THE MIDLAND NATURALIST:

THE JOURNAL OF THE
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AND ARCHÆOLOGICAL SOCIETIES AND FIELD CLUBS
OF THE MIDLAND COUNTIES.

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

VOLUME II.
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PREFACE.

The completion of the second volume of the "Midland Naturalist" affords the opportunity for reviewing what purposes its publication has served; and the Editors feel satisfied that they will not be accused of mis-statement when they say that the monthly publication of this magazine has given an appreciable stimulus to Natural History studies in the Midland Counties. Some valuable papers on Fresh-water Life published in it show that one of the Societies in the Midland Union, at least, has been busily occupied in the study of a very fascinating and interesting branch of Natural History, and with results of a most satisfactory character. The discovery for the first time in this country of *Leptodora hyalina* and of *Daphnia Kahlbergensis* (or *Bairdii* as was at first suggested) are some of these results.

The practical papers on Entomology which have been published will, it is hoped and believed, lead to a more general study of the Insect world, especially among the younger members. A sort of reproach seems to have hung over the Midland Counties as being a district unable to afford any reward to the investigations of the Entomologist: how ungrounded this, and how truly rich the field is, has been already conclusively shown in these pages by several valued contributors, (particularly Mr. W. G. Blatch,) to whom we express our gratitude, not only for what they have already done, but also (in the anticipatory sense of a well-known adage) for favours yet to come, on which we rest well assured both we and our readers may confidently rely.

In the admirable address delivered by the President at the annual meeting of the members of the Midland Union, at Leicester, in May last, (pp. 137-141,) some most suggestive remarks were made on the subject of noting down observations on points of natural science, and regularly communicating them for publication in the pages of this magazine. As we have frequently pointed out, it would be well if every one of our subscribers would consider him or herself as commissioned to observe and report on all occurrences of scientific interest which may happen within their knowledge. The present volume contains many interesting and valuable communications of this character, and we sincerely hope that in the coming year their number may be very largely increased.

We have again the pleasant duty of acknowledging our indebtedness to our large band of Meteorological observers for the valuable assistance we have received from them; to Mr. W. B. Grove, B.A., who has rendered us and our readers invaluable help in various ways; and to Mr. Chas. E. Scarse for assistance in the preparation of a carefully compiled Index.

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PRINTED AT THE MIDLAND COUNTIES HERALD OFFICES.

THE MIDLAND NATURALIST.

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

A MARINE AQUARIUM.*

BY PHILIP HENRY GOSSE, F.R.S.

Since you wish to know some details of the construction and working of my new Marine Tank, I send you the following notes. In the spring of 1876, I determined to erect an Aquarium, the water of which should be in constant circulation ; and I decided to adopt the plan of the Crystal Palace Aquarium, viz., that in which the ratio of the water in the show-tank to the water in reserve unseen, is as 1 to 5.

My old kind friend, Mr. W. Alford Lloyd, contemporary and fellow labourer from the first in aquarian development, gave me the invaluable aid of his counsel in every step of the work; ever suggesting and improving, as it went on, with a zeal which could not have been exceeded if the scheme had been his own. The mechanical contrivances and fittings were supplied by the eminent engineers, Messrs. Leete, Edwards, and Norman, to whose courtesy, skill, and thoroughness of work, I bear willing witness. The Tanks were made and put together, and the whole erected and set a-going, by mechanics of the place.

In the servants' front of my house was an apartment used as a lumber room, whose floor was about 12 feet from the ground, with a window looking N.W. This window I took out, and enlarged, for the reception of the show-tank (henceforth to be distinctively the "Tank") ; and the room itself was dubbed the "Aquarium."

The window looked upon a yard, across which was an out-house used as a coal-cellar. The farther corner of this house I excavated, for the reception of a strong slate tank (the "Reservoir"), which was sunk so that its top was level with the ground.

Another slate tank (the "Cistern") was placed within the roof, immediately over the Tank, resting partly on the summit of the stone wall of the house, and partly on the rafters, which were strengthened for the purpose.

* In a letter to Mr. William R. Hughes, F.L.S., Birmingham.

These three vessels were made of squared slabs of best slate, varying in thickness from 1½in. (base) to 1in. (sides), which were bolted together with iron rods, tightened by screws and nuts at the ends. All the internal angles were filled with Portland cement. The Tank had that side which faced the interior of the room, made of ½in. plate-glass.

The dimensions and capacities of these vessels were as follows:—Tank 42in. long, 18in. wide, 18in. deep, in the clear; each inch of depth equal to 2·73 gallons; 49 gallons in total. Reservoir 62¾in. long, 35¼in. wide, 26¼in. deep, each inch equal to 8 gallons; 210 gallons in total. Cistern 34in. long, 34in. wide, 27in. deep, holding 112 gallons.

The Reservoir in the cellar was first put together, sunk in place, proved water tight, and the earth rammed around it, in May. Early in June a water cart, viz., a hogshead on wheels, was filled thrice with the crystal water of Oddicombe shingle-beach, and emptied by a hose into it, giving me 210 gallons of pure sea-water in my Reservoir, which was protected from dust by a strong and tight cover of wood, divided and hinged in the middle for convenience of examination.

Early in September the whole apparatus of pump, pipes, valves, &c., arrived from the engineers, to be described in detail; and immediately the masonry of the house was opened to receive the Cistern and the Tank. A large opening having been made in the gable above the window, two cross-joists of 4in. square deal were inserted in the ceiling from the gable-wall to the centre beam. The base of the Cistern was got up, and laid *in situ*, square and level, save a ½in. inclination to S.W., that it might be emptyable to the last drop. A hole was now drilled in this S.W. part of the base, for insertion of the *jet pipe*, over the Tank; and another on the N.E. side, for insertion of the *warning pipe*. The sides of the Cistern were then set-up in Portland cement, bolted together, and smoothed within and without.

The base and sides of the Tank were put into place, first *tentatively*, until the Cistern, and the pump with its pipes, were adjusted; and then *finally*, cemented and bolted; and the plate-glass front was bedded in lead putty in its grooves, well worked in, and smoothed off. Before this last, however, the siphonal apparatus was prepared and affixed, which will presently be described.

Thus, then, the three continent vessels were in place, and appeared perfect. But these alone were of little avail. A large volume of sea-water, indeed, had been lying for more than three months quiescent in the lowest, dark and cool below the earth-level, and still brilliantly pure, as a tumblerful dipped out proved. But we wanted to lift this water out of the Reservoir into the Cistern in the roof, to transmit it thence into the Tank, and thence again into the Reservoir; and to do this perpetually, without an instant's intermission, day and night, by a constant circular current.

The apparatus by which this was effected I must now proceed to describe.

1.—The Pump. This was an ordinary lift-pump, of great strength, and great accuracy of workmanship, the materials of which were steel, vulcanite and glass. The last-named material was strongly recommended to me by Mr. Lloyd, for the pump barrel; a cylinder of plate-glass turned and polished within and without, so as to be mathematically true, with turned and polished balls of glass to act as valves. These can be obtained only from one house in England, that of Chedgey, in the Borough, maker and patentee. They are in demand for vinegar and other acid-works, for the same reason that made one valuable to me. Mr. Lloyd first procured one from the maker, with much personal trouble and difficulty, so greatly does the demand exceed the supply;—and then, with characteristic kindness, compelled me to accept it as his gift. It is 3in. in diameter internally, and 8in. high; has a capacity of 1½ pint, when making its available stroke of 6in., after allowing for the thickness of the piston; and it weighs 4lbs. 12oz. For this the engineers made two metal caps, one above and one below; which were then joined by two metal rods parallel to the barrel, screwed and nutted to the caps. To avoid oscillation in pumping, the fulcrum was fixed, independent of the barrel, to the stout wooden plank which carried the pump; and a "fork and cradle" motion insured parallelism of the piston-rod by means of a "guide," also fixed independently to the plank. This relieves the barrel from all side strains, which might break it. The piston-rod was of polished steel; the fulcrum (handle) and loop of iron.

This pump, firmly affixed to a stout plank, we set upright against the wall of the Aquarium, immediately on the right hand of the Tank; and at such a height that the surface of the full Tank was level with the mid-height of the barrel. Then we firmly bolted the plank to one of the rafters of the house.

2.—The Supply-pipes. But the pump was to be a forcing pump ("lift and drive"), and not merely a lifting pump. Therefore, the valve ball, descending by the up-stroke of the fulcrum, opens a chamber, in which there is a second ball. This is so far lifted, by the in-forced water from the barrel, as to open a pipe (the Cistern supply-pipe), which proceeding up through the ceiling delivers it into the Cistern above. The Pump supply-pipe, a stout tube of vulcanite, commencing 6in. from the bottom of the Reservoir, passing over its edge, under the surface of the soil, across the yard, through the foundation of the house, up the interior of the wall, through the ceiling of the ground-floor, joins the bottom of the pump-barrel; and, at every down-stroke of the handle, delivers one and a-half pint of water from the reservoir into the glass barrel; which water is, the very next moment, by the up-stroke, poured into the Cistern above. Into the perforate bottom of the Cistern, another tube (the jet-pipe) is screwed; which, proceeding vertically downward to within close proximity to the surface of the Tank, allows the water to descend by its own gravity, and fill the Tank.

The force and rapidity, with which this descending column of water shall enter, are regulated by a series of jets, or thimbles of vulcanite, in all which a screw is cut with one common thread, to screw on the extremity of the jet-pipe. These are pierced with a minute hole, very truly drilled, whose bore is different in each, according to the special requirement of the Tank.

3.—The Waste-pipe. A vulcanite pipe leaves the right side of the Tank near the front, and carries away the spare water to the Reservoir, passing down alongside of the Pump-supply-pipe. The position of its exit, about 2in. from the margin, of course determines the level at which the water always stands in the Tank. It was at first proposed that this should be a simple pipe, screwed into a hole in the side; but this would have carried off only the surface-water. To make the circulation complete, I chose to take it from a point very near the bottom. To avoid the uncouth appearance of a pipe, however, Mr. Lloyd devised the following contrivance. A slab of slate, 2½in. wide, 1in. thick, and as high as the Tank, has a semi-cylindrical groove gouged out of one face, but not reaching quite so far as either end. Its upper end meets the hole in the side of the Tank at the surface, while its lower end meets a similar hole bored through the slab itself. The slab being firmly cemented in place, the water in the Tank, entering through the horizontal hole, rises in the hidden groove (now become a tube) till it reaches the exit-hole in the Tank, when it begins, and continues, to trickle out through the waste-pipe. Thus the Tank can never overflow, unless the inflow be more copious than the bore of the waste-pipe can carry off, or this pipe become choked. To meet the latter peril, a strainer was cemented around the interior orifice, in this form: suppose a shallow box of vulcanite, to which there is no cover; the bottom drilled with a number of holes ⅛in. wide. This is set up on one of its sides, on the Tank-bottom, with its lidless top in contact with the lower part of the slab, the perforated bottom (now become the side) facing the interior of the Tank. It is not cemented, but merely kept in position by a heavy piece of the rock-work; because I need sometimes to remove it, in order to cleanse the straining-holes. By this contrivance (while the water can freely percolate and escape), since nothing larger than the pin-holes can pass, the waste-pipe, which is of 1in. bore, clear, can never become choked.

4.—The Siphon. It was judged desirable to have the power of lowering the surface in the Tank, and even of emptying it of water, at pleasure, without dipping. For this object the waste-pipe was cleverly turned into a Siphon, in this wise. The waste-pipe, after leaving the Tank, runs horizontally for a foot, before it reaches the pump-plank, and turns to the perpendicular. In the midst of this space a stop-cock of vulcanite is inserted, which ordinarily is left open, and serves as an air-vent. But, if I wish to draw off the water from the Tank, I take the tip of the stop-cock into my mouth, and suck strongly, till the salt water comes rushing up. This should be sufficient; but in practice I find it needful to suck such a mouthful thrice at least, before the up-current of water is strong enough to pour continuously, which is manifest to the ear, as it roars down the perpendicular waste-pipe. I have carefully to close the stop-cock with my fingers at each suck, before I withdraw my mouth; or the vacuum, in part formed, would be again destroyed. The water sucked into my mouth I instantly discharge into the Tank at each effort. When the current is set up, the surface in the Tank is seen rapidly to descend, until it is as low as I wish; when, the opening of the stop-cock destroying the vacuum, the outflow instantly ceases; and the jet-pipe in due course refills it.

5.—The Warning-pipe. In pumping, the Cistern which we are filling is out of sight in the roof above. In order to know when it is full, that we may not allow it to overflow, a small pipe is inserted into the side of the Cistern, an inch below the brim; which, leading down through the ceiling, ends at a few inches over the surface of the Tank. This is in sight of the person who is pumping, who cannot help hearing the babble of the stream, and seeing its sparkle, as it comes suddenly pouring down the warning-pipe; and he makes not a single stroke more.

These were, I think, all the essentials to the working of the scheme; but one or two additions were subsequently made, which I will describe. The jet thimbles could never be removed or replaced, without causing an annoying splash of water all around one's person and the furniture. To obviate this I had a vulcanite stop-cock inserted into the jet pipe, just above the jet. Thus I could close the pipe, before I unscrewed the jet; and I had now no more splashing. I have found this stop-cock useful in another way. When I siphon-off the water with the object of getting rid of the impalpable organic mud and humus, which commonly accumulates on the bottom, I remove the jet, and allow the jet-pipe to pour down its vertical torrent in full force. Thus all the moveable matters held in suspension, are whirled about; and very many of them are carried, in the siphon, down the waste-pipe to the Reservoir; where they settle quietly on the bottom, the organic parts dissolve, and the inorganic slowly accumulate in a thin pellicle on the bottom, requiring to be cleaned out, perhaps in a dozen years hence.

Although the sea-water originally put into the Reservoir was brilliantly clear and pure, and the wooden lid was made to fit close, we yet thought it prudent to guard against the possibility of extraneous matters being drawn into the supply-pipe, during the pumping, and so choking it. Accordingly a tight bell-shaped box of vulcanite was made to screw on to the bottom of the supply-pipe, about 6in. from the floor of the Reservoir. The bottom and sides of this box were drilled with many ⅛in. holes; so that it serves as a strainer, like that at the bottom of the waste-pipe.

