and may be found in most damp localities. Near the reservoir of the Coventry Canal Company I found *Vinca minor*, but am inclined to regard it as a garden escape. Several old walls in the Oldbury district yielded *Chelidonium majus*; and an old quarry in the same district, called "The Devil's Cave," gave me *Atropa Belladona*, *Carduus nutans*, and *Silene inflata*, besides one of the common Ringed Snakes. *Humulus lupulus* and *Bryonia dioica* adorn most of the hedges in this district; as do *Dipsacus sylvestris* and *Ononis spinosa* the roadsides. I have found *Saxifraga granulata*, but it is very scarce; also *Epipactis latifolia* and *Orchis mascula*. Among the Filices *Nephrodium Oreopteris* and *Ceterach officinarum* are the chief. Three plants were all I could find of *C. officinarum* at first, but subsequently I found it in some profusion on a wall near Atherstone. I would that change of residence did not compel me to leave such a pleasant and well-stored hunting ground. Let me strongly commend it to Midland Botanists. To know and appreciate it thoroughly, however, they must live in it.—GEORGE T. HARRIS.

ORNITHOLOGICAL NOTES FROM MID-LINCOLNSHIRE.—The members of the Thrush family were very scarce here at the beginning of this year. Though a plentiful meal was provided every day for all who chose to come, we only had about six Blackbirds and one pair of Missel Thrushes, and not one Song Thrush. The first was heard to sing Feb. 20th. On April 10th, several nests contained eggs, so I hope they may remain with us next winter. We have a small rookery in some hedgerow trees, the inmates were very fond of marching close up to the window in the snow and cramming their beaks with the small bird's food, which they ate at their leisure in a neighbouring tree. The first Rook's nest was begun Feb. 29th, and the whole thirteen were completed by the end of March. We are often visited by small flocks of the Black-headed Gull, (*Larus ridibundus*,) especially after heavy rains, as they are very fond of the ploughed fields where water has stood. These Gulls breed by thousands at a gullery in the north of the county and before and after the breeding season spread themselves over the country in search of food. Our only Cuckoo was first heard April 25th; last, June 26th; this bird becomes more scarce every year. All birds of prey, as well as Magpies and Jays, are almost extinct here, owing to the vigilance of the keepers. One wood near is visited nearly every spring by a pair of Common Buzzards, one or both of which are invariably shot or trapped. Small birds are more plentiful than usual, especially Greenfinches. I had been watching a nest containing four young ones from time to time, when on approaching the nest one day in the absence of the old birds they all flew out, evidently for the first time, but were strong enough to fly some little distance across a brook. A Yellow Hammer's nest contained two eggs May 6th. I was much interested in watching a White-throat's nest, built in a piece of dead thorn, quite concealed by high grass; the five eggs were hatched June 9th, on the 16th the birds were nearly fledged. A large black slug was on the edge of the nest, with every intention of ensconcing itself among the young birds, so thinking this cold visitor would be very unwelcome, I cautiously removed it, but not before two of the fledglings had hopped out of the nest, and were lost to view among the long grass. On visiting the nest next day, I looked anxiously to see if the mother bird had recovered her lost ones, and was glad to find one of them restored to the bosom of her family. On the 19th they all left the nest for good, but remained near it for a time, and never left the garden all the summer. Ten days from the time of hatching seems about the time the smaller birds leave the nest. A pair of Blackbirds made their second nest on a ledge of a wooden fence, against which a currant tree is trained on wire. The eggs were hatched June 15th, the young birds' quills were grown by the 19th, and they left the nest 24th or 25th. The male of this pair is slightly sprinkled with white feathers. He was most attentive to the first brood, spending hours every day in searching for worms for them. They left him no peace, but were for ever screaming after him, whilst he grew quite thin in his efforts to provide food for them during a somewhat dry time. We have two pairs of swallows about the house. One returns every year to a nest against the inside of a pig-stye. Five or six young ones had their heads hanging over the side June 21st. They were covered with grey down, and otherwise looked very juvenile and helpless, so they could not have been hatched long; they were able to perch out of doors July 1st. The other nest is on a wall plate inside the coal-house, access to which is through a scullery, and not more than 6ft. from the ground. The servants pass close to it every time they fetch coals. The young birds were hatched about the same time as the others; and both pairs have had second broods. A pair of House Martins took up their abode under the eave of a cottage for the first time this year. The inhabitants objected to their feathered visitors, and some time after the nest was finished knocked it down, when out fell several young ones nearly fledged. Two or three survived the fall, and were fed on the ground by the old birds, who succeeded in rearing them. Swifts do not build here that I know of, but we occasionally see a pair or two hawking for food. They and the Martins have gone, but the Swallows are still here, Sept. 14th.—A.E.I., Hatton.

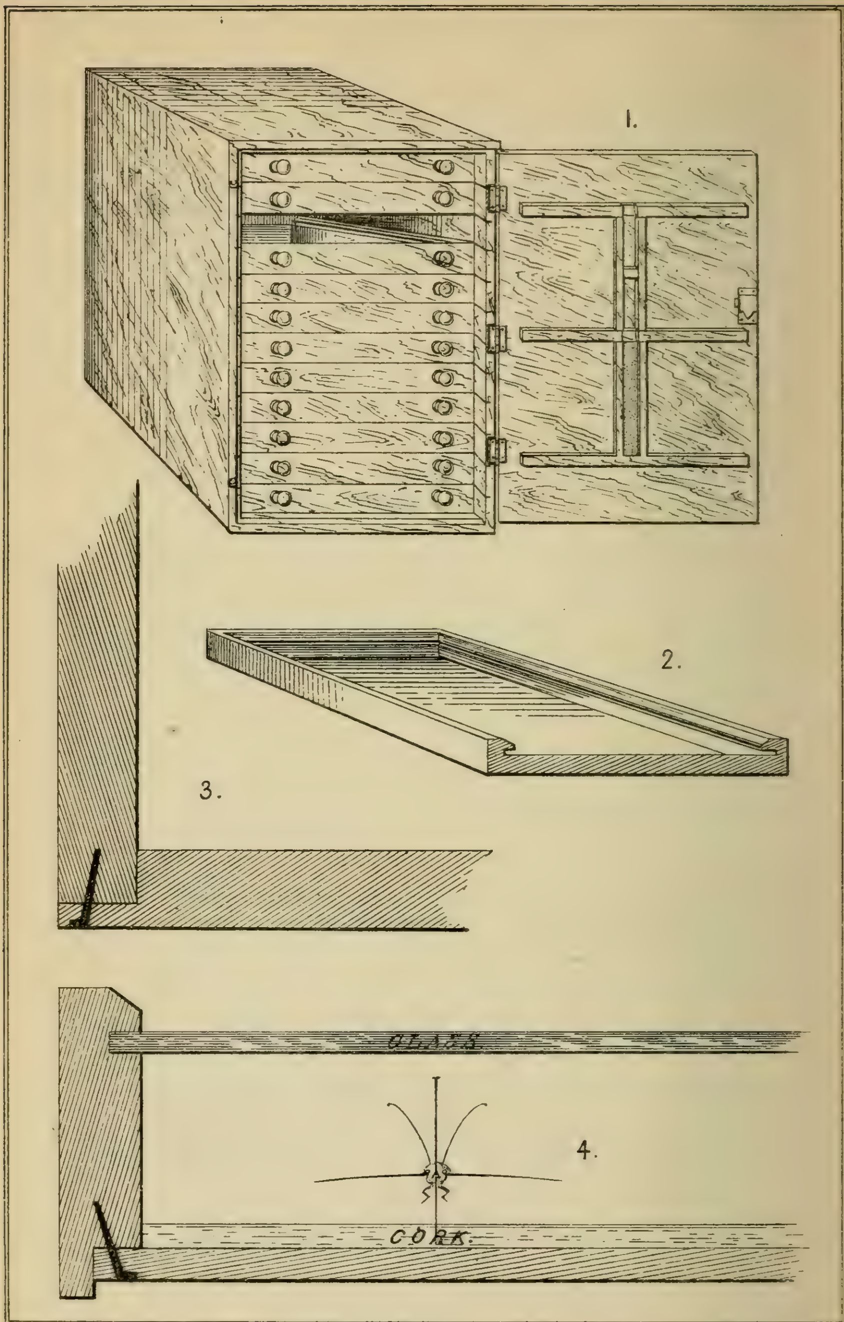
ELM TREES completely stripped of their leaves in Bretby Park, near Burton, by larvæ of *Abrasc asulmata*. White Sparrow seen at Burton Grammar School, in company with about six others of the usual colour. —W. M. ANDERSON, Burton-upon-Trent, October 1st.