The pipes were all made in lengths, with the requisite angles and connections; and were sent from London, carefully numbered, according to copious working-drawings. No bend can in the least degree be changed, vulcanite being inflexible and brittle. Every piece was fitted and screwed to its fellow, and "payed" with red-lead; some of the joints being also "served" with muslin. The lengths beneath the surface of the yard were carefully rammed with earth; and those which passed up the house-wall were secured to the joist by semi-circles of iron; and then inclosed in a narrow box of board, for facility of examination in case of need. The new window sash was now hung on hinges from the upper frame, and opened outward, to different degrees, by graduated metal quadrants, above the Tank; the area, much wider than originally, was made a bay-form recess, which allowed of a little useful angle on each side of the Tank. The pump, the pipes, the slate of the tank, were all painted black; an ornamental rim of polished Spanish mahogany was made to sit on the edge of the tank; a curtain was hung to conceal the pump; and the room generally made presentable.

By the end of September the whole was in place, and water was admitted into the Tank. Not till the last of October, however, were organisms admitted, in the forms of growing Algæ and Fishes. For it must not be supposed that all went quite smooth. The pump would not draw at first; we found that the pipes leaked, and would not deliver, till we had had much labour. Then the pump would "go back;" the water retiring from the barrel sooner or later, after the pumping had ceased; so that sometimes it required more than a hundred strokes of the handle, before the water would rise. This difficulty still continues, in a mitigated form; it is the only one which we have never quite overcome. Then the siphon would not act at all for some time; but, after several months, one day, quite suddenly and unexpectedly, it acted perfectly, and has gone well ever since.

As soon as we were in regular work, I found that my supply of water was inadequate. Some had been wasted, too; some had leaked in the imperfect fitting of the pipes' joints. Accordingly a further quantity was brought up, which made my stock as follows:—Reservoir, 180 gallons; Cistern, 60; Tank, 40; equal to 280 gallons in all. And this quantity has never since needed to be replenished. Its quality seems to have steadily improved. Clear and bright as it was at first, and faultless as it seemed for the sustentation of animal life; it is very perceptibly better now. However it be explained, many creatures that would not live more than a few weeks, or even days, a year ago, now continue without difficulty, often coming into sight months after their introduction, in full health and beauty.

The manipulation is as regular as clock-work. On Tuesday, Thursday, and Saturday evenings, my servant pumps till the warning-pipe streams, averaging some 675 strokes. If the larger-bored jets are on, there must be supplementary pumping in the intercalated days, to a varying amount. For Fishes and the higher Crustacea, &c., we find the fuller supply of jet No. 1 requisite, and this profusion takes at least 250 strokes on each of the intercalated days. The total of 675 strokes is performed in about half an hour.

The jets I use are four; of which the orifices, perfectly true and round, graduate from the thickness of a lady's medium pin (No. 1) to that of a cambric needle, (No. 4). With No. 1, 18 pump strokes deliver an hour's supply of water into the Tank; with No. 2, about 10 strokes; with No. 3, 5 strokes; and with No. 4, about $3\frac{1}{4}$ strokes. The orifice of each jet is just an inch from the surface of the Tank. A white cloud of dust-like air-bubbles is driven perpendicularly downward (about a foot with No. 1), after which they can still be followed, with a lens, careering to every part of the Tank.

This communication has already reached a length, which I greatly fear will be considered tedious. I will not then attempt to narrate my experience, as a Naturalist, in the use of the Aquarium for upwards of two years. Suffice it to say, it has been a great success; and has amply proved the value of the principle of its construction, viz., perpetual circulation, with a large reserve of water. One point I will add, which may interest some:—The total cost was covered by £60.

Sandhurst, Torquay, Nov. 20, 1878.

PARASITES OF MAN.*

BY T. SPENCER COBBOLD, M.D., F.R.S., ETC.

(Continued from Vol. I., page 328.)

Five more human nematodes remain to be noticed. Of these, two are excessively common in man, and a third, though rare as a human parasite, is very abundant in carnivorous animals. The three entozoa thus particularised are popularly known as the threadworm, the lumbricus, and the cat's worm. In the present communication I shall deal only with the first of these three common species, adding a brief notice of the Cochin China anguillules. The threadworm is just one of those species about which one does not like to say very much in public; and even that which is whispered about these entozoa in consulting rooms has to be conveyed to the victim's ears with tact and delicacy. As I have no professional motives in declaring my meaning I will mention an illustrative case, leaving it to the judgment of the Society whether the facts be published or not. An unmarried gentleman, the happiness of whose immediate future was intimately bound up with his speedy restoration to health, freely communicated to me the painful nature of his sufferings due to the presence of these little parasites. The symptoms cannot be stated in detail. Let it suffice me to say that the obnoxious guests had invaded the host by myriads, bringing their victim down to an emaciated and otherwise pitiable condition. Knowing the essential conditions of infection, I ventured to hint that the victim must in some way or other have swallowed one or more entire female parasites of this species *(Oxyuris vermicularis)*. The suggestion was a hard though happy hit; for it speedily brought the confession that in times of great distress the victim had, *en revanche*, seized hold of the living parasites and crushed them between his teeth. As, without doubt, most, if not all of the entozoa thus bitten in halves, were female worms, and as, moreover, each female parasite encloses myriads of eggs—whose contained embryos do not require a change of hosts—it is certain that thousands, not to say tens of thousands, of living germs were thus directly conveyed to the human territory. In this way the victim, originally seeking to revenge himself on the sexually mature parasites, could only have produced momentary pangs in the worms themselves, but for himself, he had thus unwittingly prepared that far more terrible and prolonged revenge which was afterwards exercised, unconsciously, by the progenies of the parent worms he had thus mutilated.

NEMATODA CONTINUED.

37.—*Oxyuris vermicularis*, Bremser.

Synonymy.—*Ascaris vermicularis*, Linneus.

Larvæ.—Only generally known in the embryonic state. Whilst within the egg they are at first tadpole-shaped, but under suitable conditions of heat and moisture they rapidly assume a vermiform character.

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* Read to the Microscopical Section of the Birmingham Natural History and Microscopical Society, December 17th, 1878. On Dr. Cobbold's behalf Mr. W. R. Hughes, F.L.S., exhibited specimens both of human and equine threadworms (*Oxyuris vermicularis* and *O. curvula*). The latter species is better known as the pinworm of the horse; female examples sometimes attaining a length of nearly five inches.

Intermediate host.—Not required.

Experiments.—Leuckart reared intra-ovular vermiform embryos by placing the eggs in moistened paper envelopes and exposing them to the action of the sun's rays. Heller reared them in glass tubes filled with saliva and carried about under the arm-pits. Heller and Zenker possessed themselves of specimens of the higher larvæ from the small intestines *(post mortem)* in a case where the patient had swallowed the eggs some days previous to his death. I caused a monkey to swallow a quantity of eggs in the hope of rearing the adult parasites, but the the result proved negative. Possibly at the *post mortem* examination I overlooked the existence of larvæ, but I do not think any were present. Lest some persons should suppose this kind of experimentation to be unwarrantable, I may remark that it had for its object the alleviation of human suffering. Others have experimented upon themselves with the same benevolent purpose. Thus, Professor Leuckart and three of his pupils infested themselves by courageously swallowing a quantity of the ova. They certainly enjoyed the satisfaction of subsequently supplying ocular proof of the success of their worm-feedings.

Remarks.—The common notion that these parasites breed within the human body is an error, and it is equally incorrect to say that they reside in the lowermost part of the intestinal canal. Their head-quarters are the cæcum and upper part of the colon. It is true that Vix and Leuckart have noticed embryos within the large intestine; but Leuckart, Heller, and myself alike regard this intestinal hatching as an unusual occurrence. For the purposes of infection it is alone necessary that the eggs of the worm be conveyed to the mouth and swallowed. Their previous immersion in water for any length of time secures their destruction, by the bursting of the egg-shells consequent upon endosmosis. The eggs are conveyed to the mouth in various ways. Ordinarily, children become infested by biting their nails, beneath the margins of which the eggs lie concealed. Professors Heller, Zenker, and myself have, all more or less, frequently had occasion to demonstrate this fact to our patients. Occasionally, the eggs are swallowed by accident during sleep. Still more rarely whole parasites may be conveyed to the mouth in a similar manner. In whatever manner they may have been conveyed to the bearer, when once the eggs have gained access to the stomach, their shells are dissolved by the action of the gastric juice, and the larvæ are liberated. In the upper intestine the larvæ grow rapidly. Here they undergo one or more changes of skin; acquiring sexual maturity within a period of less than a month.

Literature.—All standard works. See also my lectures on Helminthology, ("Worms,") and more particularly the very admirable article (Darmschmarotzer) by Heller, in Von Ziemssen's "Handbuch," or the recently issued American edition of the same work.

38.—*Leptodera stercoralis*, Bavay.

Syn.—*Anguillula (Rhabitis) stercoralis*, Bavay.

Larvæ.—These are at first known as minute embryos, measuring only $\frac{1}{250}$ of an inch in length. Subsequently, in the condition of immature rehabitiform larvæ, they acquire a length of about $\frac{1}{80}$ of an inch. All their changes of size and shape, accompanied by ecdysis, are undergone within the human intestine. Under favourable circumstances, five days are fully sufficient for the complete development and maturation of the parasite.

Int. Host.—Not necessary.

Experiments.—None.

Remarks.—In the full grown state this little nematode is stated to be only the $\frac{1}{25}$ of an inch in length. It was discovered by Dr. Normand in excrementitious matters passed by French soldiers suffering from the so-called Cochin China diarrhœa, and who had been sent home as invalids. This entozoon, by its injurious action, supplies another remarkable instance of parasitism as a cause of endemic disease. Drs. Normand and Bavay state that the victims are infested to such an extent that the number of little worms present in severe cases can only be adequately estimated at many hundreds of thousands. Their extreme rapidity of growth and maturation readily accounts for this excessive degree of infection, which is maintained with much persistence, in spite of the dysenteric action which daily expels myriads of the parasites in every stage of development. I may add that *post mortem* inspection has shown that the anguillules not only occupy all parts of the alimentary canal, from the stomach downwards, but that they also find their way into the pancreatic and biliary ducts, and even into the gall bladder.

Lit.—Normand (Dr. A.); Memoire sur la diarrhée dite de Cochinchine, in Archives de Médicine Navale, for Jan., 1877, and especially his recent article "Du Role Etiologique de l'Anguillule, *Ibid.*, Sept., 1878, Bavay; in Comptes Rendus, for October, 1876.

39.—*Leptodera intestinalis*, Bavay.

Syn.—*Anguillula (Rhabditis) intestinalis*, Bavay.

Larvæ.—Similar to those of *Leptodera stercoralis*, but relatively larger, and possessing a remarkably long œsophagus, together with a blunt instead of a sharply pointed tail.

Int. Host.—Not necessary.

Exper.—None.

Remarks.—The full grown worm is almost three times the length of the preceding species. In the Cochin China victims, it is frequently, though by no means invariably, associated with its smaller and far more abundant congener. In consequence of its occurring in comparatively small numbers, it is not easy to state to what extent this worm is concerned in the production of disease. Were it as abundant as *Leptodera stercoralis*, it would doubtless prove more destructive to the human bearer.

Lit.—Bavay; Note sur l'Anguillule intestinale; in the Archives de Méd. Navale for July, 1877.

[TO BE CONTINUED.]

THE GEOGRAPHICAL DISTRIBUTION OF PLANTS AND ANIMALS.

ABSTRACT OF AN ADDRESS DELIVERED TO THE CHELTENHAM NATURAL SCIENCE SOCIETY, BY H. J. ELWES, ESQ., F.Z.S., F.L.S., &c., ON NOV. 21, 1878, AND THE DISCUSSION THEREON.

Mr. Elwes remarked that the geographical distribution of animals and plants is a subject which, until a few years since, was scarcely thought of by Naturalists, but has recently received much attention from several of our most eminent scientific men. Nor is this surprising, when we consider the many points of the greatest interest, whether to the geographer, geologist, or others, which are brought under consideration, and how much light is thrown upon the history of the changes which have passed over our globe. After reviewing the various authors who have been most instrumental in ascertaining and explaining the various facts which have been observed, he continued that time would not permit his entering upon minute details, but proposed confining his remarks to a sketch of the most characteristic features of distribution, the reasons for which he would not touch upon, as, however ingenious and even probable might be the hypotheses which had been suggested as explanations, the majority of them were incapable of proof. From a zoological point of view, the great divisions of the world were as follows:—I. *Palæarctic*, divided into four sub-regions: (1) European, (2) Mediterranean or Mediterraneo-Persic, (3) Siberian, and (4) Mantchurian or Mongolian. The boundaries of each of the foregoing and following regions were defined, it being especially noticed that deserts and seas form the most natural ones; II. *Ethiopian region*, subdivided into (1) East African, (2) West African, (3) South African, and (4) Madagascar; III. *Oriental region*, subdivided into (1) Indian, (2) Ceylonese, (3) Indo-Chinese or Himalayo-Chinese, and (4) Indo-Malay or Malay; IV. *Australian*, subdivided into (1) Austro-Malayan, (2) Australian, (3) Polynesian, (4) New Zealand; V. *Neotropical*, subdivided into (1) Chilian, (2) Brazilian, (3) Mexican, and (4) Antillean; VI. *Nearctic*, subdivided into (1) Californian, (2) Rocky Mountains and Plains, (3) Alleghanies and Eastern United States, and (4) Canada. The foregoing divisions are made more upon zoological than botanical considerations, but in the main apply to both. The Palæarctic region, though of immense extent, does not contain throughout its northern and largest portion anything approaching to the same variety or number of species that are found in other regions of much less extent. Warblers, buntings, thrushes, grouse, waders, and waterfowl, are the most abundant and conspicuous families of birds. Deer, wild goats, sheep, and rodents, are the most characteristic animals. Coniferæ and hard-wooded timber trees, fruit trees, and herbaceous plants and grasses, are the most remarkable and useful among the vegetable forms. About 900 species of birds only are found in the entire region, of which not more than 200 or 250 at the most are resident in any one district; but we see in the Himalayas, and in some parts of Central and South America 600 or 700 species existing within a radius of fifty miles. Insects, butterflies, and beetles, are fairly represented; but in Europe these appear to increase in numbers and variety as we proceed from N.W. to S.E. In the Mediterranean, the number and variety of the plants become proportionately much greater, especially in the bulbous forms. The Mantchurian sub-region is characterised by the presence of many remarkable forms, as the wild camel on the steppes of the N.W. Tibet, and the yak, the saiga antelope, the great wild sheep of the Pamir plateau, and among birds especially by the pheasants. Its flora (except on the coast of China and Japan) is marked by the absence rather than the presence of peculiar or remarkable plants; that of the plateaus and highlands of Central Asia being poor and stunted, as might be expected from the severity of the climate. There is an intimate connection between physical geography and distribution of animals and plants which enables one to predict with tolerable certainty the character of the fauna and flora of any newly explored tracts. The oriental region having been already alluded to, it was necessary to offer a few remarks upon its subdivisions, and first of all on that of Ceylon. This sub-region (which includes the western parts of India) possesses some forms of animal life which are not present in the Indian sub-region, such as some mammals, as lemurs, tupaia and monkeys, as well as reptiles. Thus the Uropeltidæ and other genera of snakes and lizards are peculiar to it. The insects are more akin to those of Malayana than of India. The fishes of the Malay sub-region confirm the justice of its separation from the Australian region, for the fresh water forms of Siluroids and Cyprinoids, consisting of thirteen genera of the former and twenty-three of the latter, range to Java and Borneo, but do not extend further. The Ethiopian region shows a great variety and abundance of large mammals with an absence of bears, deer, goats, and sheep. The East African sub-region is the least peculiar portion of Africa, and is perhaps not so well marked as the West, which latter is the home of the anthropoid apes, in fact this sub-region has a Malayan affinity. The South African sub-region is the most peculiar and interesting of the three, especially as regards its botany. It has great numbers of heaths, bulbous and succulent plants, composites, &c., and an abundance of large game. The Madagascar sub-region is very peculiar; it is the land of the lemurs, and in fact if we received a curious bird, having very slight affinities to anything known, we should at once suspect that its native home must be Madagascar. The Australian region is very well marked: amongst mammals it is deficient in the orders present in the other regions, except bats and some rodents, while the great family of marsupials is almost restricted to it, the ornithorhynchus and echidna are peculiar to it. The birds are not quite so restricted to this region as the mammals, but we find the lyre birds, parrots, megapodes, emus, cassowaries, birds of paradise, and some curious pigeons. The Polynesian birds are very few in numbers, while mammals are absent. The New Zealand fauna is likewise very peculiar, among its birds is or was the moa; while species of another wingless family, Apteryx, still linger; there are, likewise, peculiar parrots, as the nestor and the stringops, the curious notornis among the rails, and the unique anarhynchus among the Charadriidæ. We find a great poverty of insects, only eleven species of butterflies and no snakes. It is curious what a deficiency of hardiness exists in Australian plants as compared with those of some other regions; rapidly succumbing before introduced species, many of them are with great difficulty, if at all, raised in other climes.

Mr. Symonds congratulated Mr. Elwes on the interesting address which he had just delivered, wherein he had illustrated point after point with great clearness.

Mr. Longe, Rev. W. Boyce, and Major Barnard made observations upon the failure of New Zealand plants in this climate.

Sir William Guise remarked upon the utility of such investigations as those of Mr. Elwes, wherein facts were being investigated with reference to what they tell us of the past history of the globe. Theorists had accounted for some phenomena by suggesting the existence of submerged continents or islands that appeared to be constantly dipping up and down, but the Challenger had shown that where one of these continents was supposed to exist the depth of the sea is such that it would cover the highest mountains now extant. Some facts had not been explained, for instance the peculiar flora of St. Helena, or the large tortoises of the Galapagos islands, and we required more workers such as the author of the present paper, to continue their investigations, for we wish to know how these animals and plants got there, and what relationship they have with other lands.

Mr. Day remarked that he had been investigating the geographical distribution of the fresh water fishes of India, and his conclusion as to the sub-divisions of the Indian region coincided with Mr Elwes', that there were three separate fish-faunas—the first on the primary hills of the western Ghauts, extending into Ceylon, and on the Malay Archipelago, by way of the Andaman Islands, and also identical with some Himalayan forms; secondly, an African element, which had entered India by way of Syria, along with some palæarctic genera; and, lastly, a Malayan form, which had been derived by way of Burmah and Siam; and that these last two met in the Hindustan sub-region, where the land was of tertiary formation, with here and there secondary rocks cropping out.

Dr. Wright congratulated the meeting on the observations on the geographical distribution of animals and plants they had heard that evening. The subject was almost a new one, and was only a fragment of the truth, the last condition of the earth's surface presented to the investigation of man. The geological evidence tells us of a Mediterranean fauna which existed in the Arctic regions. In Australia we find an old race of fossil kangaroos, to which those existing are mere pigmies. The same with the South American armadillo. Facts still require to be collected, and in time we may obtain sufficient evidence to work out the problem we are now seeking to discover.

Mr. Elwes having replied, the meeting adjourned.

THE BLADDERWORTS AND THEIR BLADDERS.

BY W. SOUTHALL, F.L.S.

A notice of a habitat of *Utricularia intermedia* may be of sufficient interest to merit record. I found the plant this autumn near a little tarn on the left of the road from Coniston to Hawkshead, Lancashire, a little below the water-shed on the Coniston side. The tarn itself has a boggy margin, and is girdled with a more abundant vegetation than is usual around the tarns of the Lake district; various sedges, the white water lily, and the buckbean, forming the larger portion of it. The season was too late for most flowering plants, but a few, as *Sparganium minimum*, a somewhat rare plant, were still in flower. Around the larger pool were some small pits of peaty water, and in several of those grew *U. intermedia*, and in others *U. minor;* but, as far as my observation went, the two species were not intermingled. It is stated in Darwin's

"Insectivorous Plants" that they (the Utricularias) "commonly inhabit remarkably foul ditches." Here, the water was bright, as was also the case in the only other place in which I have seen a Bladderwort growing, namely, in Connemara. It is also stated in the same work, on the authority of Warming, that "they are quite destitute of roots even from the earliest period of growth, and float near the surface of the water." These plants were certainly attached to the bottom. As to the presence of true roots I cannot speak with certainty, as I had not read the above at the time, and did not pay sufficient note; but I brought away from the most shallow pool a piece of the turfy bottom undisturbed, on which two young plants were growing. They continued to grow when placed at the bottom of a glass vessel, about a foot below the surface, and never evinced any d sposition to float to the surface. But the Bladderworts seem more amenable to the attacks of both mollusks and confervæ than any others of the small water plants in the same vessel, and the plants are consequently at present in a poor condition. Their gemmæ evidently have powers of resistance beyond the other portions of the plant, and will, I trust, grow next year. I should add, the observations recorded in "Insectivorous Plants" have mostly reference to the species *neglecta* and *vulgaris*.

An after-examination of the contents of the bladders by the microscope afforded a particularly interesting series of objects, the number and variety packed within some of them causing me to wonder how they could have got inside. Entomostraca are prying and lively enough to penetrate into any odd corner; but in many of the other captives the power of locomotion is at all events very slow and obscure. There are, it is true, two long bristles or antennæ that spring from either side of the valvular opening of each bladder, and these may act as guides to it, whilst the numerous short bristles surrounding the entrance prevent escape. The long antennæ in some bladders project directly forward from the bladder, and in others are bent round underneath. There were bubbles of air in many of the bladders. The foreign contents were largely living, but also dead and decomposed in the state of a sort of muddy pabulum. With the assistance of my friend, Mr. J. E. Bagnall, the following list of the contents has been drawn up:—

Vegetable Forms.—Motile forms of a unicellular alga very like Protococcus. A unicellular alga like Pleurococcus in series of four cells, the inner portion green, the outer part of the cells hyaline. Amongst Desmids: Cosmarium in conjugation, three species of Closterium—some of the bladders contained a large number of these; Penium, Euastrum, Ankistrodesmus, Micrasterias frequent. Of Diatoms: *Meridion circulare*, species of Naviculare and others. Cells of algæ, Tyndaridea, and others.

Animal Forms.—Of Rhizopods: Difflugia abundant in one bladder, Arcella, and a peculiar bowl-shaped species. Of Entomostraca: *Alona ovata*, numerous and lively; Cypris, Cyclops, Daphnia. Rotifers: *R. vulgaris*, and other species. Infusoria: Chilodon and Paramecium. Of the smaller algæ, and Desmids particularly, various stages of growth were represented. Probably more time and research would have resulted in a yet larger list of prisoners. The bladders of *U. minor*, not only from being most numerous, yielded the best results. I was surprised at the large proportion of animals in a living, or at all events undecayed condition. Some of the Crustaceans must have lived inside the bladders for many days if not a week or more. For instance, the *Alona ovata*, which as far as my knowledge went did not exist in the water in which the plants were placed away from other plants. I may add that perhaps a month afterwards I examined three bladders that had been detached and remained at the bottom of the bottle. The walls had become very thin, but had retained their shape. Within there was abundance of *debris*, but no muddy solution. All traces of Entomostraca, except a few plates, jaws, &c., had disappeared, though Cyclops was living in the water; the Desmids were in full vigour, and algæ had grown *within* the bladders, one bladder being almost full of Tyndaridea closely coiled.

Reviews.

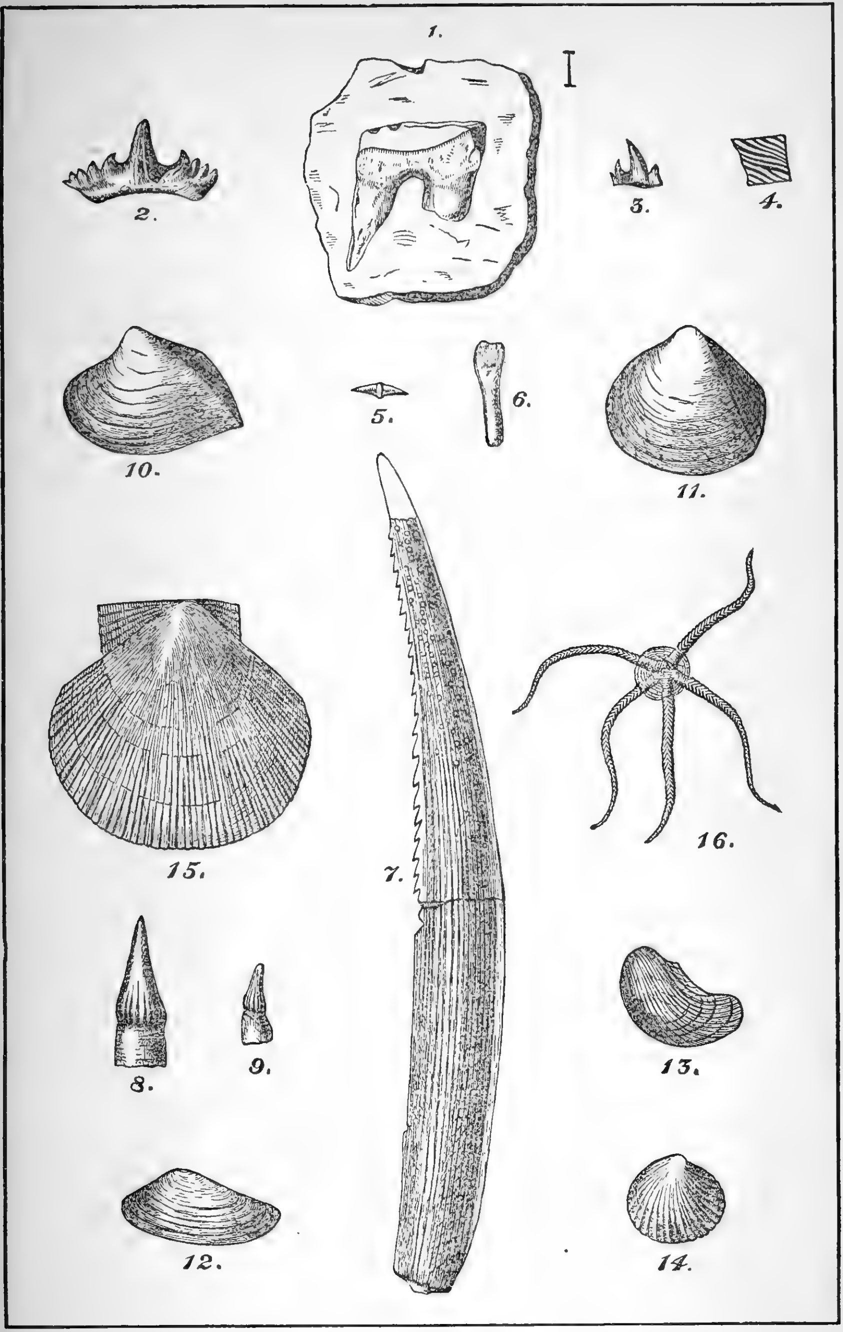
Proceedings of the Dudley and Midland Geological and Scientific Society and Field Club. No. 5, Vol. III., December, 1877. Dudley: Samuel Mills.