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—GEOLOGICAL SECTION.—September 28th.—Mr. T. Bolton exhibited a specimen of *Cochlearia Armoracia*, the horseradish, with pinnatifid leaves. Mr. J. H. Baxter exhibited leaf of *Rhododendron Nuttallii* and of *Elæagnus umbellata*, showing the scales on each. GENERAL MEETING.—October 5th.—The President, Mr. W. Southall, F.L.S., F.R.M.S., gave a short address, in which he pointed out the many advantages which the removal of the society to Sir Josiah Mason's Science College offered to the members. He referred to the uniform kindness with which it had been treated by the Midland Institute during the many years that they had been connected together, and said that the only reason for now parting was the inability of the Institute to provide the increased accommodation which the society now required. At the conclusion of the address, a vote of thanks, proposed by Mr. Hughes, and seconded by Mr. Badger, was unanimously passed to the President for his interesting address. A vote of congratulation to Sir Josiah Mason on the completion of the College, and of thanks to the Bailiff and Trustees for the kindness and liberality with which they had received the proposals of the society, moved by Mr. Graham, and seconded by Mr. Levick, was carried unanimously. Professor T. W. Bridge spoke welcoming the society to the College, and said that he did not think the advantages were all on one side, as it was hoped that many interesting biological subjects would be materially assisted by the researches of members of the society, and for this purpose the biological laboratory would be at the disposal of members wishing to use it, an announcement which was received with acclamation. The meeting then adjourned to a neighbouring room, where was an exhibition of microscopic objects, both numerous and interesting, and the inspection of these occupied the rest of the evening. This was the first meeting of the society in its new quarters at the College, where it has a large room entirely at its disposal, which is being fitted up as a library and committee room, and which it is intended to open for a short time daily as a reading room and studio. The weekly meetings are to be held in the biological theatre, a large room admirably adapted for the purpose, and which, on this occasion, probably the largest general meeting ever held, was nearly filled. BIOLOGICAL SECTION. —October 12th. Mr. A. W. Wills, President of the section, congratulated the members on its removal to Mason's College, and hoped that, with the increased accommodation and great advantages now at its disposal, an impulse might be given to original research, to be productive in the future of very valuable results. He also impressed upon the members the desirability of exhibiting interesting though common objects, even if they have been exhibited before, as there is a constant influx of new members who may never have seen them. Lastly, he mentioned that it was intended to provide a cabinet for the reception of mounted microscopic objects, which he hoped would in time become a complete reference collection, and as a start he offered the gift of a small series of slides of rare Desmidieæ from North Wales. Mr. W. Southall exhibited *Tacsonia Van-Volxemi* in fruit, and called attention to the large secretion of nectar in the flower. Mr. T. Bolton exhibited Paste Eels *(Anguillulæ.)* Mr. W. R. Hughes exhibited a potato growing through a ring about ½in. in diameter, which it had encountered in the earth. Mr. W. G. Blatch exhibited *Bembidium quinquestriatum* and *Ptinella denticollis*, two rare Coleoptera new to the district, the first-named from Olton, the second from Knowle. Mr. A. W. Wills exhibited *Hæmatococcus binalis*. Mr. J. E. Bagnall exhibited *Fissidens Orrii*, a moss new to science, and section of leaf of *Rhopala Pahlii*, to show transverse bars. October 19th.—Mr. H. E. Forrest exhibited *Peziza aurantea*, a beautiful fungus from Sutton Park, also slide showing asci and paraphyses of the same. Mr. W. H. Wilkinson exhibited *Pholas dactylus* and *Psammobia Ferroensis*, from Bridlington Bay. Mr. T. Bolton exhibited the Cydippe, *Pleurobranchia pileus*, one of the jelly fishes. Mr. J. Levick exhibited *Cristatella* and *Volvox*. Mr. H. E. Forrest read a paper by the Rev. J. E. Vize, M.A., on *Spirogyra nitida*, one of the confervoid Algæ, in which he described the history of the plant and modes of conjugation, and the production of the two different kinds of spores, one of which, the oospore, he believed to be analogous to the resting spore of *Peronospora*, the potato fungus, and intended to reproduce the alga in the following year. The paper was illustrated by drawings and specimens in the microscopes.

BIRMINGHAM AND MIDLAND INSTITUTE SCIENTIFIC SOCIETY. —September 29th, Mr. J. T. Bunce gave an address to the members, in the course of which he drew attention to the value of the society, and upon the importance of strengthening and giving its operations a regular and systematic direction. Science, with her sister Art, constituted the very life of Birmingham. There was not a trade or manufacture for which they were renowned that did not demand the constant application of scientific principles and that was not dependent upon scientific knowledge. That man is the best workman or the most successful manufacturer who most thoroughly knows the root and meaning of the processes he employs or the properties and capacities of the material in which he works. They might depend upon it that wherever enterprising masters and instructed workmen were to be found, there the best trade of the world would go, and that was the lesson which Englishmen had to learn if they were to keep the trade they had, and to maintain their position. They must be thoroughly educated in the scientific conditions which govern their labour, and if they are to be so educated, it must be not only by taking advantage of science classes, but by afterwards closely and continuously following up the line of study begun in the classes, and giving these a special direction in accordance with the chosen work of life. October 6th.—Mr. Wright Wilson gave the first of a course of three lectures on "The Anatomy of the Human Subject." October 13th.—Mr. W. W. Staveley read a paper on "Tar Products." He described, by means of numerous specimens of chemicals and colours, the beautiful products obtained from coal-tar, and said that bright and beautiful as had been the colours produced from tar, great as had been the success of the artificial over the natural colours, grand as had been the achievements of chemists in this domain, there was yet a brighter and grander future ahead for the chemistry of coal-tar.

CHELTENHAM NATURAL SCIENCE SOCIETY.—The first meeting of the society for the session of 1880-81 was held on Thursday, October 7th. Dr. T. Wright, F.R.S., &c., president, reviewed the work of the society during the past session. He next referred to the invitation sent to the Midland Union of Natural History Societies, to meet in Cheltenham in June next, 1881. This invitation was most cordially accepted, and arrangements should be made prospectively to make this Union meeting a success. The guarantee fund must be increased in amount in order to enable the Council to make suitable provision for the Congress. The Darwin Prize scheme and the President's Prize were then dealt with at length. The claims of the "Midland Naturalist" for the support of the members were then enumerated. After the cordial thanks of the society had been given to Dr. Wright for the efficient manner in which he had carried on his duties as president, Col. Basevi, the hon. secretary, read the report of the scrutineers as to the election of officers, namely:—Dr. T. Wright, F.R.S., to be president; Col. Basevi, hon. secretary; Council: F. Day, F.L.S., &c., H. James, Dr. T. Wilson, Dr. G. Ferguson, M.A., F. D. Longe, F.G.S., Major Barnard, F.L.S., R. M. Lingwood, Dr. Julius Maier, Rev. E. Cornford, and Dr. Ker. From the report of the auditors it appeared that £63 7s. 10d. had been received during the year, and £28 16s. 11d. expended, leaving a balance in hand of £34 10s. 11d. A vote of thanks was given to Colonel Basevi, and the officers of the Society, for their services.



Entomological Cabinet

A CHEAP AND USEFUL ENTOMOLOGICAL CABINET.

BY W. G. BLATCH.

It is said that no one knows where the shoe pinches so well as he who wears it, so no one can enter into or even conceive of the troubles of a would-be entomologist unless he has experienced them. Their name is certainly legion, but like other vexations incident to humanity are best dealt with singly. One of the greatest, as I know full well, is that of providing a safe and readily available receptacle for stowing away and systematically preserving our insect treasures when they have been obtained and duly "set." Of course good cabinets can readily be had by those who have the means and are willing to pay for them, the cost being from ten shillings to a guinea per drawer. But only the comparatively wealthy can afford to indulge in such expensive luxuries. Generally speaking, the most unsuitable receptacles are improvised for storing insects, dust and mites and other enemies find easy admittance into them, and soon produce such havoc that, losing all heart, the collector throws the lot away in disgust, and forthwith abandons both an extremely interesting study and a healthful pursuit. We are not all like Thomas Edward, who, when he lost one collection, manfully set about forming another, but we have most of us had experiences similar to his when he lost his valuable collection of plants for want of a suitable receptacle for storing them. Now it is curious but true that matters of the first importance are left for consideration until last. The boy first catches his bird before he thinks of a cage to put it in, and the entomological tyro hunts for insects long before he seriously considers what he shall preserve them in. No doubt this must always be the case to a considerable extent, but yet it is beyond question a wise course to provide a suitable stable when you are about to buy a horse.

In Entomology, as in most other things, a good deal depends upon the way you start, as to whether you will succeed or fail in the end. I would have the young entomologist begin well, and he can only do this by having something to store his insects in, in an orderly manner, before he accumulates many specimens. It is of importance also that the "something" should not be too large or too expensive, and that it should be capable of growing with the collection. I have come to the conclusion that a cabinet is the only thing to be used, and that it is possible to provide a really serviceable article at a very small cost. With the help of Mr. T. B. Taylor, who has kindly had the accompanying sketches drawn on stone, I have worked out an idea for an inexpensive cabinet that any schoolboy could make for himself (improving upon the suggestion as he pleased) during his long Midsummer or Christmas holidays.

Figure 1 on the accompanying plate (XI.) shows the little cabinet complete, as made with twelve drawers. The size of it is—height 20½ inches, breadth 14¼ inches, depth 19¼ inches; it is made of white pine, ⅝ inch thick throughout (one inch would of course be better, but the idea has been to keep down the cost.) The door has three horizontal and two upright stays, the space between the latter being utilised as camphor cells, with sliding plate of perforated zinc in front. The drawers run on metal slips fixed in the sides of the cabinet, and the whole thing is finished with black varnish. Figure 2 shows a drawer as seen from the back, and figures 3 and 4 indicate with sufficient clearness the working details. The latter show sections of the drawers of the full size. The sides of the drawers are grooved for glass, which is made to run in at the back of each. The size (inside) of the drawers is as follows: seventeen inches in length, 12¼ inches in breadth, and 15-16ths of an inch in depth between the groove for glass and the bottom, the extreme depth outside measurement being 1¼ inches. It will thus be seen that in this little cabinet there is not the smallest loss of space or waste of material. Of course, "long" pins cannot be used, but the Nos. 7, 14, and 8 of Kirby, Beard, and Co. will work in well, and for any cabinet these are the best to use for ordinary purposes.

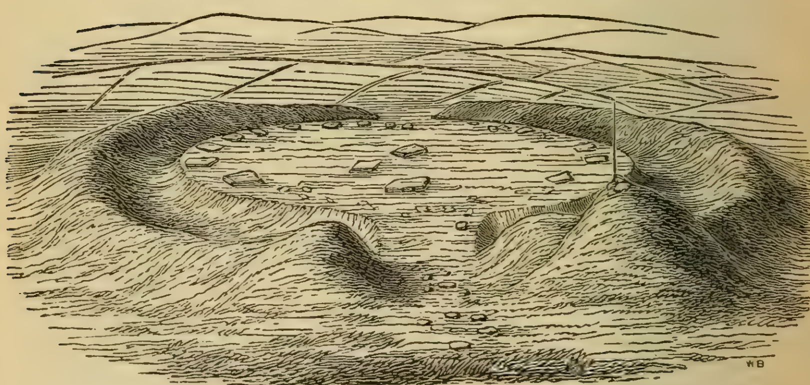
One of these cabinets (twelve drawers) would hold a fair series of all the British Butterflies, or all the Heteroptera and Homoptera. Three or four would take all the moths, (Macros,) and the Beetles might be got into from four to six, according to "series." As one is filled another can be placed beside it. Four or more would stand one above the other, or in pairs, according to space in room; and, if made of well-seasoned wood, would prove as serviceable as those of far greater cost and pretension.