This part brings down the proceedings of the Dudley Society to the end of 1877. It is full of most excellent matter; and other societies may learn much from it how to chronicle their proceedings in a satisfactory and useful manner. Judging the Society by this record of its work, it is evidently interesting its members in local geology, and placing on record facts which will be of use to future geologists. The present part contains accounts of the Field Meetings in 1877, which included visits to the neighbourhood of Walsall, to Droitwich, where the Rhætic Beds at Dunhampstead were examined, the neighbourhood of Dudley, following the walk described by Hugh Miller in his "First Impressions of England," to the Stiperstones and the Snailsbeach Lead Mines, to Ludlow, to Ross, Chepstow and the Wye, and to Cannock, where they were joined by the North Staffordshire Naturalists' Club. There are papers on "A Railway Cutting at Daw End, near Walsall," by Mr. J. W. Oliver; on "A Photograph of a Section of Wenlock Shale from the Wren's Nest, taken from a sketch under the microscope," by Mr. Terry; "Analyses of various Limestones," "On the Rhætic Section at Dunhampstead Cutting, near Droitwich, and its correlation with the same strata elsewhere," by Mr. W. J. Harrison, F.G.S.; "On Salt," by the Rev. J. H. Thompson; "On the Parkfield Fossil Forest," "On an Ink Photograph of the Fossil *Aëtosaurus Ferratus*,' Fraas, "On the Botany of the neighbourhood of Ross and the lower portion of the Wye Valley," by Mr. Hy. Southall; "On the Contents of a Hyæna's Den on the Great Doward, Whitchurch, Ross," by the Rev. W. S. Symonds, F.G.S.; "The Bunter Conglomerates of Cannock Chase," by Mr. W. Molyneux, F.G.S.; and "Registers of Rainfall in 1876-7, at Pedmore," by Mr. E. B. Marten, the painstaking secretary of the Society. These Proceedings are well illustrated. We subjoin, as a specimen of the illustrations, woodcuts of the following Rhætic fossils:—

Fig. 1.—*Microlestes Rhæticus*, Owen.
Fig. 2.—*Hybodus reticulatus*, Agassiz.
Fig. 3.—*Hybodus minor*, Ag.
Fig. 4.—*Gyrolepis Alberti*, Agassiz.
Fig. 5.—*Acrodus minimus*, Ag.
Fig. 6.—*Sargodon tomicus*, Quenstedt.
Fig. 7.—*Nemacanthus monilifer*, Ag.
Fig. 8.—*Saurichthys apicalis*, Ag.
Fig. 9.—*Saurichthys acuminatus*, Ag.
Fig. 10.—*Axinus cloacinus*, Oppel.
Fig. 11.—*Cardium Rhæticum*, Merian.
Fig. 12.—*Anoplophora musculoides*, Schlotheim.
Fig 13.—*Avicula contorta*, Portlock.
Fig. 14.—*Monotis decussata*, Goldfuss.
Fig. 15.—*Pecten Valoniensis*, Defr.
Fig. 16.—*Ophiolepis Damesii*, Wright.

In our correspondence will be found an interesting note on these Proceedings from the pen of Mr. W. Whitaker, F.G.S.

E. W. B.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Practical Geology. By W. Jerome Harrison, F.G.S. London: W. Stewart and Co. Pp. 157, forty-two illustrations. Price 2s.

Among the many text-books of Geology it is a difficult, and in some cases a delicate task to recommend to the student which particular works to read. He cannot commence with too simple a work, one which interests the reader and conveys to him a general idea of the principles of geology; and once gaining the interest, he will be tempted to undertake the reading of some more advanced volume. There is a danger, however, to the student when pushing on his enquiries into the larger manuals, of becoming to some extent wearied with details, which observation will not enable him to enliven. Hence the great value of some practical experience in the field. Indeed, Mr. Harrison tells us how he attributes the success of his geological classes to a constant insistance on the necessity for field work, combined with the close examination, sketching, &c., of models and specimens; for an acquaintance with a few facts will enable the young student to appreciate the many. In the same way, even a hurried visit to a previously unseen tract of country will enable the more advanced student to read with interest and intelligence memoirs that previously seemed dry and uninviting.

In the little work before us, Mr. Harrison has furnished the young student who is ready and anxious to go out in the field with a guide and companion, who tells him what and how to observe. Commencing with an account of the apparatus necessary, the author gives instructions how to set to work, and then takes his readers over all the British formations, pointing out their leading characters and fossils. So that the student who is possessed of a geological map, and will read the descriptions here furnished, with the map before him, and who will use every opportunity of taking both into the field, may soon expect to become a good observer.

The work is full of useful suggestions; and, besides the purely descriptive portions, Mr. Harrison takes care to combine many explanations of facts, as well as notes on the physical history of the deposits and on foreign strata. If some of the formations with which he is more intimately acquainted receive an apparently undue share of attention, as, for instance, the chapter on the Rhætic Beds, compared with that on the Silurian Rocks; this is a very pardonable favouritism, rather than offence. The work has been most carefully prepared and edited, and contains references to all the more important researches made known up to the time of publication; and the way in which the subject is treated, giving evidence of much personal observation and thought, and of much heartiness and enthusiasm in the cause of geology, give us great pleasure in recommending it to all desirous of becoming practically acquainted with the geology of their country.

H. B. Woodward.

The Eruptive Rocks of Brent Tor and its Neighbourhood. By Frank Rutley, F.G.S., Geological Survey Memoir. Price 15s. 6d. 1878.

Surely the memoirs of the Geological Survey must be of a very bashful and retiring nature, for the amount of "introduction" which they require on making their appearance in public is something remarkable. Here we have a small pamphlet of fifty-five pages in a paper cover. The first page, in large print, is occupied by Professor Ramsay, the Director-General of the Survey, with some general introductory remarks. Then, in smaller letters, Mr. Bristow, the Senior Director, paraphrases Professor Ramsay—or, perhaps, we ought rather to say the matter is *vice versa*, as Mr. Bristow's "Notice" is dated a week the earlier of the two. Lastly, in still smaller type, as becomes his junior official condition, the author's "Preface" appears.

The first chapter consists of some very useful introductory remarks on the use of the microscope in petrographical research. In connection with this matter, it is greatly to be wished that some competent worker, such as Mr. Rutley himself or Mr. Sorby, Mr. Allport or Professor Bonney, would write us an English text-book on the subject. At present we are mainly dependent on the Germans, Rosenbusch and Zirkel.

The next chapter gives us a description of Brent Tor and its neighbourhood. It is situated on the west of Dartmoor, between the Rivers Tamar and Tavy. This district was geologically mapped by the founder of the survey, the late Sir Henry de la Beche, in 1839. One would have thought that a fresh map of the district on the 6-inch scale would have been undertaken prior to the publication of this Memoir; and there can be no doubt that, if Mr. Rutley had had such a map to aid him, his labours would have gained greatly in precision and certainty.

In Part II. we find the result of the microscopic examination of twenty-seven rock specimens, thirteen of which are illustrated by very carefully executed coloured figures; this is decidedly a valuable contribution to the subject. Finally, the author states the "deductions" which, in his opinion, are to be drawn from the mode of occurrence of the rocks in the field, together with the evidence they yield under the microscope. He agrees with De la Beche in considering Brent Tor a fragment of the nucleus of an old volcano, while the schistose ash beds of the neighbourhood possibly emanated from it, both being of carboniferous age. These beds owe their preservation to their being on the downthrow side of a fault ranging from N.W. to S.E., along the eastern edge of the Tor. From a reference on page 78, this work appears to have been written nearly three years ago, although only now published; and this delay of publication also applies to most of the other Memoirs of the Geological Survey, a delay which is neither just to the authors nor to the public.

Mr. Rutley's abilities with the pencil are well known, and this book is illustrated with six plates and ten woodcuts, which deserve much better paper than that upon which they are printed. The four plates of chromolithographs of microscopic sections we have already referred to.

W. J. H.

Microscopy.

Having lately had the privilege of using one of the new Oil Immersion ⅛th, made by Zeiss, of Jena, from calculations of Professor Abbe, and on a design of Mr. Stephenson, F.R.M.S., [See Vol. I. (1878) Journal of R.M.S., p. 51,] I would strongly urge on all who can afford to buy one to order a glass forthwith. I have been engaged during part of this year in examining slides of the mastax of *Melicerta ringens*, sent to me by the Rev. Lord Sydney G. Osborne, and have written a paper on them, which has been published in the current transactions of the Royal Microscopical Society; but, unfortunately, I had not had, before writing my paper, the privilege of viewing the slides through this Oil Immersion ⅛th. I have since had that privilege, and I must almost re-write the paper. It is simply a magical instrument for bringing out *structure* for a laminated surface, which, under an ordinary ⅛th, looks not merely transparent, but empty of superficies, like a window-frame with the glass out, becomes under this glass one mass of fine lines. Parts of the mastax of Melicerta, which I had treated like unoccupied frames, are seen under this power to be "full of matter"—that is to say, solid areas of transparent texture. The glass will not supersede the ordinary ⅛th, because it is useless for such intermediate fluids as water; but for all objects immersed in the ordinary fluids used in mounting objects for the microscope, it will be found to be a great addition to our instruments. This specimen glass was lent me by Mr. Frank Crisp, Secretary R.M.S., who, I believe, has been amongst the first observers who have realised the value of the new power. To gentlemen engaged in the study of tissue and minerals, or, indeed, of any transparent objects which will bear immersion in balsam, this glass will prove of great importance.—F. A. BEDWELL

At a recent meeting of the Birmingham Natural History and Microscopical Society, Mr. H. E. Forrest exhibited and described a simple and easy method of drawing objects under the Microscope. The apparatus consists of a three-sided prism, fitted to slide on to the eye-piece of the Microscope, and capable of being adjusted to any angle. The Microscope is put in a horizontal position, and the light thrown by a condenser straight up the tube. The lamp is enclosed in a box or cylinder, with a hole on one side the size of the condenser, in order to shut off all unnecessary light. The room being darkened, the image of the object is seen thrown on to the paper placed underneath, and has merely to be traced over with a pencil. The size of the drawing is governed by its distance from the prism; the rays diverge, consequently the further the paper from the prism, the larger is the picture; and by placing the paper on the floor, an image may be drawn 4ft. or 5ft. in diameter. The advantages claimed for this little instrument by Mr. Forrest are simplicity, cheapness, and superiority to the camera or neutral tint glass, in that it really throws the image on to the paper instead of only apparently doing so. As seen in operation at the meeting, one disadvantage was apparent. The loss of light was so great that it was impossible to use the prism with high powers. Subsequently, Mr. Forrest has made a great improvement, suggested to him by Mr. T. Waller. He now uses a rectangular prism, instead of the equi-angular one exhibited at the meeting, and he informs us that the light both enters and leaves the prism perpendicularly; by this means the loss of light is inconsiderable, and even diatoms may be drawn with a $\frac{1}{8}$ objective. The position of the prism in relation to the eye-piece is as follows:—The base is parallel to the horizon, the other equal side being parallel and close to the eye-piece; the hypothenuse thus making an angle of 45° with both the horizon and eye-piece.

A valued correspondent sends the following note on "Microscopic Objectives." He says "That well-known optician, Mr. Swift, of London, informs me that 'at the beginning of the new year I am going to cut the price of my objectives down to those of the best continental makers; quality at same time will be guaranteed.' I have seen and worked with many of Hartnack's instruments, but have no hesitation in declaring that a 'College Microscope' I have lately had from Mr. Swift is superior to any Continental model."

METEOROLOGY OF THE MIDLANDS.

THE WEATHER OF NOVEMBER, 1878.

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

The month opened with a few days of fine weather. Of this time the Rev. J. S. Barber (Spondon) says: "Bees were exceedingly active, and could be heard at considerable distances from their hives. They were busy upon all flowers, especially those of mignonette." But this was not to last; soon the traditional fogs set in, the thermometer fell with cold northerly winds and snow, and so continued to the end of the month. Rainfall was about an average. At the westerly stations the 9th was almost without exception the day of maximum fall, which in several places exceeded one inch, and produced slight floods. A storm on the 15th produced the maximum fall in the central counties, while the 24th gave a similar result in the East Midlands. On the morning of the 12th snow covered the ground generally to a depth of three or four inches, and there was another pretty general fall on the 24th. The nights were cold and frosts numerous. At Stoney Middleton "the minimum thermometer recorded below 32° every night during month." Dense fogs prevailed from the 18th to the 21st. Gales from the North occurred on the 9th (when barometer fell ·882in. in twelve hours at Cheltenham) and 15th. Lightning was seen at Oxford on the 18th, and lunar halos on the 6th and 11th. A lunar rainbow was seen by Mr. Griffiths at Bishop's Castle on the 10th, and a solar halo at Loughborough (Mr. Berridge) on the 23rd. At Tamworth, "an immense quantity of cobweb was noticed on the grass on the 20th." Winter birds, as the Fieldafre and Redwing, seem very numerous, and at Nottingham Mr. Johnson states that they have taken a great number of the holly-berries.