I have had one of these little cabinets made, and have the maker's estimate for cost. Mr. S. H. Smith, of 27, Chapman Road, Small Heath, will make any number of them at the rate of 2s. per drawer, including carcase; or, if glazed, corked, and papered, ready for use, at 3s. 6d. per drawer.

ARBOR LOW,

(A MEGALITHIC CIRCLE, EIGHT MILES FROM ROWSLEY.)

BY A. H. SCOTT-WHITE, B.SC., B.A., F.G.S., ETC.



View of Arbor Low from the south.

On nearly every hill-top and moor in Derbyshire evidences are to be found of the existence of a people, or rather of peoples, who inhabited the country long before the periods on which historical records touch. Not only is this true of Derbyshire, but all over Great Britain; nay, all over the world we meet with stone-circles or *cromlechs*, stone chambers or *dolmens*, *menhirs* or standing-stones, *tumuli*, fortified camps, &c. We have no description of the formation or use of any of these in any literature, unless such be referred to occasionally in the earlier books of the Bible, and by one or two classical authors. Thus, for example, Moses, we are told, erected twelve stones at Mount Sinai; when Achan was stoned, the Israelites "raised over him a great heap of stones;" Joshua pitched twelve stones in Gilgal after crossing the Jordan; and one or two more such possible references to megalithic monuments occur in what are known as the historical books. From classical authors I will quote only a single reference. Nestor, describing the course for the chariot-race to his son Antiochus, in Iliad, Bk. xxiii., tells him :—

> Now mark; the goal thou can'st not miss * * * *
> * * * two white stones, one upon either side,
> Where meet two roads, and close by runs the race-course sweeping wide,
> Whether these stones were raised to mark where some old chieftain died,
> Or served for goal in olden times on this same racing ground;
> Here hath Achilles fixed the goal.

So what we now term a menhir is here spoken of, and Nestor suggests that it marked the burial-place of some hero who had died long before Homer's time; it was, in other words, "pre-historic" even then. Such old stone-monuments as these continued to be revered, or regarded with superstitious awe, even into the times when Christianity flourished, for not only do we find that Charlemagne found it necessary to issue an edict, "Jubemus ut corpora Christianorum Saxonorum ad cemeteria ecclesiæ deferantur et non ad tumulos paganorum;" but even as late as 1859, a farmer in the Isle of Man offered a heifer as a burnt sacrifice, that he might avert the anger of the spirits "excited by the exploration of a chambered tomb near Tynwald Mount by Messrs. Oliver and Oswald." Much as we may be inclined to smile at this superstition, we must rejoice at the results it produced, for to it we owe much of the knowledge we are now able to gain of our long-since dead ancestors; to it the Isle of Man (Isle of Stones) is indebted for its name, and had it been stronger in England no doubt many a Balbus would have got the stone for his walls from some quarry, instead of destroying the menhirs and dolmens, of whose use and history he knew nothing and cared less.

Of English megalithic remains the largest is, or rather was, that of Avebury, or Abury, in Wiltshire. This, when perfect, enclosed an area of 28½ acres, and consisted of a circular ditch and embankment, and a great circle of stones, with two smaller circles inside. "But the pretty little village of Abury, like some beautiful parasite, has grown up at the expense, and in the midst of, the ancient temple." The most perfect example still remaining is that of Stonehenge, and next to these two comes Arbor Low, the Northern Stonehenge, as it is sometimes called. It consists of a circle of large, unhewn stones, obtained from the lime-

*Professor Blackie's Translation.

stone quarries in the neighbourhood. These stones were probably thirty in number, they average 6ft. to 8ft. in length, by 3ft. tc 4ft. in breadth, and possibly stood upright* and equidistant from one another around the edge of the central platform. Now they are all lying on the ground, and because the narrow ends of some point inwards, it has been suggested that they were so arranged to represent the rays of the sun, and that they thus indicate sun or fire-worship. But, as Mr. Bateman points out, they almost as frequently are directed towards the ditch. The central platform, which is circular, and not oval in form, is about fifty yards in diameter. The large stones in the middle (the largest 14ft. by 8ft.) probably formed a dolmen, or sepulchral chamber. Such chambers are erected even at the present day by some hill tribes in India, among whom, Dr. Hooker says, "the funeral ceremonies are the only ones of any importance, and are often conducted with barbaric pomp and expense."

The platform is surrounded by a ditch about six yards wide, and this again by a vallum or rampart, formed of the earth partly from the ditch, partly from the outside, and not improbably augmented by more earth, brought from a distance by friends and relatives out of compliment to the departed one, as the Scotch Highlander of to-day does after politely telling you, "I will add a stone to your cairn."

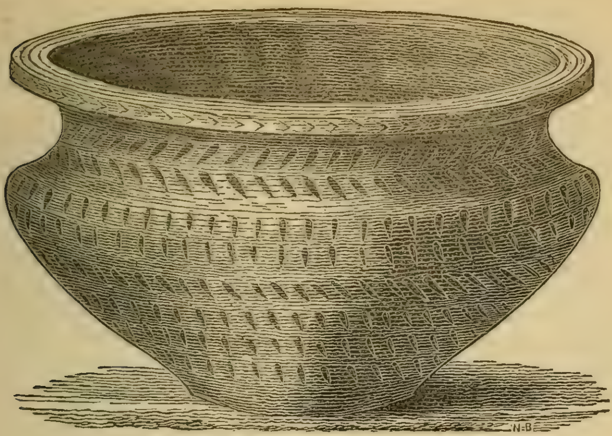
The vallum measures 270 yards in circumference on the top, and even now is from six yards to eight yards high, but varies in height all round. Through this vallum are two entrances to the central platform, each ten to twelve yards wide; these are opposite to one another, one leading to the north, the other to the south.

On the eastern side of the southern entrance the vallum rises considerably higher than anywhere else in its circumference, and formed a tumulus or funeral mound. This was successfully examined by Mr. Bateman in 1845. He cut it across from the south towards the centre, and found a small six-sided cist or chest, "constructed by ten† limestones placed on end, and having a floor of three similar stones neatly jointed,"‡ the whole being covered by a single flat stone about 5ft. in length, by 3ft. in width. The surrounding earth being carefully removed, and the cover taken off the cist, which was quite free from soil, was found to contain "a quantity of calcined human bones," and amongst these two flint implements, one somewhat triangular and having three sharp edges, the other flat with one sharp edge, also a pin made from leg bone of a deer, and a piece of iron pyrites. At the west end were two urns; of these the more elegant one is 4½in. high, 9½in. in diameter at its widest part, and 3½in. at the base. It is slightly ornamented on the top of the rim by three lines, (as if a piece of string had been pressed on the soft clay,) and on the body by sets of six lines, some placed obliquely, others vertically.

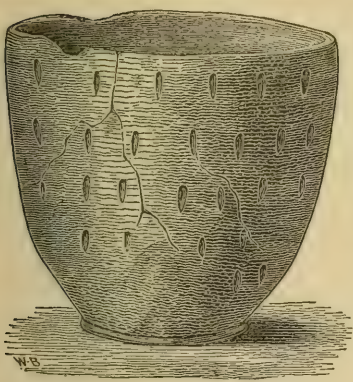
* After writing the above, a gentleman in the neighbourhood assured me that he remembered seeing some of the stones erect when he was a boy.

† There were nine stones around the sides, one on the top, and three forming the floor.

‡ Bateman's "Vestiges of Derbyshire."



(*From tumulus at Arbor Low, one-third real size.*)



The second vase is $4\frac{3}{4}$in. high, and $5\frac{1}{4}$in. in diameter, the markings on it are very simple ; it is made of coarse clay, and is not so highly glazed as the other. Considering the maker had no potter's wheel, they are both of elegant shape. In addition to these a piece of the edge of another vase was found. The floor of the cist was on the natural soil, and it was strewed with rats' bones *(Arvicola amphibia)* within and without.

(*From tumulus at Arbor Low, one third real size.*)

In the distance, about 350 yards from Arbor Low, is another tumulus, called Gib Hill, a very conical mound of about 18ft. in height and 70ft. to 80ft. in diameter, with the usual basin-shaped cavity on the top. It is connected with Arbor Low by a rampart of earth running in a serpentine manner somewhat like the avenue through Abury ; a fact of interest to those who believe in the serpent-worship of the Celts. This tumulus was opened by Mr. Bateman in 1842, and he found that it had been raised over four smaller mounds. The central interment consisted of a dolmen formed of four blocks of limestone, and covered by a slab 4ft. square. This cist contained burnt human bones, a small urn, $4\frac{1}{2}$in. high, and several pieces of white calcined flint. In the earth of the tumulus were also found an arrow-head of flint,* 2½in. long, a fragment of a basaltic celt,† a small iron brooch, now much corroded, but which had once a stone set in it, and another fragment of iron; these last Mr. Bateman considers indicate an interment of later date than the one consisting of the burnt bones.

We cannot visit such a spot as this without allowing our thoughts to travel back to the times when these tumuli and this temple were first erected, and trying, if possible, to learn something of those, our barbarian ancestors, who held their religious worship and their funeral feasts here. Pre-historic times are, as everyone now knows, divided into four great periods, marked off from one another, fairly distinctly, by different races of men, and by the different degrees of civilisation to which each attained. To which of these does Arbor Low belong? Not to the oldest or Palæolithic period, when the British Isles were connected with the Continent, and when man had to struggle for existence against many formidable foes—lions, bears, mammoths, and the rest--most of which are now extinct. Not to this period, for, as far as evidence goes, the men then paid no more respect to their dead than do the Eskimos of to-day, but left them either unburied or so slightly protected that the bodies soon fell a prey to the prowling hyænas.