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.									
Cainscross, Stroud	W. B. Baker, Esq.	2·88	·74	9	10	56·0	1	24·0	29
Cheltenham	R. Tyrer, Esq.	3·00	·64	10	16	51·2	10	20·0	29
SHROPSHIRE.									
Haughton Hall, Shifnal	Rev. J. Brooke	3·60	·77	10	13	47·0	9	24·0	27
Whitchurch	A. B. George, Esq.	3·77	·40	9	14	....			
Woolstaston	Rev. E. D. Carr	4·22	1·07	9	21	50·0	9	22·5	21
Leaton Vicarage, Shrewsbury	Rev. E. V. Pigott	3·19	·66	9	18	50·6	10	23·7	26
More Rectory, Bishop's Castle	Rev. A. Male	4·78	1·00	9	21	48·0	9	23·0	12
Larden Hall, Much Wenlock	Miss F. R. Boughton	2·68	1·12	9	11				
Bishop's Castle	E. Griffiths, Esq.	4·28	1·02	9	22	50·0	9	25·0	12
Cardington	Rev. Wm. Elliott	3·84	1·09	9	16				
Adderley Rectory	Rev. A. Corbet	2·58	·71	9	16				
Stokesay	Rev. J. D. La Touche	3·60	·93	9	15	51·9	10	25·0	12 & 27
HEREFORDSHIRE.									
Whitfield	W. Wheatley, Esq.	3·08	1·06	9	14	....	....	24·0	29
Stoke Bliss	Rev. G. E. Alexander	3·06	1·22	9	14	51·0	9	29·0	26 & 28
WORCESTERSHIRE.									
Orleton, Tenbury	T. H. Davis, Esq	3·21	1·10	9	14	50·3	8	27·0	27
West Malvern	A. H. Hartland, Esq.	2·71	1·00	9	13	47·0	9	28·0	28
Pedmore	E. B. Marten, Esq.	3·24	·91	9	13	53·0	19	27·0	28
Stourbridge	Mr. J. Jeffries	3·15	·84	9	13	48·0	8, 9, 18	26·0	12 & 26
STAFFORDSHIRE.									
Thorganby Villa, Wolverhmtn	G. J. C. Broom, Esq.	3·08	·69	9	14				
Barlaston	W. Scott, Esq	2·65	·65	15	10	49·8	18	19·2	28
Amblecote	Mr. J. Robins	3·09	1·00	9	11				
Dudley	Mr. J. Fisher	3·21	·82	9	13	50·0	9	28·0	11 & 28
Sedgley	Mr. C. Beale	2·27	·74	9	14	46·0	9	29·0	1 . 28, 29
Kinver	Rev. W. H. Bolton	2·83	·95	9	11	47·0	9 & 17	28·9	2 12, 22,
Walsall	Mr. N. E. Best	2·94	·97	9	11	45·0	10	29·0	28 (25,26
Grammar School, Burton	C. U. Tripp, Esq.	2·71	·51	9	19	50·0	1	25·0	27
Patshull Gardens	Mr. T. W. Dell	2.95	·75	10	10	54·0	4	25·0	27
Weston-under-Lyziard R'tory	Hon. and Rev. J. Bridgeman	2·97	·78	9	16	48·0	9	25·0	27
Wrottesley	E. Simpson, Esq.	2·89	86	9	11	49·0	10	26·4	29
Tamworth	W. Arnold, Esq.	2·63	·55	9	12				
Tean Vicarage, near Cheadle	Rev. G. T. Ryves	2·72	·67	15	14	47·5	2	22·0	12
Heath House, Cheadle	J. G. Philips, Esq.	2·37	·56	15	11	47·0	2, 10, 18	24·0	21
Alstonfield Vicarage	Rev. W. H. Purchas	3·32	·72	9	11	48·1	1	19·0	21
WARWICKSHIRE.									
Coundon, Coventry	Lieut.-Col. R. Caldicott	3·42	·77	15	16	47·0	9 & 10	29·0	22 & 28
Coventry	J. Gulson, Esq.	3·51	·78	15	17	50·0	10	29·0	23, 29.30
Bickenhill Vicarage	J. Ward, Esq.	3·02	·96	9	16	47·0		28·0	
St. Mary's College, Oscott	Rev. S. J Whitty	2·84	·70	9	13	47·8	10	28·4	29
Henley-in-Arden	T. H. G. Newton, Esq.	3·93	1·40	10	12	50·0	10	28·0	13, 23, 29
Rugby School	Rev T. N. Hutchinson	3·84	1·14	10	14	49·6	24	27·2	23
DERBYSHIRE.									
Buxton	E. J. Sykes, Esq.	4·73	1·08	15	14	47·5	1	22·6	20
Stoney Middleton	Rev. U. Smith	2·63	1·22	9	6	48·0	8	13·0	20
Brampton St. Thomas	Rev. J. M. Mello	3·09	·69	9	15	50·0	1 & 6	23·0	20
Fernslope, Belper	J. G Jackson, Esq.	2·53	·56	15	14	48·0	1	25·0	21
Spondon	C. E. Jones, Esq.	2·96	·62	24	14	48·0		25·5	29
YORKSHIRE.									
Hesley Hall	B. J. Whitaker, Esq.	2·40	·51	12	17	49·0	2	25·0	20
NOTTINGHAMSHIRE.									
Highfield House, Nottingh'm	E. J. Lowe, Esq.	2·36	·54	10	16	54·4	10	25·3	27
Hodsock Priory, Worksop	H. Mellish, Esq.	2·43	·49	15	17	49·7	10	24·7	20
Park Hill, Nottingham	H. F. Johnson, Esq.	2·59	·47	15	13	48·5	1	27·5	20 & 21
LEICESTERSHIRE.									
Loughborough	W. Berridge, Esq.	2·68	·53	24	16	49·9	3	27·7	21
Ashby Magna	Rev. E. Willes	3·41	·63	24	19	49·0	10		
Market Harborough	S. W. Cox, Esq.	3·88	·74	9	18	47·0	9 & 24	24·0	23
Kibworth	T Macauley, Esq.	3·46	·69	15	18				
Town Museum, Leicester	W. J. Harrison, Esq.	3·25	56	24	19	49·4	1	28·5	21
Belmont Villas, Leicester	H. Billson, Esq.	3·20	·55	24	19	49·0	1	29·0	21
Syston	J. Hames, jun., Esq.	3·74	·46	9	22	45·0	2,3,10,11	28·0	21 & 22
Waltham-le-Wold	E. Ball, Esq.	4·07	·61	23	18	44·0	2 (19	26·0	21
Little Dalby Hall	G. Jones, Esq.	3·39	·58	24	17	47·0	3, 9, 18	25·0	9
Coston Rectory, Melton	Rev. A. M. Rendell	4·01	·66	15	18	51·0	10	23·0	21
Belvoir Castle	W. Ingram	3·62	·43	25	20	48·0	10	26·0	18,21,22, 30
NORTHAMPTONSHIRE.									
Towcester Brewery	J. Webb, Esq.	3·10	·53	15	14				
Castle Ashby	R. G. Scriven, Esq.	2·83	·54	10	18	50·0	10 & 24	28·0	9
Pitsford	C. A. Markham, Esq.	3·16	·50	24	18	51·0	25	28·0	23 & 30
Kettering	J. Wallis, Esq.	3·03	·44	27	19	50·0	11	29·0	9 & 29
Althorpe	W. F. Jakeman, Esq.	3.24	·64	15	17	49·0	10 & 24	26·0	22 & 29
Northampton	H. Terry, Esq.	2·73	·45	10	16	49·0	5 & 10	28·0	8 & 28
RUTLAND.									
Burley-on-the-Hill	W. Temple, Esq.	3·17	·59	16	17	52·0	7	24·0	9 & 23
West Deyne, Uppingham	Rev. G. H. Mullins	3·54	·68	24	18	49·9	24	28·9	12
Northfields, Stamford	W. Hayes, Esq.	3·46	·64	24	15	55·0	7	28·0	9
Radcliffe Observatory, Oxford	Mr. H. E. Bellamy	2·28	·44	27	16	51·9	10	30·3	12
Spital Cemetery, Carlisle	T. Bell, Esq.	1·64	·40	7	17	48·3	1	22·9	25
Ventnor Hospital	H. Sagar, Esq.	4·09	·60	27	19	52·4	10	31·4	12
Altarnun Vicarage	**Rev. G. Tripp**	6·10	1·06	11	22	54·0	25	22·0	20

Correspondence.

Dudley Geological Society's Proceedings.—I wish, from the standpoint of a Geological Surveyor, to call the attention of readers of the "Midland Naturalist" to the above-named publication of one of the Societies of the "Midland Union." Two of the papers, by Messrs. Oliver and W. J. Harrison, are on sections on the Midland Railway, and these are not confined to descriptive text, but are accompanied by plates which give measured drawings of the sections on a large scale, and also plans, so that the exact position of any outcrop, &c., can be fixed on the ground when the cutting has been turfed over. This careful record of facts that in all likelihood will soon be hidden up cannot fail to be valued by field-geologists, to whom there can hardly be a more gloomy sight than a large railway-cutting, beautifully smoothed and turfed, of which no record has been kept. I would therefore impress on members of our many provincial societies to note all facts, however trifling they may seem to be; and if any one is in doubt as to how such noting should be done, let him look at the publication referred to. Others of the papers have small plans to show the place of the section or fossils described. Here again is a good example, for the want of precision in such matters has greatly lessened the value of many papers. As the Dudley and Midland Geological Society ceased to publish its proceedings for some years, and has but lately gone into print again, such sure signs of life are welcome, and to none more so than to working Geologists.—W. Whitaker.

Ceratodus at Penarth.—Aust Cliff was for a long time the only British locality which yielded teeth of that remarkable fish the Ceratodus. I found a fragment of a tooth at the Spinney Hill Rhætic Section, near Leicester, in 1873, (it was kindly identified by Mr. W. Davies, of the British Museum,) and Mr. E. Wilson has since got it, near Nottingham. I can now record its occurrence at Penarth, near Cardiff, where it has been found by Mr. Storrie, of the Cardiff Museum.—W. J. H.

Helix Cantiana.—At p. 323, Vol. I., I gave a few notes on the distribution of this species in Britain, placing the county of Northampton in my list of theoretical habitats. Upon receiving the December number of the "Midland Naturalist," I at once turned to the very excellent index, and found that Mr. T. C. Musson, of Nottingham, has recorded (p. 50) its occurrence at Kingscliffe, Northamptonshire. He has kindly sent me specimens. The only adult shell is smaller than usual, white and thin, the latter being an anomalous character, (not uncommon among the Mollusca,) seeing that it occurred on the Great Oolite. I take this opportunity of correcting a mistake I made in giving Littleton, near Evesham, as a habitat. Mr. Slatter tells me it should have been "Evesham, particularly near the ancient walls of the Abbey enclosures," near Littleton being the locality for *Cochlicopa tridens*.—G. Sherriff Tye.

Fertilisation of Orchids.—During the summers of 1874-5, I netted, on Boxley Warren, for purposes of exchange with a friend, for dissection, over 2,000 Lepidoptera. Of these, thirty-five had the anthers of *Orchis pyramidalis* (a common species here,) adhering to their trunks in the manner described and figured in Darwin's "Fertilisation of Orchids." They were of the following species:—Meadow Brown, Ringlet, Small Heath, Small White, Chalk Hill Blue, Common Blue, Burnet Moth. In connection with the last-named species, I had the rare good fortune to witness the whole operation. Seeing a Burnet seated on a large head of *Orchis pyramidalis*, I cautiously approached with pocket lens in one hand

and net in the other. I got close enough to see through the lens the trunk thrust first into one flower, then drawn out with the pair of anthers glued to the trunk with the natural glue of the orchis anther; then thrust into another flower, thus fertilising it with the anthers of the first flower, and then drawn out, now with *two* pairs of anthers glued on. After three pairs of anthers had been attached he became frightened, I suppose at my lens, and flew off. I immediately netted him.—FRED. F. GRENSTED, Maidstone.

THE RHÆTIC STARFISH.—(See Mid. Nat., Vol. I., p. 230.).—After lecturing to the Cardiff Naturalists' Society on Dec. 5th, on "The Origin of Scenery," I went the next day, under the guidance of Mr. Storrie, the indefatigable Curator of the Cardiff Museum, to examine the unrivalled Rhætic section, which stretches along the coast from Penarth to Lavernock. We obtained many beautiful specimens from the bone bed, &c., but I especially wish to note a fine slab, nearly 2ft. square, on which were many specimens of *Cardium Rhæticum*, *Avicula contorta*, and *Pecten valoniensis*, the three characteristic Rhætic shells thus occurring all in a lump as it were. Between the shells I was delighted to recognise several specimens of that lovely star-fish *Ophiolepis Damesii*; the bodies were crushed, but the arms more finely preserved than I have hitherto seen them. This is the first instance on record of the occurrence of this star-fish at Penarth. The slab is now in the Cardiff Museum. In the December Number of "Science Gossip," p. 271, I notice "a star-fish" has been found by Mr. T. Stock, at Aust Cliff, another well-known Rhætic section. It is remarkable that this fossil, of which I found the first specimen near Leicester, in February, 1873, should now turn up at almost every section.—W. JEROME HARRISON.

FROST PHENOMENA.—During the past week the frost and fog together have produced some interesting effects. Hoar-frost is always deposited on that side of an object which faces the wind, so that the direction of the ice-fringes upon the twigs and rails is an accurate register of the air-current. This current must be a very light one, or the rime is shaken off as fast as it accumulates; but, however still the air may seem, there is generally a slight movement in some one direction, and this may readily be ascertained by the direction of the spicules of hoar-frost. On Wednesday morning the ice-fringes all pointed towards the north, and there was a distinct difference in the whiteness of the landscape as seen from the northern and the southern sides. But there was a slight thaw on Wednesday afternoon. The air-current (it was scarcely so much as a breeze) veered round to the south, and on Thursday morning the white side of the landscape was reversed. It continued so till Friday night, when the current again got round to the north without any intermediate thaw, and on Saturday morning all boughs and rails which had not been shaken had a double fringe, one on each side; the northern fringe pointing straight to the breeze, the southern one actually curling round from south to north in a curious and very remarkable manner, not of course from any bending of the individual spicules, but from the unilateral deposition of each fresh spicule, producing the form known to botanists as a "scorpioid cyme," very plainly seen in the flower of the Forget-me-not. So great was the deposit of rime on Saturday morning that many of the spicules were 1¼in. in length, and the leafless elms were as thick with winter foliage as if Midsummer had come back again without its chlorophyll—a ghostly, and yet a wonderful and lovely sight.—F. T. MOTT, Birstal Hill, Leicester, Dec. 14th.

ORNITHOLOGY.—I have the pleasure of recording the occurrence of two now comparatively rare birds, namely, the Honey Buzzard, *(Pernis apivorus,)* and the Crested Grebe, *(Podiceps cristatus)* the former captured at Markfield, within the last fortnight; the latter at Cropston, in the spring of the present year.—J. E. Weatherhead, in the *Leicester Journal*, October 18th, 1878.

Ornithological Notes.—Our Stoke swallows took their departure at the end of September, but for nearly a fortnight afterwards I observed a good many stragglers flying about their usual haunts. On the 9th October I saw a great flock, consisting of many hundreds, congregated about the lower part of Whitley Common. It seemed to be the final muster of the last division of the district, assembled preparatory to their long flight. The day was mild, but very rough and stormy. They were flying high and low, and the surface of the river by Whitley Bridge was quite crowded with them. I still observed a few stragglers on the 10th and 11th, but I saw none after that date. Mr. Phillips, however, tells me that he saw four at Stoke Green on the 26th, and two on the 28th. My old friend Anthony Hunt, now residing at Eastcote, Northamptonshire, was much interested in observing a colony of swallows, who had built their nests under the warm thatch of his house. At the usual time of emigration they all took their departure excepting one pair whose brood were unusually late, and the young birds still unfledged at the time departure. The old birds remained behind in the evident hope of their being able to follow. On the 16th October they were still observed diligently hawking for flies, and feeding their young. The morning of the 17th, however, was raw and foggy. The old birds could stay no longer, and leaving their young in the nest, they disappeared and were seen no more. There are numerous flocks of starlings about the neighbourhood; their numbers decrease when the weather becomes severe, as many of the flocks retreat to the southern countries for a milder climate. A good many of the winter migratory birds have returned to us. I noticed the redwing on the 20th, and the fieldfares appeared about ten days later. In severe seasons the berries of the holly are greedily devoured by these birds. At present, however, many of the hollies in this neighbourhood are still quite bright with the scarlet berries with which they were adorned last Christmas, looking as if they would remain until that season again comes round. On Friday last a fine specimen of the "Glaucous Gull" was hanging at Messrs. Blythe's. It was shot near Flamborough Head. Its colour was whitish grey, not having acquired the pure white on the breast of an old bird. The stretch across the wings was upwards of five feet. It is now in the hands of David Smith to be stuffed and set up, who has also a Tern and a Gull, which were driven inland by stormy weather, and shot in this neighbourhood, and a specimen of the Water Ousel, killed near Coventry. This pretty little bird is common about rapid mountain streams, but not often seen hereabouts.—John Gulson, Coventry, Nov. 5th, 1878.