Long after Palæolithic man came the Neolithic age, with a great advance in civilisation, the farmers and herdsmen replaced the hunters, the fauna was nearly that of to-day, and our country was an island, or rather group of islands, as now. The Neolithic remains are numerous in Derbyshire, consisting of cairns or barrows and chambered tombs, which were frequently family vaults, and probably represent the huts of the living. In these tombs the bodies were buried in the position of rest during lifetime, *i.e.*, huddled up, as the savage curls himself up for warmth during sleep; with the bodies were sometimes placed the *spolia opima* of the field, vessels of food and drink, flint and pyrites for obtaining fire, and implements of flint, weapons and ornaments, for use in the happy hunting-grounds of the blessed.

The Bronze age follows, and shades into the Later Stone age, as though a wave of conquerors had gradually won their way over the country, or mingled with the earlier inhabitants, and it was these men who introduced, with probably a new faith, the practice of cremation, and, according to Mr. Rooke Pennington, sutteeism, infanticide, the slaughter of slaves and prisoners, and cannibalism. These people we may easily picture to ourselves: the rich "were clothed in linen or home-spun," others wore skins and adorned their bodies with red and yellow ochre; "a dagger attached to the girdle in a sheath of wood or leather, and an axe were their constant companions." In the earlier part of the period, to which most of the English burial places are referable, we must remember that bronze was very precious, and had not replaced stone.

*3in. by 2½in., apparently purposely defaced, little of the original polished surface remains.

†This was obtained at the re-opening in 1848, together with two teeth of a horse and a molar of some carnivorous animal.

Professor Boyd Dawkins tells us moreover, "the face was shaven, and the beard, moustaches, or whiskers, were sometimes plucked out. The hair was worn long, and arranged into a pyramid sufficiently large, in some cases, to admit of the use of a hair-pin twenty inches long. So careful were they of their coiffure, that they are proved, in the lake dwellings of Switzerland, to have used head-rests made of pottery," like African dandies of the present day, "to prevent its being disarranged in sleep. Ear-rings and necklaces were also worn, and pendants and amulets made of stone and bone as well as of bronze and glass." Space does not allow me to describe the scene enacted at the funeral of some great chief amongst these savages, the gathering of the clan, the piled-up pyre, surmounted by the dead body, the funeral feast and its orgies, the building of the cist and the placing in it of ornaments, pottery, and weapons; and lastly, the heaping up of the great mound. It is to this age that, in my opinion, Arbor Low probably belongs. First possibly erected and used as a burial-place, and then, through reverence for the departed ancestor, coming to be regarded as a sacred spot where religious services might be held, and the dead brought for cremation and interment.

The etymology of the name presents considerable difficulty; not the "Low," however, for that comes from the A. S. *hlæw* or *hláw*, a heap, barrow, or small hill, and is connected with *hlifian*, whence our verb "to lift." Sir J. Lubbock considers Arbor to be the same word as Abury. This is hard to see, and many will consider me bold to differ from such an authority; I have, however, the Professor of Anglo-Saxon at Cambridge to rely on. Mr. Charles Cox says "that tradition has long maintained that an important battle between the Britons and the Romans was fought on Hartington Moor, and that in the pronunciation of the name of this low, those living nearest to the spot not unfrequently sound it as though spelt Artor or Arthur," so that these facts favour Mr. Fergusson's conjecture, that Arbor Low marks the site of one of King Arthur's great battles. Unlikely as I think this idea to be, I mention it as a suggested way out of a difficulty.*

THE AUTUMN AND WINTER MIGRATORY BIRDS OF BODICOTE, OXFORDSHIRE.

BY OLIVER V. APLIN.

By autumn and winter visitors I would mean those birds which are either to be seen here only in autumn or winter, or have occurred but very rarely at other seasons, and are usually considered in the light of winter birds. Several species—such as the Starling, Lark, Missel Thrush, Lapwing, &c.—receive large additions to their numbers in winter; but, of course, are as much residents as any others, and, there-

* Read before the Nottingham Literary and Philosophical Society at Arbor Low, July 8th, 1880.

fore, will not be included here. Neither do I intend to make mention of any save those which may be reasonably expected to visit us each year.

Some of those that I do mention may be found even to have bred with us occasionally; and in the case of the Wild Duck there is no doubt but that it does so annually in small numbers. In fact, it is very hard to lay down any rule which will mark out the winter visitors. The only way appears to be to take those which are usually and popularly known as such.

The first on our list is—

Falco æsalon, (Gmelin,) Merlin, one or more of which are procured every season, from September onwards.

Otus brachyotus, (Forster,) Short-eared Owl, occurs rather more frequently than the last. November is the usual month of its arrival.

Turdus pilaris, (Linnæus,) Fieldfare. — In some years we have enormous flocks of this species, in others very few. They are usually most plentiful at the beginning of a frost, when there has been hard weather in the north. It is only when a good season has well ripened the haws that they resort in any numbers to feed in the hedges; at other times, when from a cold and wet summer the berries are hard, dry, and shrivelled, they seldom touch them. Hollyberries are a great attraction, frequently bringing them close in to the houses. During mild weather the flocks are found feeding in the meadows. A long-continued frost with snow drives them southward; many, however, perish. This bird arrives usually rather after the next, and I have seen them as late as the middle of May.

Turdus iliacus, (Linnæus.) Redwing, occurs in smaller numbers than the last, but is still a plentiful species. It is, I believe, more insectivorous than the Felt, and thus suffers more from frost and snow. They generally arrive about the second week in October.

Motacilla boarula, (Latham,) Grey Wagtail, visits us late in the autumn or early in winter, at which time it may be found not very uncommonly along the streams, especially where the banks are shelving. It has bred, I believe.

Fringilla montifringilla, (Linnæus,) Mountain Finch, comes to us in some numbers, but irregularly.

Fringilla spinus, (Linnæus,) Siskin.—Small parties of this little bird may often be seen feeding in the tops of the alder trees, in company with the next species. I don't see them much before November. In the spring of 1879 I observed a few as late in the year as the 20th of April.

Linota rufescens, (Vieillot,) Lesser Redpole.—More numerous than the last. Its habits are very similar.

Loxia curvirostra, (Linnæus,) Crossbill.—Only a rare and occasional visitor, generally in small flocks. They are usually found in fir plantations.

Corvus cornix, (Linnæus,) Hooded Crow.—A rare autumn visitant, most frequently arriving in October. When it does occur there are generally several together.

Garrulus glandarius, (Linnæus,) Jay.—Although breeding—not very commonly—in the district, I have taken notice of this species here, inasmuch as in this immediate neighbourhood during the summer months it is, I may almost say, *never* found, whilst from November to March inclusive it may frequently be seen.

Charadrius pluvialis, (Linnæus,) Golden Plover.—Large flocks are sometimes seen in winter; rarely in the meadows, but more usually flying over.

Totanus ochropus, (Linnæus,) Green Sandpiper.—An occasional visitor in autumn and early winter. It is found along the streams, often as early as the first week in September.

Tringoides hypoleucus,(Linnæus,) Common Sandpiper.—More frequent than the last. It haunts the same places; more usually several together. July and August are the months in which it is most often seen.

Scolopax rusticola, (Linnæus,) Woodcock.—Not at all plentiful; a few only are shot each season.

Gallinago media, (Leach,) Snipe.—The first flight is often early in September. Their numbers during the season depend greatly on the state of the meadows. Just after a flood has gone down is the best time for them. At such times a hundred or more may be put up out of one field. This bird has been observed occasionally in every month of the year, except May and June.

Gallinago gallinula, (Linnæus,) Jack Snipe.—Never very plentiful, and seldom arriving before October. It is very difficult to flush.

Anser segetum, (Gmelin,) Bean Goose (?.)—Small flocks of grey wild geese have at times been put up from off the stubbles and young wheat. These are, probably, of this species. Wild geese are heard flying over, and have occasionally been seen on the floods; but (although solitary specimens of several species have been shot) it is impossible to say to which of these the majority belong.

Anas boschas, (Linnæus,) Wild Duck.—A few of these breed here, but we get large flocks on the flooded meadows, which are, of course, immigrants.

Anas penelope, (Linnæus,) Wigeon.—Some seasons (probably those in which the northern winter is severe) large flocks come; others, very few indeed. They always arrive later in the year than the last. A flock of these beautiful ducks swinging round over the floods is a very pleasing sight. They whistle incessantly whilst on the wing. I have seen them as late in the season as the beginning of March.

Querquedula crecca, (Linnæus,) Teal.—Never very plentiful, but haunting the secluded streams, singly or in pairs, all the season. Occasionally, however, I have seen as many as eight or ten together. They arrive early in October, and stay on till March. The Teal has a habit of sailing for a considerable distance on outspread wings.

With this bird our list closes. Several species, such as the Great Grey Shrike, Waxwing, Snow Bunting, Pochard, Tufted Duck, &c.,

although eminently winter birds, yet have occurred so very rarely, that their place seems rather under the heading of accidental visitors; so that, properly speaking, in the present class we can only number twenty-one species for certainty.

Bodicote, Oxon, November, 1880.

THE HEPATICÆ OF WARWICKSHIRE.

BY JAMES E. BAGNALL, HON. LIBRARIAN BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.

The following list of the Hepaticæ of Warwickshire is the result of an examination of many districts in the county during the years 1879 and 1880, my attention during this period having been especially given to these plants. But although I have given the subject my best attention, I cannot but think that much remains still to be done; the time given to the study has been short, and the seasons have been unpropitious. Better seasons and more extended knowledge of these plants may probably lead to the finding of many plants hitherto sought in vain.

My principal text book has been that able synopsis, "Hepaticæ Europæ," by Du Mortier, and the classification adopted is that of the above work.

All the species here enumerated are represented in my herbarium from one or more of the habitats cited. Purton, in "The Midland Flora, 1817-21," gives but few localities for and records but a meagre list of these plants; these are duly quoted, in all other cases the localities given are taken from my own note book.

Unfortunately for English students, Dr. Carrington's valuable "British Hepaticæ" is still incomplete, so that the only text books available for such students are Hooker's "British Jungermanniæ," a very prizable but expensive work rarely to be met with; the 5th volume of Smith's "British Flora," in which this family is very ably treated by Sir W. Hooker; and Cooke's "British Hepaticæ." This last is a very fair synopsis, very useful, and remarkably cheap.

As the nomenclature of Du Mortier differs from that of our English authors, I have in each such case given the synonyms of both Hooker, Purton, and Cooke.

In studying this family of plants I may state that I have had the advantage of being able to compare my specimens with those contained in the "Hepaticæ Britannicæ Exsiccatæ," fasc. I. and II., by Carrington and Pearson, also with numerous specimens received from my valued correspondents, H. Boswell, Esq., E. M. Holmes, Esq., and W. Curnow, Esq., and as I have in each case been very careful in my examinations, I think my list, though short, will be found correct.

The following works are quoted by their respective abbreviations:—

Purt.—A Botanical Description of British Plants in the Midland Counties. By T. Purton, Surgeon, Alcester, Vol. II., 1817. An Appendix to The Midland Flora, Parts 1 and 2. By Thomas Purton, F.L.S., 1821.

Hook.—The English Flora, Cryptogamia, Vol. V., Part 1. By William Jackson Hooker, LL.D., 1833.

Cooke.—British Hepaticæ or Scale-Mosses, and Liverworts.

Fossombronia pusilla Dmrt. *Jungermannia pusilla* Purt., Hooker. Marly banks, woods, and fields, local. "Rare, in a cart rut, Oversley Wood" Purton. Abundant in Oversley Wood, 1879! Coleshill Heath! Bank by Olton Railway Station! Marly field, Wishaw! Field by Brown's Wood, Solihull! Oct., April.

Madotheca platyphylla Dmrt. *Jungermannia platyphylla* Hooker. On the roots of trees and in woods, local. Drayton bushes, near Stratford-on-Avon! Yarningale Common! Near the Aqueduct, Bearley! April.

Frullania dilatata Dmrt. *Jungermannia dilatata* Hook. On trees and walls, frequent. Solihull! Rowington! in fruit on Canal Bridge, Shrewley! Fruit local. April.

F. Tamarisci Dmrt. *Jungermannia tamarisci* Hook., Purt. Trunks of trees, local. "Ridgway" Purt. On elms, near Rowington Church in fruit! Yarningale Common! March.

Radula complanata Dmrt. *Jungermannia complanata* L., Hook. Trunks of trees, frequent in marly and calcareous soils. Yarningale Common! Alcester and Stratford districts! Harbury! Shustoke! Chesterton! Solihull! Fruit March, April.

Scapania undulata Dmrt. *Jungermannia undulata* L., Hook. Marshy heath lands and waysides, local. Four Ashes, near Hockley! Salter Street, near Earlswood! Oversley Wood! Sutton Park! Marston Green! Not observed in fruit.

S. nemorosa Dmrt. *Jungermannia nemorosa* L., Hook. Marly banks in woods, rare. Oversley Wood! Lane from Four Ashes to Hockley! Sutton Park! Not seen in fruit.

S. curta Dmrt. Damp heathy places, rare. Sutton Park. My specimens from this locality have been carefully compared with Dr. Carrington's description and plate.

Plagiochila asplenioides Dmrt. *Jungermannia asplenioides* L., Hook. Moist woods and marly banks, local. Oversley Wood! Bush Wood, Lapworth! Wheyporridge and Hay Lanes, Solihull! Reddicap Hill, Sutton! Shirley! Barren.

Diplophyllum albicans Dmrt. *Jungermannia albicans* L., Hook, Cooke. Woods and marly, wet banks, local. Oversley Wood! Chesterton Wood! Haywoods! Hartshill Hayes! Trickley Coppice! Brown's Wood, Solihull! Wheyporridge Lane, Solihull! Sutton Park! Barren.

Aplazia crenulata Dmrt. *Jungermannia crenulata* Hook, Cooke. Moist heaths, rare. Holly Lane, Honily! Salter Street, near Earlswood! Shirley Heath! Fruit, March, April.

A. sphærocarpa Dmrt. *Jungermannia sphærocarpa* Hook, Cooke. Damp hedge banks and heaths, local. Sutton Park! Honily! March.

Gymnocolea inflata Dmrt. *Jungermannia inflata* Huds., Hook, Cooke. Moist heath lands and thatch, local or overlooked. On thatch of old out-house, Bodmir! Very abundant on Sutton Coldfield! Fruit, March, April.

Jungermannia ventricosa Dicks. Heath lands, rare. Sutton Park! Barren.

Lophocolea bidentata Dmrt. *Jungermannia bidentata* L., Hook. Woods, banks. Heath lands, &c., very common. Sutton Park! &c. A peculiar erect form in sandstone quarries, near Hartshill, 1880. March, April.

L. spicata Taylor. This has been recorded from near Erdington, but I have not found it in Warwickshire.

L. heterophylla Dmrt. *Jungermannia heterophylla* Sch., Hook. Moist places on decaying wood and roots of trees, very frequent. Sutton Park! Haywoods! &c.! I have found this plant in every wood I have yet visited. February, April.

Cephalozia byssacea Dmrt. *Jung. byssacea* Roth., Hook. Heathy places in a marly soil, local. Heathy footways, Mill Lane, Kenilworth! On heath lands in Sutton Park! I find a plant exactly agreeing with the specimens from Mr. Curnow, labelled *J. Starkii* in Pearson and Carrington's "Hepatic. Brit. Exsiccatæ."

C. bicuspidata Dmrt. *Jungermannia bicuspidata* L., Hook., Cooke Damp banks, moist heaths, drains and marshes, very frequent. I find this in every part of the county. Mar., Ap.

C. curvifolia Dmrt. *Jungermannia curvifolia* Dicks., Purt., Hook., Cooke. "Coleshill Heath," (Purt.) I have never been able to find this plant in the above habitat.

Blepharostoma connivens Dmrt. *Jungermannia connivens* Dicks., Purt., Hook., Cooke. "Boggy and moist shady places; not rare," (Purt.) I have never found this anywhere in the county, but from Purton's remarks I imagine he found it in his own neighbourhood.

Chiloscyphus polyanthos Dmrt. *Jungermannia polyanthos* L., Hook. Marshes and moist places, apparently local. Sutton Park abundant! marshy spinney, near Bannersly Pool! moist banks, Beardsmore, near Hockley! Barren.

Trichocolea tomentella Dmrt. *Jungermannia tomentella* Ehrh., Hook, Marshy places, very rare. Above Blackroot Pool, Sutton Park!

Cincinnulus Trichomanes Dmrt. *Jungermannia Trichomanes* Dicks., Hook., Purt. *Calypogeia Trichomanes* Cooke. Moist heaths, drains, damp banks, &c., frequent. "On a bank bounding Coughton Park." (Purt.,) Walmley! Sutton Park! fruit rare, Haywoods! April.

Alicularia scalaris Corda. *Jungermannia scalaris* Schrad., Hook. Hedge banks, heaths, and woods, frequent. Sutton Park! Trickley Coppice! Shirley! March, April.

Metzgeria furcata Dmrt. *Jungermannia furcata* L., Hook., Purt. On the trunks of trees, not unfrequent. "Cookhill and Studley." (Purt.) Yarningale Common! Shustoke! Rowington! near Solihull Hall abundant! Although abundant in the last locality, I have never found it fruiting.

Aneura multifida Dmrt. *Jungermannia multifida* Hook. Woods, dripping marly banks, &c., local. In fine fruit, Rowington Canal bank! Tile Hill Wood! and stonework of Aston Waterworks Reservoir! April.

Var. ambrosioides Nees. Damp heath lands. Holly Lane, near Honily!

A. sinuata Dmrt. *A. pinnatifida* Nees., Cook. *Jungermannia multifida b. sinuata* Hook. Damp heaths and dripping banks, local. Coleshill Heath! Stonework, Waterworks Reservoir, Aston! March, April.

A. pinguis Dmrt. *Jungermannia pinguis* L., Hook. Marshy and moist places, local. Near Iron Wood, Olbury, near Atherstone in good fruit April, 1870. Olton, near Mill Pool! Rowington Canal bank! Marsh, near Packington! April.

Purton states that this plant is common; such, however, is not my own experience.

Pellia epiphylla Corda. *Jungermannia epiphylla* Hook., Purt. Wet, shady banks, drains, bogs, &c. Very frequent, and fruiting abundantly. March, April.

Purton considered this plant rare. I find it in all the woods near Alcester, where he resided.

P. calycina Nees. *Jung. epiphylla, c. furcigera* Hook. On moist, marly banks, very local, if not rare. Abundant on Rowington Canal bank! near Bentley Park! near Shustoke! April.

Lunularia cruciata Dmrt. *L. vulgaris* Cooke. Moist banks and stone work, local. Abundant on stonework bounding Waterworks Reservoir, Aston! Sutton Park on banks of streams! Barren.

Marchantia polymorpha Lin. Moist banks and in drains, frequent. On burnt heath land, Sutton Park, abundantly in fruit! Waterworks Reservoir, Aston! Shustoke! and abundant on pots in Tropical House, Aston Lower Grounds. June, July.

Preissia hemispherica Cogn. *P. commutata* Cooke. *Marchantia hemispherica* Hook. Banks of streams, rare. Stream near Blythe bridge, Solihull! Barren when found, but fruited when grown in fern case.

Conocephalus conicus Dmrt. *Marchantia conica* L., Hook. *Fegatella conica* Corda., Cooke. Side of streams, damp banks, &c., frequent, local in fruit. In fruit Sutton Park, near Bird-in-Hand, Henley-in-Arden. March.