The Common Viper, (*Vipera hornis.*)—The viper is very common in Devonshire among the gorse bushes, in stony places having a southern aspect; also on the southern slopes of the Cotswold Hills. It appears early in the spring, and is then in a rather torpid state, and can be easily taken or killed. Almost all the vipers that appear early are males, and there appear to be more male vipers than females. The male can readily be distinguished from the female by the darker marks and spots upon its body, and by the gradual tapering of the body from the head to the horny apex of the tail. The marks upon the female are lighter, inclining to a brown colour, and the tail appears as if affixed to the body, which abruptly terminates at the commencement of the tail. In the summer months the viper is not so readily seen, being then more active than the common snake, and escapes or conceals itself in the long grass, bushes, or stones, being a timid animal except when attacked. The favourite food of the viper is the short-tailed field mouse, although frogs and grass snails are often found in its stomach. The toad which is often found in the stomach of the common snake is not found in the stomach of the viper. The reproductive organs in the male and female differ very much. The male has a soft roe like a fish, the female a string of oblong small bodies—ova—which develope into the shape and size of robins eggs, consisting of yellow matter like the yolk of an egg, before there is any trace of the existence of a young viper. The young viper does not escape from its fine membranous covering until immediately before its passage into the world, when it is lively, active, and well provided with every means of procuring food, and at once leaves the parent. They may be often seen coiled up on a flat stone in a sunny spot when very little longer than when they passed from the old one. You often meet with very young ones early in the spring, during the summer months, and as late as September in the autumn. The young vipers are of a reddish or copper colour; something like that of the common blindworm. —Henry Bird.

Gleanings.

The Midland Naturalist.—The Northampton Natural History Society has set an example which we commend to the consideration of the other societies in "our Union." The committee has decided to present each member (100 in number) with a copy of the "Midland Naturalist" during the present year.

Lyell's Student's Elements of Geology.—A third edition of this popular work has just been issued, revised by Mr. Leonard Lyell, Prof. Judd, and Mr. Etheridge.

Glacial Deposits.—Mr. D. Mackintosh, F.G.S., of Birkenhead, who is well known as an untiring worker at the Drift of the North and North-west of England, has printed a syllabus of a paper he has lately laid before the Royal Society. After some introductory remarks, he treats of the "Boulder-supplying capacity" of (1) Criffel in Kirkcudbrightshire, (2) the Lake District, and (3) the Arenig Mountains. Then the association of flints and lias fossils with Northern Boulders is discussed with many other interesting points. Altogether this "syllabus" is well calculated to whet the appetites of glacialists, and to make them wish for a speedy publication of Mr. Mackintosh's Memoir, either by the Royal or the Geological Society. It is, we believe, illustrated by an elaborate map.

"The Bijou List of British Butterflies," just issued by Mr. H. W. Marsden, of Gloucester, will be welcomed by Lepidopterists as a useful pocket companion. It is based on Dr. Staudinger's List, includes all the "reputed" species, and gives synonymes and authorities. It ought to help to break down the wall of exclusiveness with which the English Lepidopterist has so persistently shut himself in with his "British Butterflies," as if he wished it to be thought that they had "no connection" with those "over the water."

Professor Huxley will lecture in Leicester to the Literary and Philosophical Society on March 24th on "The Structural Characters and the Operations of the Simplest Forms of Living Beings." This subject will be especially interesting in connection with the recent researches of Dr. W. Johnston, F.G.S., the Assistant Officer of Health for Leicester, who traces the infantile diarrhœa, which has been so fearfully prevalent in that town, to the action of various forms of *Bacteria*, Microscopic organisms, on whose "operations" Professor Huxley will no doubt give full information.

Tablets to Mount Specimens on.—For this purpose wood is generally used, but it is expensive, liable to warp, and difficult to cut true. Various substitutes have been recommended, such as glass covered with paper, &c., but we have lately tried a plan recommended by Prof. Miall, of the Leeds Museum, and found it to answer perfectly. It consists in using pasteboard three-sixteenths of an inch in thickness, or if the tablets are large one-quarter of an inch thick. Any large paper dealer will make pasteboard of any required thickness, and cut it to any size, with perfect accuracy, by a machine. The tablets may be covered with paper of different tints to aid in classification, and the specimens should be fixed on with coaguline.

A Microscopical Society, Literary, and Scientific Institution has been formed at Boston, (mainly by the exertions of Messrs. F. W. Morris and B. J. Stow,) under the presidency of the Rev. G. E. Pattenden, LL.D. The first meeting was held in the Art Room, Shoofriars Hall, Boston, on Monday, the 16th December, when an address was delivered by the President, who said much that was interesting about botany, chemistry, geology, and microscopy. He congratulated the promoters upon their success in the formation of the society. The meeting then resolved itself into a conversazione and exhibition of Natural History and other specimens.

Age of Birds.—Mr. Gulson writes:—"Mr. Miller, of Combe Gardens, has sent me the following amusing account of a venerable Jackdaw, who is one of his *protégés*. He says:—'The bird in question was reared in the spring of 1865, by one of the under-gardeners here. I know the date is correct. I took it from our labour-book, and the young man was only with me one spring—that of 1865, in which the daw was reared. The age of the bird is now, calculating from June, 1865, 13½ years. Jack was left to the gardeners as a sort of legacy. I took to the bird and fed it with crumbs from my window. He came regularly for his food. For several years this pet mated with the wild birds. One he selected, and I believe stuck to all through; I know it from the drooping habit of its wings. Their nest was in a hole in an ash tree close by. Many a lump of bread did Jack carry away from my window to feed his family year after year in that hole. Besides his mate, Jack has a great number of relations and followers or friends, who come to my window in hard times. Jack is blind of one eye, the result no doubt of defending his nest in the hollow tree. He also has a crooked leg, but, considering his age, he is in fairly good plumage, and comes for his soft bread regularly. He does not like crust.' Considering the enormous number of young birds which are reared every year, the death-rate among the feathered tribes must necessarily be a very high one, and few can survive to the good old age of the bird mentioned above. During a hard winter many sorts of birds find subsistence difficult, and their number becomes greatly reduced, but a few mild seasons and abundant food soon restore about their average number."

Reports of Societies.

BIRMINGHAM AND MIDLAND INSTITUTE SCIENTIFIC SOCIETY.—November 27th.—Mr. G. S. Dunn, B.A., read a paper on the "Human Ear." In the course of it he stated that since the so-called Corti's rods are absent in birds, they could not be the means whereby musical tunes are distinguished; but that probably the membrane in which they are situated fulfils this office. December 3rd.—A party of the members visited the brass-founding establishment of Messrs. W. Tonks and Sons. Amongst the processes inspected were those of modelling the patterns, moulding, casting, tube-making, brazing, polishing, stamping, making brass-headed nails, pickling, lacquering, and tool-making. December 11th.—Mr. J. W. Pickering read a paper on "The Autotype Process of Photography," which he described as the reproduction of an artist's work in monochrome by the natural forces of light or actinism and chemical affinity, the materials employed being those of the artist's own palette. Mr. Pickering gave a short history of photography, from its introduction in 1839 by Mr. Mungo Ponton, who announced it as "a process of producing images by the action of light on paper which had been impregnated with a solution of bichromate of potash," to its perfection in 1864 by Mr. Wilson Swan, of Newcastle, who, by temporarily transferring the film to another surface, and washing it from its under-surface, succeeded in bringing out the half-tones, and thus rendered the process so complete that autotype pictures are incapable of being affected by the atmosphere. The lecture was illustrated by a practical demonstration of the process, and an exhibition of a fine series of autotype copies of works of art, lent for the occasion by the Autotype Company.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—Microscopical General Meeting.—November 19th.—Mr. J. Levick exhibited *Epistylis grandis*, *Zoothamnium arbuscula*, and *Carchesium polypinum*, all fed upon carmine. Mr. H. E. Forrest exhibited and described a simple and easy method of drawing objects under the microscope, of which a brief description will be found under the head "Microscopy," at page 18. General Meeting.—December 3rd.—Mr. W. Southall exhibited a spike of fruit of *Gunnera scabra*, native of Chili. Mr. W. G. Blatch read a paper on "Midland Entomology," which will be printed in the "Midland Naturalist." Biological Section.—December 10th.—Mr. H. E. Forrest read a paper on "the History and Development of *Zoothamnium arbuscula* and some other Vorticellidæ," which will appear in a future number. Among the specimens exhibited were the rare beetle *Prionus coriarius*, occasionally found in the south of England, and of which Mr. W. G. Blatch now contributed the male taken at Aston, in July last; and marine organisms, shown in the microscope, by Mr. T. Bolton, and identified by Professor E. Ray Lankester as the Trochosphere phase or larvæ of the Polyzoon, *Alcyonidium hirsutum*. In reference to these, Professor Lankester writes, "These larvæ are very interesting objects for study. They have the form of a compressed circular disc, or rather of two discs placed one on the other. The larger one is bounded by a circlet of powerful cilia, the 'architroch' or 'primitive ciliated band,' which appears under one form or another in so many invertebrate larvæ. On the upper surface of this ciliated disc is carried the mouth, which leads into a very remarkable protrusible pharynx. The rudimentary digestive cavity is clearly seen in specimens slightly compressed by the cover-glass. The ciliated band is what gives rise later to the tentacles of the Polyzoon. These larvæ have never been well figured in England. Last year M. Jules Barrois published a large work on the subject at Lille, with many plates."

BURTON NATURAL HISTORY AND ARCHÆOLOGICAL SOCIETY.—December 10th.—Mr. Ford read an interesting paper on "The Gypsum Beds of the Triassic Marls of the Neighbourhood." He pointed out that gypsum is usually considered to be a chemically-formed rock, deposited in the waters of a lake or inland sea by evaporation, in the same manner as rock salt. But no instances can be pointed out where beds of gypsum are forming at the present day in this manner; and it seems more likely that they are the result of the mutual decomposition of carbonate of lime and some sulphide or sulphate. The resulting sulphate of lime (gypsum) being soluble in water would be carried in solution through the rocks until it arrived at the water level, where it crystallised out, filling fissures, &c. Gypsum can be traced from Chellaston, by Aston, to Thrumpton, Gotham, Beacon Hill, Newark, and Bingham. It is also worked near Carlisle, and in the other direction at Fauld and Chartley. A thin vein, about 1½ inches across, occurs in the bed of the Ouse beyond Goole. The plaster marls extend all under Needwood Forest, and crop out in the valleys of the Trent and Dove. At Shobnall, crystallised gypsum or selenite occurs in fine veins. The superior quality of the Burton beer is owing to the amount of gypsum dissolved in the well waters. Distant brewers are now regularly getting this material supplied in sacks, to make the water they brew with somewhat similar to the Burton water. The author concluded by proposing an excursion in the spring to Tutbury, the plaster quarries at Fauld, &c., and returning from Sudbury.

CHELTENHAM NATURAL SCIENCE SOCIETY.—November 21st.—The second evening meeting of the Society for this session was held at the Corn Exchange. Dr. Wright, after having briefly returned thanks to the Society for having re-elected him as President for the present session, introduced the subject for the evening—an address on the geographical distribution of the existing races of plants and animals, by Mr. H. J. Elwes, F.Z.S., &c., who was well known to the scientific public as a most energetic traveller, and as a careful collector not only of objects of Natural History but also of facts bearing upon physical geography. An abstract of the address and the discussion thereon will be found at page 9.

NOTTINGHAM LITERARY AND PHILOSOPHICAL SOCIETY.—NATURAL SCIENCE SECTION.—November 29th.—Lecture on "Trees," by the Rev. G. E. C. Casey, M.A., F.G.S., illustrated by diagrams and photographs. December 13th.—"The Animals of Australia," illustrated by photographic slides from life, by A. H. Scott White, Esq., B.A., B.Sc., F.G.S.

NOTTINGHAM NATURALISTS' SOCIETY.—Meeetings have been held as follows:—November 20th, paper on "Insect Architecture," by Mr. H. Johnson. December 4th, exhibition of prize collections of Natural History objects. Prizes were awarded as follows:—Botany: 1st prize, Mr. H. Johnson; 2nd, Miss Cross. Conchology: 1st prize, Mr. C. T. Musson. Entomology: 1st prize, Mr. W. J. Rawson; second Mr. R. Wix. Geology: 1st prize, Mr. C. T. Musson. Microscopical objects mounted: Mr. Thornton. December 18th, paper on "Oysters and their Culture," by Mr. B. S. Dodd.

PETERBOROUGH NATURAL HISTORY AND SCIENTIFIC SOCIETY.—November 6th.—The President (E. Wheeler, Esq.,) read a paper on "Climbing Plants," mainly based on Dr. Darwin's work on that subject. The parts of plants that climb and how they climb were described. The most common and the most interesting plants that twine merely or that have irritable leaves or tendrils were also described, and the special adaptability of each climber to its work was noticed. A number of pen and ink sketches were exhibited to explain the various organs mentioned. November 25th.—Mr. W. Wakeford gave an address on oxygen and hydrogen. Mr. Bodger exhibited geological specimens, consisting of plants from the coal shales; shells and corals from the Silurian Rocks; and a few Oolitic plants, of rare occurrence, from the Gristhorpe beds; together with several specimens of various iron-ores. December 10th.—The Rev. W. Katterns read a paper on "The Food and Organisation of Plants." The paper, which is an introduction to a series upon the growth of vegetation, is the outcome of experiments made since 1873. A brief *resumé* would fail to state explicitly the author's views, which, it may be stated, differ in several particulars from those usually held on the subject. It was decided, owing to the importance of the paper, that it should be printed at the expense of the Society, for exclusive circulation amongst the members. The Secretary (Mr. J. W. Bodger,) read a paper on the substances he had obtained from garden soil, which, at the suggestion of Mr. Katterns, he had analysed. An animated discussion took place, which lasted so long that a special meeting had to be called for the further discussion of this paper. Mr. Bodger exhibited a number of seaweeds and corallines which he had received as a present for the Society's Museum.