Anthoceros punctatus Lin. Marly and sandy fields, local or overlooked. "In a stubble field at Kinwarton." (Purt.) Field by Brown's Wood, Solihull! stubble field, near Old Park Wood, Leek Wootton, abundant! stubble field at Wishaw, abundant! October, March.

A. lævis Lin. *A. major* Purton. "Moist, shady places, rare. Arrow, August 11th, 1812." (Purt.)

Riccia glauca Lin. Marly and sandy heaths. "Rare, Kinwarton, Salford," (Purt.) Local, field by Brown's Wood, Solihull. Stubble fields at Wishaw! and Leek Wootton! abundant, Coleshill Heath! &c. Winter and spring,

R. glaucescens. Carr. Banks rare. On new railway embankment, Sutton Park. March, 1879.

Ricciella fluitans Al. Braun. *Riccia fluitans* Hook., Purt., Cooke. On the mud of pools and also floating, rare. "In a pond upon Alne Hills," Purt., Arbury Park, T. Kirk, Coleshill Pool! Barren.

METEOROLOGY OF THE MIDLANDS.

THE WEATHER OF OCTOBER, 1880.

BY W. JEROME HARRISON, F.G.S.

The total rainfall of the month was large, but nearly the whole fell in two periods of two days each, viz., on the 4th and 5th, and again from the 25th to the 27th; disastrous floods were the result in many localities. At Orleton the downfall of the second wet period (26th—27th) produced the greatest flood on the River Teme since 1795, with the exception of the one in November, 1852. The latter half of the month was very cold, easterly winds prevailing, and there was a little snow on the 20th. The mean temperature of the month (43°) is below the average. The barometer was unsteady, falling very low on the 28th, when a severe gale was experienced. A lunar halo was seen at Loughborough on the 15th.

STATION.	OBSERVER.	RAINFALL. Total for M. In.	Greatest fall in 24 hours. In.	Greatest fall in 24 hours. Date.	No. of rainy d.	TEMPERATURE. Greatest ht. Deg	Greatest ht. Date.	Great'st cold Deg	Great'st cold Date.
GLOUCESTERSHIRE.									
Cheltenham	R. Tyrer, Esq.	4·75	1·68	4	17	64·8	1	21·6	24
Stroud	S. J Coley, Esq	7·68	1·90	3	14	63·0	1 & 2	25·0	30
SHROPSHIRE.									
Haughton Hall, Shifnal	Rev. J. Brooke	4·92	1·61	27	16	61·0	1	24·0	20, 24, 30
Woolstaston	Rev. E. D. Carr	5·95	1·75	27	16	65·0	1	25 5	20
More Rectory, Bishop's Castle	Rev. A. Male	5·40	1·37	4	15	65·0	1	21·0	24
Larden Hall	Miss F. R. Boughton	6·73	1·78	27	16				
Bishop's Castle	E. Griffiths, Esq.	5·36	1·54	27	13	66·0	1	23·0	20
Cardington	Rev. W. Elliot	6·28	1·57	27	13				
HEREFORDSHIRE.									
Stoke Bliss	Rev. G. E. Alexander	5·64	1·77	4	12	62·0	1	29·0	23 & 29
WORCESTERSHIRE.									
Orleton, Tenbury	T. H. Davis, Esq.	6·17	1·95	4	13	66·5	1	22·2	24
West Malvern	A. H. Hartland, Esq.	4·59	1·59	4	11	58·0	18	26·0	20
Pedmore	E. B. Marten, Esq.	5·12	1·24	27	13	69·0	1	21·0	20, 23, 29
Longlands, Stourbridge	J. Jeffries, Esq	5·08	1·35	27	11	62·0	1	26·0	23
Dennis, Stourbridge	Mr. C. Webb	5·28	1·35	27	15	65·0	1	22·0	23
Evesham	T. J. Slatter, Esq	4·45	1·54	4	15	62·5	1	17·2	30
STAFFORDSHIRE.									
Beacon Stoop, Weaver Hills	C. L. Wragge, F.R.G.S.	3·96	1·80	27	15	60·2	1	23·9	20
Dudley	Mr. J. Fisher	3·94	1·48	5	10				
Kinver	Rev. W. H. Bolton	4·97	1·34	4	11	61·0	1	24·0	29
Walsall	Mr. N. E. Best	5·95	1·70	27	14	58·0	1	25·0	19 & 23
Grammar School, Burton	C. U. Tripp, Esq.	4·22	1·28	27	17	66·0	1	23·0	24
Weston-under-Lyziard R'tory	Hon. and Rev. J. Bridgeman	4·76	1·44	27	15	63·0	1	24·0	20
Wrottesley	E. Simpson, Esq.	4·98	1·63	27	11	61·5	2	24·7	21
Cheadle	J. C. Phillips, Esq.	4·07	1·40	27	14	61·0	1	27·0	20, 21, 30
Alstonfield Vicarage	Rev. W. H. Purchas	3·29	1·72	27	9	65·8	1	19·6	24
Farley, near Cheadle	C. L. Wragge, Esq.	4·38	1·44	4	13	61·6	1	27·0	20
Oakamoor	E. Kettle, Esq.	4·22	1·45	4	11	61·5	1	22·0	20
Lichfield	Mr. J. P. Roberts	5·34	1·61	27	11				
WARWICKSHIRE.									
Coundon, Coventry	Lieut.-Col. R. Caldicott	5·79	1·52	4	14	60·0	1	30·0	20, 23, 29
Bickenhill Vicarage	J. Ward, Esq.	5·42	1·25	27	11	54·0		20·0	
St. Mary's College, Oscott	Rev. S. J. Whitty	5·46	1·34	27	13	64·1	1	26·0	24
Henley-in-Arden	T. H. G. Newton, Esq.	4·58	1·45	4	11	59·0	11, 16, 18	26·0	24
Rugby School	Rev. T. N. Hutchinson	6·62	1·50	4	17	62·0	1	25·6	24
DERBYSHIRE.									
Stoney Middleton	Rev. U. Smith	7·42	2·37	4	14	62·0	1	18·0	19
Fernslope, Belper	F. J. Jackson, Esq.	5·24	1·55	27	16	62·0	1	26·0	20 & 24
Spondon	J. T. Barber, Esq.	5·31	1·43	4	13	59·0		25 0	
Duffield	W. Bland, Esq.	4·69	1·36	27	10				
NOTTINGHAMSHIRE.									
Hodsock Priory, Worksop	H. Mellish, Esq.	6·60	1·83	27	16	63·0	1	22·6	20
Park Hill, Nottingham	H. F. Johnson, Esq.	5·31	1·43	27	14	59·0	1	29·0	23
Tuxford	J. N. Dufty, Esq.	6·23	1·51	27	17	58·0	1	24·0	20
LEICESTERSHIRE.									
Loughborough	W. Berridge, Esq.	5·22	1·51	4	14	64·9	1	24·1	24
Ashby Magna	Rev. E. Willes	5·67	1·47	4	12	67·0	1	21·0	24
Kibworth	T. Macaulay, Esq.	6·52	1·23	4	19			26·0	20 & 23
Syston	J. Hames, jun., Esq.	4·87	1·15	27	16	60·0	2	25·0	24
Waltham-le-Wold	E. Ball, Esq.	5·69	1·30	5	13	56·0	4	26·0	19
Coston Rectory, Melton	Rev. A. M. Rendell	5·91	1·13	4	13	60·5	1	23·5	24
Dalby Hall	Mr. G. Jones	5·58	1·07	27	14	63·0	1	22·0	24
Market Harborough	S. W. Cox, Esq.	6·60	1·38	4	14	59·0	1	22·0	24
NORTHAMPTONSHIRE.									
Towcester Brewery	J. Webb, Esq.	5·72	1·08	4	14				
Kettering	J. Wallis, Esq.	6·38	1·21	8	15	60·0	2	30·0	21
Althorpe	G. S. Groom, Esq.	4·81	1·20	4	12	59·0	1	23·0	23
RUTLAND.									
Uppingham	Rev. G. H. Mullins	6·44	1·26	4	15	59·6	1	27·2	20
Northfields, Stamford	W. Hayes, Esq.	6·56	1·23	4	10	64·0	1	25·0	30
Ventnor	J. Codley, Esq	8·28	1·41	9	18	66·8	1	32·5	21
Altarnun, Cornwall	Rev. J. Power, M.A.	8·07	2·20	5	16	68·0	2	24·0	30

CORRECTION.—Total September rainfall at Stoney Middleton should be 6·02in., and maximum fall 1·50in.

Natural History Notes by Observers.—*Shifnal.*—Dahlias and other tender plants cut down on 20th; Acorns an abundant crop, as also of Hips, but scarcely any Haws or Horse-chestnuts; Potatos a great crop and little disease, especially the Champions. Last detachment of Swallows took flight on 11th. *More Rectory.*—A solitary Swallow was flittering about on the 11th and 12th, but then disappeared. The first Fieldfare appeared on the 22nd, followed by large flocks on the 24th. *Cheltenham.*—All leaves off the Limes, Walnuts, and Chestnuts by the last week of October. *Bishop's Castle.*—The weight of snow on the Oak trees caused immense damage to the trees, some being completely stripped of their branches. The damage on the Earl of Powis' estate is reckoned at several thousand pounds. *Burton-upon-Trent.*—White Pheasant at Bretby seen daily for some time; *O. dilatata* taken at Bretby October 14th. The Spanish Chestnuts have not produced so little fruit for some years. Fieldfares seen November 2nd.

Correspondence.

Late Swallows.—On the 16th of this month (November) two Swallows were seen flying up and down in the shelter of a belt of trees near this village. It was blowing very hard at the time. This is late for them to be here.—Oliver V. Aplin, Bodicote, Oxon.

Rana esculenta, (Edible Frog,) near Cheltenham.—On Easter Monday, 1878, I captured, near Cheltenham, what I then thought was a very fine specimen of the Common Frog. It has since, however, proved to be the Edible Frog, *Rana esculenta*, and therefore, I believe, worth recording.—Alfred Shrive, 66, New Summer Street, Birmingham.

Phyllody of the Floral Organs of a Grass.—A few days since, walking over Middleton Heath, I gathered what seemed at first sight a viviparous state of the false oat grass, *Avena elatior;* as from the glumes of each of the spikelets proceeded what seemed to be merely a young grassy shoot. Closer examination, however, proved it to be a case of phyllody of the lower pales of both the upper and lower flowers of this plant; each pale having developed into a perfect green leaf, consisting of leaf sheath, ligule, and lamina. These leaves, however, differed from ordinary leaves in this particular—that each leaf was terminated by a narrow attenuate membranous process exactly similar to the terminating point of the pales, and from the back of this process, either from the middle or from the apex, (according as it represented the upper or the lower flower) proceeded a straight or a twisted and kneed awn. The appearance was very singular, and was an excellent example establishing the dictum of the great German poet Goethe, who first recognised in the flower and fruit the recurrence of the foliage.—J.E.B.

Phenological and General Observations taken in the vicinity of Farley, Staffordshire, during September, 1880.—1st, ripe fruit of *Rubus fruticosus* (the Blackberry) first seen on high ground on left main watershed of Churnet R.; hence a position subject to a more equable temperature and more favourable climatological conditions than the low-lying and enclosed valley below. 3rd, fruit of *Corylus Avellana* first gathered in ripe condition. 15th, leaves of Sycamore beginning to turn yellow. 21st, *Spiræa ulmaria* still in flower by rivulet near foot of Weaver Hills, but only one plant seen in this condition. About same time, and in same locality, last flowers of *Epilobium hirsutum; Geranium pratense* still in flower by woodside near foot of Weaver. 23rd, Birch leaves by now changing colour. 24th, noticed an isolated case of a Birch in Churnet Valley woods nearly bare; leaves of *Corylus Avellana* "yellowing." 25th to 28th, leaves of Beech commenced to fall. 28th, fruit of *Sambucus nigra* ripe at Farley, in wild state, first noticed, a few berries only ripe. 25th to 29th, Sycamore first shedding leaves. 30th, *Centaurea*, *Prunella vulgaris*, *Geranium Robertianum*, *Campanula rotundifolia*, *Lychnis*, *Stachys sylvatica*, &c., still in flower; Blackberries very plentiful; Hazel-nuts very scarce. General Notes from May to September.—Very few flowers of *Cratægus Oxyacantha*; blossom only occasionally seen, and but little fruit. The hay harvest commenced at the end of June, and considerable damage was done to the crop by subsequent heavy rains, especially by the falls of July 17th, 0·920 inch, and August 7th, 1·515 inch during the passage of a serious cyclone. Some of the best hay was gathered at the foot of the Weaver Hills during the sway of the succeeding barometric crest, anti-cyclonic pressures of the second week in August, and dry period following, when the most favourable conditions for harvesting prevailed in accordance with the summer character of this type of weather, which is always more or less permanent. *Pieris Brassicæ* and *P. Rapæ* very scarce throughout the entire period. I counted about three "white" Butterflies altogether, and the assistant at my observatory declares he only remembers seeing *one*. Brown Butterflies seldom seen, (assistant remembers noticing six,) but of more frequent occurrence than the Cabbage Butterfly. *Melolontha vulgaris*, the common Cockchafer, I recollect only to have seen once. Only *one* or *two* Grasshoppers were observed. Wasps *very* numerous and many nests taken. *Apis mellifica*, the common Hive Bee, not often seen. Very few Larks. Heard *Alauda arvensis* singing in the spring but "now and again;" noticed but few Swifts.—Clement L. Wragge.

A Walk in November, with Observations on Autumn Fruits and Foliage.—On Tuesday, November 2nd, I walked to the quaint old town of Olney, Bucks, returning home through Yardley Chase. To those botanists who look for flowers alone my walk would have seemed a cheerless one, for the "gentle race" had nearly all passed away; a few rain-beaten specimens of the never-failing Daisy, some yellow Crowfoots, the ubiquitous Groundsel, and a few Ragworts and Devil's-bit Scabious were nearly all that remained of the summer's glory. In the place of the flowers, which were faded and gone, many brightly-coloured berries and curiously-formed seed vessels adorned the banks and hedgerows. The wild Clematis threw its elegant stems in graceful profusion over the hedge, garnished with bunches of white feathery Achenes. In many a shaded nook still lingered some of "those berries that emboss the bramble, black as jet." Most of the fruit was spoilt by the late excessive rains and by the frost. There had been promise of a good crop this season. The foliage exhibited every shade of colour from dark green to bright red and purple. The Wild Rose flings its stems loosely over the hedge, displaying the bright "scarlet hips"; both these and the "stony haws" of the thorns are but sparingly distributed this year. The leaves of the Guelder Rose were a bright red colour, many shrubs being laden with clusters of the wax-like berries formed a very pleasing object. Some of the other "clustering fruits" which garnished the hedges were the crimson berries of the Honeysuckle, the Bryonies, and the woody Nightshade, which was more deeply tinged with orange. Flora's mourners, in true funereal garb, might also be noticed—the Privet, the Buckthorn, and the Dogwood—the foliage of this latter shrub dies off a deep blood-red colour, and where growing by the side of elm or maple, whose leaves are golden yellow, is a very attractive feature in the woodland scenery. The Spindle Tree *(Euonymus europæus)* surpasses in beauty any other shrub at this season, the pretty pink capsules, which open and display their seeds covered with a peculiar arillus, are as attractive as the rich-coloured autumn leaves. The golden yellow foliage of the Larch trees formed a very pleasing contrast to the dark evergreen of the other Pines. The leaves of the Beeches were of a warm chestnut tint, mingled with patches of bright yellow, which when waving in the breeze and lit up by the sunshine seemed like sheets of fire. The colours of the Oak leaves varied from pale yellow to deep russet brown. Some trees are laden with acorns this year, but the supply in this district is but partial. The leaves were falling thick and fast from many Ash and Chestnut trees, while the Limes, Sycamores, and Poplars were almost bare. The Ivy, which clothes many a rugged trunk and crumbling wall, was noticed in flower. I was much surprised while walking down the High Street, Olney, to see a Swallow still hawking about. Most of them left us about the 15th October, while their congeners, the House Martins, departed about September 22nd. The mosses which I gathered on my return journey included some Tortulas and *Grimmia pulvinata* from the walls, some feathery Hypnums, silver Bryum, and a minute kind *(Pottia minutula,)* with small bright red capsules, and *Atrichum undulatum*, several plants of which I noticed bearing two capsules. I also gathered *Frullania dilatata*, and many different coloured lichens from the trees and fences.—R. Rogers, Castle Ashby.

Wild Plants Flowering at Falmouth, 23rd November, 1880.

Ranunculus repens	Crepis virens
Fumaria officinalis	Thrincia hirta
Capsella bursa-pastoris	Hypochæris radicata
Coronopus didyma	Cnicus lanceolatus
Sinapis arvensis	Centaurea nigra
Lychnis dioica	Pyrethrum inodorum
Stellaria media	Bellis perennis
Cerastium viscosum	Senecio vulgare
Geranium Robertianum	S. Jacobæa
Ulex Europæus	Chrysanthemum Leucanthemum
Rubus corylifolius	Achillea millefolium
Potentilla reptans	Taraxacum dens-leonis
Fœniculum vulgare	Erica cinerea
Heracleum spondylium	Linaria repens
Smyrnium olusatrum	Veronica agrestis
Daucus Carota	Lamium purpureum
D. maritima	L. maculata
Hedera helix	Betonica officinalis
Scabiosa succisa	Prunella vulgaris
Apargia autumnalis	Plantago lanceolata
Sonchus oleraceus	Euphorbia peplus
S. arvensis	Parietaria officinalis

Garden Plants Flowering in Open Air.

Hydrangeas	Desfontainia spinosa
Veronicas	Berberis Darwinii
Geraniums	Aralia Sieboldii
Eschalonia	Gladiolus
Yucca	Stocks, &c.
Rhododendrons	

Howard Fox.

BOTANICAL NOTES FROM SOUTH BEDS.—EARLIEST OBSERVED DATES OF FLOWERING :—

Name.	Date.	Aspect.	Soil, &c.
* Spiranthes autumnalis	August 28th.	S.E.	Lower chalk, hill side.
Hedera helix............	October 3rd.	Open.	
	FOLIAGE.		
Ash	Novem. 1st.	Open.	About half the foliage fallen.
Oak	,, 1st.	Open.	Heads of foliage, full.
Elm	,, 1st.	Open.	Heads of foliage, full.
	SECOND BLOSSOMING THIS SEASON.		
Cornus sanguinea	Sept. 19th.	S.W.	Hedgerow.
Lonicera Periclymenum	Oct. 10th.	W.	Hedgerow, blooming freely.
	LATEST OBSERVED DATES OF FLOWERING.		
Lactuca muralis	August 24th.	Open.	Old wall.
Spiræa filipendula	,, 28th.	S.	Chalk, hill side.
Calaminta acinos.........	,, 28th.	Open.	Stubble field.
Campanula hybrida	Sep. 29th.	N.E.	Turnip field.
Parnassia palustris......	,, 29th.	N.E.	Chalk escarpment.
Anthyllis vulneraria	,, 29th.	N.E.	Chalk escarpment.
Ononis arvensis	,, 29th.	N.E.	Chalk escarpment.
Vicia sepium............	October 3rd.	W.	Hedge.
Convolvulus sepium	,, 3rd.	W.	Hedge.
Campanula glomerata ..	,, 10th.	N.E.	Chalk escarpment.
Stellaria graminea	,, 10th.	Open.	Green lane.
Gentiana amarella	,, 10th.	N.E.	Chalk escarpment.
Helianthemum vulgare ..	,, 10th.	N.E.	Chalk escarpment.
Pimpinella saxifraga	,, 10th.	N.E.	Chalk escarpment.
Reseda lutea............	,, 16th.	S.	Railway bank.
Scrophularia aquatica ..	,, 16th.	S.	Spring head.
Scabiosa columbaria	,, 17th.	S.E.	Chalk escarpment.
Reseda luteola	,, 17th.	S.E.	Chalk escarpment.
Geranium Robertianum..	,, 17th.	S.	Hedge bank
Linaria spuria	,, 10th.	Open.	Stubble field.
L. elatine	,, 10th.	Open.	Stubble field.
Myosotis palustris	Novem. 6th.	S.W.	Under a warm hedge.
Equisetum palustre	,, 6th.	Open.	Moist meadow.
Ranunculus acris........	,, 6th.	S.W.	Meadow.