RUGBY SCHOOL NATURAL HISTORY SOCIETY.—December 7th.—H. V. Weisse (O.R.) read a paper on the "Electric Light, and the Probabilities of its general Substitution for Gas." He argued that this was improbable.—T. B. Oldham (M.) exhibited a specimen of *Am. Capricornus* (named by R. Etheridge, Esq.) from a blue clay underlying a brown conglomerate, hitherto regarded as the base of the Middle Lias at Crick. He then read a summary of his paper on the "Geology of Rugby," which won the Society's prize.—The President read a paper on "The Growth, History, and chief Collectors of the Society's Entomological Collection."—The Secretary read a paper on "Tripontium," now Cave's Hill, an Antonine town on the Watling Street, near Rugby.—Mr. Bloxam discussed the paper.—R. D. Oldham (O.R.) pointed out the importance of the *Am. Capricornus* in drawing the line of demarcation between Middle and Lower Lias. This is to be done by Palæontology. The Geological Survey, when here, seem to have adopted a lithological basis of demarcation. Their line accordingly is wrong; the truth is that there is no marked line.—The meeting then terminated. This was the last meeting of the year.

SMALL HEATH LITERARY AND SCIENTIFIC SOCIETY.—The third lecture of the series for the present session was delivered in the Congregational Schoolroom, Coventry Road, on Monday, December 9th, by Mr. J. W. Oliver, (Professor of Geology and Botany at the Birmingham and Midland Institute,) on "The Story of the Rocks." The subject was treated in a popular and interesting style, and was illustrated by a number of diagrams and specimens.—At the ordinary meeting of the Society, held in the Board Sceools, Jenkins Street, on December 17th, a debate took place on the question, "That we are now in possession of sufficient evidence to enable us conclusively to accept the theory of evolution." The affirmative was taken by Councillor Lawson Tait, who was to have been supported by Dr. John Lloyd, but the latter gentleman was unable to be present. Mr. Tait concisely set forth the main claims of the Evolutionary Philosophy, after which the Rev. Charles Joseph and Mr. W. J. Bain delivered speeches in the negative. The result of the voting of the members showed a majority of six in favour of the negative, but, on the vote of members and visitors together being taken, the majority was very much larger. The debate was a very spirited one, and the attendance larger than at any previous meeting.

STROUD NATURAL HISTORY AND PHILOSOPHICAL SOCIETY.——December 10th.—Major Fisher gave a very interesting account of "Modern Falconry," illustrating the subject with some excellent sketches and two living specimens of falcons.

Answers to Correspondents.

SCIENTIFIC BOOKWORM.—Foreign books of all kinds may be obtained through Mr. D. Nutt, 270, Strand, London, W.C., or from Williams and Norgate, 14, Henrietta Street, Covent Garden. The latter firm has lately published catalogues, which they will send on application. For English and foreign science books consult the "Book Circulars" of Mr. W. Wesley, 28, Essex Street, Strand. For English science books consult the catalogues of Mr. Wheldon, 58, Great Queen Street, Lincoln's Inn Fields; Messrs. Reeves and Turner, 196, Strand; Mr. Quaritch, Piccadilly; or W. H. Smith and Son, 186, Strand. All these will send catalogues on application, and expensive books may often be obtained in this way at less than half price.

All communications to be addressed, The Editors of the MIDLAND NATURALIST, Midland Counties Herald Office, Birmingham.

PASSAGES FROM POPULAR LECTURES.

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

II.—THE SCALE OF BEING.

When a human baby opens its dazed eyes upon this world, what it first perceives is simply light and darkness. It distinguishes neither forms nor colours. It is mentally in the condition of the oyster, the starfish, the worm, and other animals of low type. But a few weeks of exercise and experience bring it to its second stage. It perceives the outlines of things. It recognises differences of sound and of colour, and knows its mother's voice and face among a thousand. It has reached the condition of a vertebrate animal—a lamb or a sucking pig. But it does not stop here; it is only in the bud yet, and has a great deal of capacity still to be developed.

In a few months it knows a tree from a steam engine, and when it sees the picture of a cow it will say "moo!" But it calls every horned creature a cow, and everything with leaves and branches a tree. It is a human child, but a very ignorant one; nevertheless, it is already learning the elements of science, of which a very large part is simply the knowledge of one thing from another, and of the connections between one thing and another; the perception of differences and likenesses, of causes and effects, first among visible objects, and then among invisible forces.

The more we have learned to comprehend the real differences by which objects are separated from each other, and the real likenesses by which they are connected together, the further we are from babyhood. We are accustomed to reckon a man's age by the number of years he has lived. A better standard would be the number of ideas he has got. The use of lectures and classes is to give us a few more ideas than we had before—to add a few degrees to our real age. The kind of ideas does not very much matter so that they are new to us and true in themselves. They are all useful, all add a little to our age, taking us a few steps further from the cradle and nearer to heaven. Let us endeavour to gather up a few ideas—there may be a new one among them here and there, new to some of us at least—about those inhabitants of the world which have no speech and little motion, but to which we owe the whole of our physical life, and at least one-half of its enjoyments.

We call these creatures Plants. We class them together as the vegetable kingdom, perceiving that there is a mineral kingdom below them, and an animal kingdom above them; and we call the study of this class of creatures Botany.

What do we mean when we say that the mineral kingdom is below them and the animal kingdom above them? We don't use these words *below* and *above* in reference to height, that is, to distance from the centre of the earth, as when we say that a man's nose is below his eyes and above his chin. The mineral kingdom is not in this sense altogether below the vegetable, for the great mountain ranges of the world rise up far above all trace or possibility of vegetation. We use them not in reference to a scale of feet and inches, but in reference to a scale of *capabilities.* We say that plants are higher than minerals, because they have more varied and more complex capacities, they can *do* more. And, for the same reason, we say that animals are higher than plants.

A mineral, such as a piece of iron, has a definite form, a definite colour, it will conduct heat and electricity in definite degrees, and it will attract oxygen if it comes near it in the presence of water. But a plant has nearly all the capacities of a mineral, and many more besides. It feeds, and breathes, and grows, and reproduces its kind, and has a multitude of internal motions and operations going on among its tissues. It *does* an immense number of things which the piece of iron cannot do. The difference between them is wider than the difference between a watch and a stone, but it is something of the same kind.

But, if the plant is higher in the scale of being than the mineral, it is a great deal lower than the animal. A dog not only feeds, and breathes, and grows, and reproduces its kind, but can move about from place to place rapidly and easily ; and has a voice, and eyes to see with, and ears to take in sound, and a brain in which ideas and passions are developed. A plant has none of these capacities.

When we look at the whole material contents of this world, we find that there is one marked and striking difference which divides them into two great classes—the organic and the inorganic. In the first of these divisions every object has a variety of parts, differing from each other, and each part has certain definite work to do in connection with a common purpose. We call these parts organs. In a dog there are legs for running, a nose for smelling, teeth for eating, and a tail to wag. In a tree there are roots to suck up moisture, a stem to support the boughs, boughs to carry the leaves, leaves to spread out the sap in the sunshine, flowers to produce seed. But in a piece of iron there are no organs. It is a mass of grains or fibres, all alike, and each doing the same work. So is a stone, so is water, so is the air. All these together we call the inorganic world ; animals and vegetables make up the organic world. *Life* is said also to be a special characteristic of creatures which have definite organs. It may be so ; but it is not quite proved that life is entirely absent from inorganic objects. In crystallisation we have a phenomenon in which some of the elementary characters of life make their appearance, and in which organic differentiation of parts seems to be foreshadowed. Who shall say whether the vegetative force, which builds an oak out of an acorn, is not of the same nature as that which builds a "silver tree" out of a chemical solution ?

MIDLAND ENTOMOLOGY : ENQUIRIES AND SUGGESTIONS.

BY W. G. BLATCH.

Is any progress being made in the study of Entomology in the Midland Counties? Are Entomologists really "few and far between" in central England ; or are they, like many of their favourite insects, too unobtrusive in their habits? Can anything be done to develop and foster Entomological tastes in our local Societies?

These three questions are a digest of a great number of enquiries which I have heard made during the last few months, and they seem to indicate that, in at least one leading Society in the "Midland Union," Entomology is about to assume a new and more hopeful phase. This is very gratifying; for although I do not admit that this science is neglected quite to the extent some would have us believe, I am only too well aware that it does not receive the attention it deserves; but, in truth, the last remark applies equally to the whole of the British Islands as to the Midland Counties. From all parts we hear the same lament that Entomology is too much neglected. It seems to flourish most in the south and north, whilst in the east and west it is very little regarded. The English and Scotch, respectively, are most attached to this pursuit, the Irish being a long way behind both, and the Welsh just nowhere at all! But, however interesting it might be to prosecute an enquiry into this broader subject, our attention for the present must be concentrated upon the narrower theme of "Midland Entomology."

How it has come about I am unable to explain, but certain it is that, entomologically speaking, the Midland Counties have acquired a bad name. In the "Entomologists' Intelligencer" for 1857 frequent allusion is made to the alleged barrenness of the Midland fauna—especially as regards insects—and one writer, in giving counsel to Coleopterists, says: "In a general sense, therefore, *let the Midland Counties be shunned by all as they would the plague!*" The italics are in the original, and are used, I imagine, to intensify the meaning, and to impress upon any rash adventurer in search of Midland insects the utter hopelessness of his design. I recollect that, upon my advent into this district, now eleven years ago, I was told that I might choose some other hobby than Entomology, "for there are no insects in the Midlands except *Nebria brevicollis*, *Pieris rapæ*, *Panorpa communis*, *Musca domestica*, and a few others equally common!" I was certainly very much impressed, though not depressed, by this information; for, as my object was to make myself acquainted with the insects of the locality, and not simply and primarily to acquire a "complete collection," I was not deterred from prosecuting my researches as far as my limited time and abilities allowed. With what result? Why, during the very first season I found, almost without effort, so many "good things" that my faith in the written and oral counsels referred to was greatly shaken, if not wholly destroyed, and the conclusion I came to was that this district would prove as interesting and productive (in a general way) as any other, if properly worked. Subsequent experience, and a comparison of notes with a few close but unobtrusive observers, have confirmed the justness of this view.

It would occupy too much space here to give a list of the rarer species of insects captured in the district. For Lepidoptera I must refer enquirers to the Transactions (Vols. I. and II.) of the Birmingham Natural History and Microscopical Society. The lists there given, however, only apply to the immediate neighbourhood of Birmingham, and must not be taken as representing the wealth of the Midlands in the particular order selected. To the lists as limited there are many additions ready to be made; and if they were opened so as to include the wider area, they would expand enormously. As they stand, however, indicative of what has been accomplished, they are suggestive of much more to be done before the knowledge to be obtained of even the Butterflies and Moths of our suburban woods, lanes, and fields is exhausted.

I have no catalogue of Midland Coleoptera to refer to, but I can testify that better things are to be found amongst us than *Nebria brevicollis* and *Pterostichus madidus*, and that the sterility said to prevail here exists only in the imagination of those who draw conclusions from insufficient premises. Amongst the species of Coleoptera taken by myself, I may mention that I have found at Knowle, nearly in the middle of the most midland of the Midland Counties, specimens of the rare *Trachys troglodytes*, whilst *Encephalus complicans*, *Orobitis cyaneus*, *Callidium alni*, &c., have been frequently found by myself in the same locality. It is worth mention here that a fine specimen of the rare *Prionus coriarius* has been presented to me by Mr. Thos. Taylor, whose nephew found it last July crawling on a wall at Aston-juxta-Birmingham. A few hours' hunting on Cannock Chase produced *Carabus nitens*, *C. arvensis*, *Nebria livida*, *Miscodera arctica*, *Pterostichus lepidus*, *Silpha opaca*, and several other uncommon species. Not far from Burton-upon-Trent Mr. Harris, of that place, discovered the rare and curious *Macronychus quadrituberculatus*, a species found nowhere else in England. Surely a district in which such insects as these are to be found cannot be considered unworthy of further examination. The fact is, as I have before hinted, our knowledge of Midland insects is in a very imperfect state; and, because little is known, it has been rather hastily and unwarrantably concluded that there is little to know. I do not claim for the Midlands the insect riches of the east and south, but I do say that a great deal more may be discovered here, with a little effort, than has ever been dreamed of. The habits of great numbers of our insects are so obscure, and the laws and conditions which regulate their appearance from time to time so little understood, that it is only by close and systematic observation, extending over a number of years, that the insect inhabitants of any particular locality can be ascertained. Practically the Entomology of an extensive district like our own is inexhaustible, something "new" or "new to the district" being constantly turned up, and it may be taken as an axiom that *the more closely a locality is examined the more productive will it be found to be.*

Having thus, to some extent, cleared the Midland district from the aspersions cast upon it, and shown that it presents a not altogether unpromising field for Entomological energy and enterprise, we may now fairly ask what is being done towards developing its insect riches.

It must at once be admitted that, compared with the extent of the field and the vast number and variety of its insect denizens, the work is sadly neglected. The important and extremely interesting orders *Hymenoptera* and *Diptera* are scarcely touched, whilst most of the lesser orders are almost as much disregarded as if they had no existence. The order Lepidoptera appears to be the favourite—about fifty persons (probably there are many more) in Birmingham alone (to my knowledge) paying it more or less attention. Only a very few of these, however, care for more than the mere capture and possession of the insects, the majority not troubling themselves about their natural history, and not contributing anything to the general store of information respecting them. A few keen and trustworthy observers are, however, to be found amongst the number; the names of some of them (Dr. Jordan, *e.g.*) being known wherever Entomology is studied. The order Coleoptera is now receiving more attention than heretofore, several of our best Entomologists being at work upon it. The progress made, however, although appreciable, is not so great as could be desired. Two very good reasons (as affecting existing workers) may be given for this, viz., because the observers, being, as a rule, widely separated from each other, are unable to work much in unison; and because the time, and therefore the opportunities, at their disposal for Entomological purposes are extremely limited.