J. S., Luton.

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY. GEOLOGICAL SECTION.—October 26th. Mr. Morley mentioned seeing four Lunar Rainbows in one evening in Nant Francon. Mr. C. Pumphrey exhibited a curiously-mottled Limestone from Tenbury, collected at the excursion of the Worcestershire Society. Mr. W. Madeley, secretary of the Dudley Society, read an interesting paper on "Coal," describing the origin of coal in vegetable matter accumulated in swampy tracts, which were sometimes submerged for long periods, during which shales and bands of ironstone were deposited. The various organic

* Spiranthes autumnalis, on October 11th, 1879, was in full blossom on a chalk hill side with S.E. aspect. At the same spot, on October 9th, 1880, only a few spikes with ripe capsules, were to be seen.

remains (Lepidodendron, ferns, shells, and insects) were illustrated by a numerous collection of Fossils, many of which were very fine and beautiful specimens. General Meeting.—November 2nd. Mr. W. E. Richardson exhibited a splendid collection of about 500 Ferns from Jamaica. Professor T. W. Bridge exhibited a large collection of fishes, reptiles, and other animals beautifully preserved in spirit. They had been obtained mainly by purchase, but a few by gift for the Museum of Mason's Science College. It would be impossible here to give a full account of the many curious, rare, and beautiful forms in the collection, but, to mention a few out of the many, there were specimens of the *Ceratodus*, a fish forming a connecting link between widely divergent groups of fishes; the Hammer-headed Shark, the Bony Pike of North America, one of the few living representatives of the fossil Ganoids; the Flying Fish, Sun Fishes, Porcupine Fish, the long-tailed Trygon, &c.; the curious legless Lizard, *Amphisbœna*, and the amphibians, *Menobranchus* and the Axolotl, the former of which has gills throughout life; the Lancelet, *Amphioxus*, one of the lowest of the vertebrata; two species of Ascidians, (the Sea Squirts,) which in their earlier stages are decided vertebrates; several Molluscs, including the *Hyalea*, rarely seen in the flesh, being chiefly known by its beautiful glassy shell; the Octopus, a specimen that died in the Aston Aquarium; a Pentacrinus, almost the only living representative of the fossil Crinoids or "Stone Lilies;" Star Fishes; "Sea Hedgehogs," *(Echini,)* and some wonderfully-perfect specimens of Pennatula. Mr. W. R. Hughes moved, and Mr. Wright Wilson seconded, a cordial vote of thanks to Professor Bridge for his exhibition, and for the able description which he had given of them. In doing so, both gentlemen took occasion to advert to the desirability of every member of the society doing what he could to spare specimens from his collection towards the Mason College Museum, which, in the future, if the present nucleus proved an index to the whole, bid fair to be one of the most important in England. Mr. Wright Wilson exhibited a fowl's egg containing a double yelk, the second yelk having a portion of its sac protruding through an orifice at the apex of the shell. Mr. S. Allport exhibited a collection of large ganoid scales from lower Cretaceous rocks near Bahia, on the coast of Brazil. Biological Section.—November 9th. Mr. J. F. Goode exhibited a Queen Termite or White Ant, from Natal, and workers of the same species. Mr. Bagnall exhibited *Avena elatior*, false oat, showing phyllody of the lower paleæ, from Middleton. Mr. W. Southall exhibited a nest of the Reed Warbler, from Sir Harry's Road, Edgbaston, the second year of nesting in the same spot. Mr. A. W. Wills read a paper on some new and rare Desmidieæ found by him in North Wales. The paper, which was illustrated with numerous drawings and specimens under the microscopes, was listened to with much attention, and elicited a hearty vote of thanks. Mr. Wills also called the attention of the members to the importance of always making accurate measurements of microscopic objects, so that the drawings made from them might be of scientific value; and said the best and simplest means of attaining that end was to draw all objects to one scale, say 400 diameters, so that comparison between the various species would be an easy matter. Microscopical General Meeting.—November 16th. Mr. W. P. Marshall exhibited the seed pod of the milk-weed *(Asclepias,)* a small plant growing wild in Ontario, Canada, and so called because it is found full of milk when broken in two. The pods hang on the side of the plant and are filled with large parachuted seeds. Mr. H. E. Forrest exhibited a number of species of living Desmids and Diatoms from Sutton Park. Mr. John Edmonds followed with some notes "On the Mineralised Diatoms found by Mr. W. H. Shrubsole, F.G.S., in the London Clay," illustrated by specimens, including a beautifully arranged slide of selected diatoms prepared by Messrs. A. C. Cole and Son, and large diagrams. These diatoms are found forming a shallow layer throughout the London basin, and have been traced over about a hundred miles, the layer appearing continuous throughout the London clay, although very thin in comparison to the thickness of the entire formation. The siliceous skeletons of the diatoms are entirely coated over with "iron pyrites," or sulphide of iron, giving them a brilliant gold or silver lustre. This coat can be dissolved off them by the action of weak acids, leaving the siliceous skeletons quite clean, and with their characteristic markings intact. It is remarkable that all the species of these diatoms belong to forms having a circular or triangular outline, the common spindle-shaped and rod-like forms being conspicuous by their absence. Mr. Edmonds stated that Mr. Shrubsole, in conjunction with Mr. F. Kitton, had in preparation a paper upon the subject, which would shortly appear. At the conclusion of the paper, Mr. W. J. Harrison, F.G.S., spoke, pointing out that the discovery of this diatomaceous layer was of great service in determining a definite horizon in the London clay, as its occurrence in well-boring would determine approximately the thickness of clay which would have to be cut through before the chalk could be reached. It would also largely aid in the discovery of "faults," which without such a guide were very difficult of determination.—At recent meetings of the Society, Professor Babington and Mr. Herbert Spencer were unanimously elected hon. vice-presidents.

BIRMINGHAM AND MIDLAND INSTITUTE SCIENTIFIC SOCIETY. —October 27th.—Mr. T. Birkmire read a paper on "Plant Adaptations." November 3rd.—The members visited the ammunition works of Messrs. Kynock and Co., at Witton, and saw the various processes of making cartridges. November 10th.—Mr. J. W. Oliver gave an interesting lecture on "Linnæus, his Life and Work." November 17th.—Mr. E. Evans read a paper on "Blowpipe Manipulation," and gave practical illustrations in this very important branch of chemistry.

NOTTINGHAM LITERARY AND PHILOSOPHICAL SOCIETY.—NATURAL SCIENCE SECTION—October 13th.—Mr. J. H. Jennings, President of the Section, gave an address on "The Preparation of Rock Sections for the Microscope." On November 4th, Mr. A. H. Simpson gave a lecture entitled "The Chemistry of a Kitchen Fire."

NOTTINGHAM NATURALISTS' SOCIETY.—October 20th. Mr. J Shipman read a paper on the "Triassic Rocks of Cheshire and their Equivalents at Nottingham," in which he compared the lithological characters and physical aspects and relations presented by the rocks of this age in their typical development in Cheshire with those of the same age at Nottingham, where they are much thinner. Commencing at the base of the series, he described how the Lower Mottled Sandstone passes up into the Bunter Pebble Beds, as at Nottingham, though between these places, at Dale, in South Derbyshire, there was a break and a distinctly eroded surface. The Bunter Pebble Beds in Cheshire were a deep red or reddish brown rather fine-grained sandstone, while at Nottingham they were yellow, coarser, and less compact, but contained the same characteristic quartz and quartzite pebbles in both areas. The Upper Mottled, (estimated to be 600ft. thick,) absent at Nottingham, seemed the counterpart of the Lower Mottled of Cheshire and Nottingham. His chief attention, however, was devoted to the Keuper Basement Beds, which he found to rise in blackened craggy cliffs from steep wooded slopes of Upper Mottled to heights of from 400ft. to 500ft. above the sea. Although Drift lay thickly on the low ground forming the western half of Cheshire, the many quarries and natural exposures rendered the geology not difficult of observation. The Keuper was found to rest on a level surface of the Upper Mottled, *apparently* quite conformably, and there was no conglomerate parting, as between the Bunter Pebble Beds and the Keuper at Nottingham. It was in the Basement Beds that the footprints of *Labyrinthodon* were met with, always at one particular horizon, represented by a thin dark line in the quarry at Storeton Hill. The Keuper "Waterstones" of Cheshire contained more sandstone and less marl than those of Nottingham, the sandstone being thicker and of a more compact texture, though towards their passage into Upper Keuper the likeness became stronger. One result of his visit to Cheshire was to place it beyond doubt that the patches of massive pebbly grit that cap the hills at Bramcote, near Nottingham, to the thickness of some 60ft., and that were originally mapped by Hull as Bunter Pebble Beds, are really outliers of the white sandstone (Keuper Basement Beds) of Ashbourne, in Derbyshire, Alton, in Staffordshire, and of Cheshire. Mr. E. Wilson, F.G.S., and himself had now traced these rocks across the Midlands from Nottingham to Cheshire, and they had met with evidence showing that these rocks, though now denuded into scattered patches, partly concealed by overlying deposits, were originally formed in a narrow channel that stretched across the Midlands from Cheshire to Nottingham, and perhaps still farther east, during early Keuper times.