We cannot, I fear, claim that a very decided affirmative has been given to the first question at the beginning of this paper, but even a feeble response may greatly encourage an ardent lover, and all lovers of insects will rejoice to know that some, even if little, progress is certainly being made in our knowledge of Midland Entomology.

In reply to the second question, as to the number, distribution, and character of the Entomologists of the district, there is not much to be added to what has already been said. The number of real workers is comparatively small, they are very much isolated, and, probably the natural result of their separation from each other, they are characterised by great unobtrusiveness. It is to be hoped that more of the members of our societies will enter upon this fascinating study, and that those who are already far advanced in the science may be induced to "come out" of their seclusion, and make known their discoveries for the benefit of their less accomplished co-workers. If our Entomologists could by any means be brought into easy communication, and prevailed upon to unite in systematic action—meeting together occasionally, if possible, for mutual intercourse and comparison of notes—I feel quite sure that great and rapid strides would be made in their favourite pursuit, and that the Midland Counties would soon become famous in the annals of Entomology.

It now remains to reply to the third and last question—Whether anything can be done to develop and foster Entomological tastes in our societies? All seem to be agreed that it is desirable to encourage the study of Entomology; but opinions will no doubt differ as to the means by which that end should be sought. That this science is neglected by our members generally has already been shown, and it seems to me that the first step towards applying any remedy is to find out, if possible, the cause of the neglect complained of. At first sight it is not easy to understand why Botany, Geology, and Microscopy should attract a larger number of observers, and be considered more suitable subjects for study than Entomology. Such, however, seems to be the case in most of our societies, and I think it will not be very difficult, after a little closer examination, to show that there are sufficient reasons for the preference. Some of these are undoubtedly beyond our power to obviate, but there are others that, to some extent, admit of being practically dealt with.

The superficial but general idea "that insects are unworthy of notice because they are so common and insignificant, and that the study of flies and beetles is consequently too childish an occupation for any but schoolboys," is not deserving of the trouble of refutation, although it must be admitted that it has often had a deterrent effect; for few persons are so thoroughly case-hardened that they can persistently withstand the shafts of ridicule—the ridicule, moreover, of their friends.

That Entomologists should be subjected to derision is neither wonderful nor singular; every specialist must expect to receive his share. It is as inseparable from those peculiar people who *will* deviate from the beaten track as shadow is from substance. I think it should be considered complimentary rather than derogatory, and that instead of shrinking from it we ought to welcome it as indicating, in proportion to its intensity, the importance of our special pursuit, and the strength of our moral courage.

The real difficulties are of a more serious nature, two or three of which may be discussed. First there is the *vastness of the subject.* It is no joke to face our myriad insect tribes and their myriads of Latin and Latinish names. Bruin amongst the bees, and the proverbial hornet's nest, are as nothing to it. Who, unless moved by an enthusiasm that blinds to contingencies, would dare to begin the attack? The immense number of our species of insects is in itself enough to stagger any ordinary tyro; but the classification and nomenclature by which they are fenced about form a perfect *chevaux de frise* before which the boldest quails. We cannot, of course, alter this state of things. Additions will continue to be made to the number of our known insects, and the anomalies of nomenclature and classification, the natural outgrowth (an excrescence if you will) of the science, will certainly not diminish as new workers appear. The best way of avoiding this difficulty is not to see it. The would-be Entomologist must not think of the number of insects to be known, and must resolutely shut his eyes upon the musty mass of synonymy. His course will then be easy, and his progress rapid. He will begin with a single insect, a separate genus, or a distinct order, and, as his interest is excited, and his knowledge extended, the obstacles he feared at the outset will fade away, becoming small by degrees and beautifully less.

Having advanced thus far, the student would be none the worse for a little encouragement from the Society of which he happened to be a member. I offer it as a suggestion whether our Societies might not be of much use in developing original research by offering to publish monographs of obscure genera, descriptions of new and little known species, or any other similar work, the result of independent observations. Special subjects, beginning with insects hurtful or beneficial to man, might be recommended for study, and original memoirs invited; these could be examined by a competent Committee, and the best selected for publication.

By these means the science of Entomology would be advanced. Entomologists—both old hands and incipients—would be benefited, and our Societies would crown themselves with honour.

Having dealt with one of the main causes that operate to deter persons from entering upon the pursuit of Entomology, we may proceed to consider another of even greater importance, viz., *the want of reliable and easily accessible works descriptive of the species of insects belonging to the several orders.* With few exceptions the records of Entomological research are scattered about and hidden away in a vast mass of literature, consisting of transactions of the various learned Societies, (English and foreign,) pamphlets, magazines, &c., and are inaccessible to the ordinary student. If it is desired to identify any particular insect, or to find out what is known of its natural history, it will probably be necessary to consult a dozen different works—English, French, German, and Latin—gleaning a little information from each of them. The Botanist and Geologist are better off than the Entomologist in the matter of text-books, and this doubtless accounts in great measure for the fact previously alluded to, that those subjects are commonly preferred to the one under consideration. Our Societies could do much to remove this difficulty by purchasing a copy of every good monograph published, and by laying themselves out to secure sets of all the scientific societies' publications—generally expensive and beyond the means of individuals—instead of frittering away their funds in buying the cheaper books which nearly everyone could afford to obtain for himself.

Two very effectual means of fostering Entomological tastes amongst us would be the formation of collections and the issue of lists, as complete as possible, and to be added to from time to time, of Midland Insects, with notes as to localities, dates, and other particulars. Every society should have not only a general collection of insects, but a collection of the insects of their particular district. These, together with the local lists, would form a good base of operations, and afford the requisite facilities for gauging his own work, to any one who might desire to enter upon the study, and would, besides, be extremely valuable to the more advanced workers.

A suggestion has been made that a new class of constituents should be added to our societies by the admission of youths with a taste for Natural History, under the name of Associates. If that idea should be acted upon, it might be worth consideration (bear in mind that it is principally to the young we must look for our expected crop of Entomologists) whether small money or book prizes might not be offered for Entomological work, either in the form of original papers, general collections of insects, or collections illustrative of particular orders or families.

No doubt there are many other methods by which the taste for Entomology could be extended, and very much more could, of course, be said in reference to the few rather crude hints I have ventured to throw out. This paper, however, is not intended to be more than merely suggestive, and the aim of the writer will have been accomplished if it conduces in the remotest degree to greater attention being paid in and by our societies to the interesting subject of "Midland Entomology."

MOSS HABITATS.

BY JAMES E. BAGNALL.

(Continued from Vol. I., page 320.)

A newly-ploughed field, or, better still, one that has lain fallow for some little time, although presenting few charms for the general observer of Nature, will be spots to which the would-be bryologist must give his particular attention, and during those dreary months which intervene between October and April he will, if in any way an enthusiast, find plenty of work for his microscope.

The mosses to be found in such habitats are usually the simplest, from a pretty point of view the least noticeable, and the shortest lived of any he may study, and when preserved for the herbarium are, perhaps, the most disappointing, looking very often more like dried masses of mud than aught else, still these earth mosses or *Phascei* are worthy of his attention. The plan I adopt with these minuter species is not only to dry some of them with their underlying mud, but also to mount a few specimens of each on the ordinary 3in. by 1in. slips of glass, in glycerine jelly, for my cabinet, and very pretty objects many of them make when thus prepared.

The older Botanists placed all the *Phascei* in the genus *Phascum*, but modern Botanists, seeing that the group was a very heterogeneous one, have split these *Phascei* into several genera, such as *Pleuridium*, *Phascum*, *Sphærangium*, *Ephemerum*, *Archidium*, &c. I shall speak only of those that I have myself found most frequent.

Besides these I also find in like habitats such mosses as *Pottia minutula*, *Funaria fascicularis*, and *Tortula unguiculata*.

The *Phascei* usually occur in scattered patches, and, being minute, require the constant use of the field lens, and rather close searching in many cases. Taking their general characteristics they may readily be known by their small bladder-like capsules, usually more or less concealed by the surrounding leaves, the fruit-stalk being very short in most species, and by the absence of a true lid or operculum [Plate IV., Fig. 11.]*

Pleuridium subulatum is a not unfrequent inhabitant of sandy and marly fields. It may also often be found in great abundance in the cleared spaces of woods, and is in good condition about April; will be found in yellowish patches, often rather extensive; the capsule is oval, and immersed in the awl-shaped bristly-looking leaves; the leaves are rigid, and have a broad nerve, which scarcely extends to the tip of the leaf; the uppermost leaves are longer than the lower ones, and much narrower.

Phascum cuspidatum is a frequent denizen of sandy fields, and occurs in small scattered light-green patches. The leaves are large for the size of the plant, are concave, oblong lance-shaped, and somewhat keeled, with the margin turned over towards the under side; the nerve projects beyond the leaf-tip, forming a short cusp-like point; the capsule is roundish and more or less hidden among the leaves; leaf-cells quadrate, slightly papillose; spores slightly roughened.

* All the references in this Article are to Plate IV., Vol. I., facing page 193.

Sphærangium muticum is much more rare, occurs in sandy and marly fields in dark-green or brownish tufts, looking to the unassisted eye like small tufts of minute bulbs. It is more minute than the last, and has broad, roundish, concave leaves, not keeled, but rounded on the back, the nerve rarely reaching the leaf-tip, and the leaves are usually slightly toothed in their upper part, and have plane margins ; the capsule is round, and quite hidden among the upper leaves ; the spores pale, roundish, smooth ; leaf-cells large. In good fruit, March or April.

Ephemerum serratum occurs most abundantly in marly fields, but may also be found in sandy ones, and looks to the unassisted eye like a little patch of green conferva ; the lens will, however, show the small reddish-brown sessile capsules, surrounded by the narrow lance-shaped slightly toothed leaves ; the leaves are nerveless, light-green, with transparent longish leaf cells ; spores yellow, globose, slightly roughened. In this moss the protonema [Plate IV., Fig. 3 *a*] continues throughout the lifetime of the moss ; and hence, in a single specimen under the microscope, the life-history of a moss may often be seen—the protonema, young buds, perfect plant, and capsule bearing the spores. Fruit, October to April.

Archidium phascoides I have rarely found in fields, but it does occur occasionally in marly fallow fields ; it is very minute, and requires close searching, and as the capsule is very small may often be passed over as a mere barren tuft of *Dicranella varia*. It may, however, be known by its round capsules and strongly nerved leaves, and by its giving off lateral, sterile, whip-shaped shoots from the fertile stem.

Pottia minutula I find not unfrequent in marly fields, in small, brownish-green tufts. The stem is very short, the leaves oblong, lance-shaped, tapering to the point, slightly overlapping and spreading when moist, erect when dry, margin much recurved ; capsule on a short fruit-stalk ; mouth naked, *i.e.*, without a fringe ; lid large, conical ; leaf-cells quadrate.

Tortula unguiculata occurs in every sort of soil, is very variable, and often puzzling. Sometimes great glaucous green tufts of this moss will be seen without a vestige of fruit, at other times fruiting specimens will be abundant. The leaves are oblong, lance-shaped, blunt, with a minute point formed by the projecting nerve, margin curved towards the under side ; leaf-cells dense and quadrate in the upper part, large and transparent below ; leaves much twisted when dry ; capsule erect, cylindrical ; fringe of thirty-two twisted teeth ; lid awl-shaped.

Funaria fascicularis occurs in sandy fields, in scattered tufts, and will be readily known by its widely lance-shaped toothed leaves, with large leaf-cells, pear-shaped capsule, convex lid, and inflated calyptra, (Plate IV., Fig. 17,) no peristome or fringe.

Many of our heath-lands are being rapidly reclaimed ; and vexatious as it may be to the Botanist to see the haunts of some of his favourites destroyed, he will, if wise, feel that it is far better that these lands should be made the means of employing labour and adding to the wealth of the country, rather than allowed to lie idle, the mere producers of weeds.

But, in the neighbourhood of these reclaimed wastes, the borders of many of the fields, and the waysides of the lanes will still retain much of their heath-like character, and in such localities I have found the mosses of our heath-lands fairly represented. The mosses that I shall characterise as heath-mosses are *Ceratodon purpureus*, *Campylopus fragilis*, *Bryum nutans*, *Funaria hygrometrica*, *Polytrichum piliferum*, and *Hypnum cupressiforme*. These mosses, although abundant on heath-lands in Warwickshire, are by no means confined to such localities.

Ceratodon purpureus will be found abundantly on heathy waysides in good fruit about the middle of May, and will be found forming large dull-green patches, the purple fruit-stalk and fruit giving quite a character to the locality. The leaves are lance-shaped, with reflexed entire margins keeled on the back ; the capsules oval, slightly curved, furrowed when dry, and slightly strumose at the base, (Plate IV., Fig. 13 *b* ;) lid conical, and fringe of sixteen teeth united by transverse bars. The fringe of this species forms a beautiful object for the microscope.

Funaria hygrometrica will be found very abundantly in like places, more especially where the soil has been burnt, forming large yellowish-green patches, and when abundant has a very striking appearance. The leaves are large, very concave; the leaf-cells large, hexagonal ; capsule curved, somewhat pear-shaped, purple, and furrowed when ripe, surmounted by a beautifully marked plane-convex lid; the peristome or fringe double, the outer fringe being formed of sixteen beautifully marked reddish teeth, the inner of sixteen yellowish teeth ; annulus large.

Campylopus fragilis, although abundant on our Sutton Park heath-lands, is by no means common on the heathy waysides; it will be found forming dense yellowish-green patches, the very fragile leaves being scattered abundantly over the patches ; the leaves are lance-shaped, the nerve is broad, forming the greater part of the leaf, and composed of small quadrate cells. The cells of the leaf-base are large and transparent. The fruit is rare, and is usually found in autumn.

Bryum nutans is a very abundant moss on damp heath-lands. I also find it in very dense masses on thatched roofs. It occurs in large dark-green tufts, the lower leaves are oval, lance-shaped, entire, the upper ones are longer, narrowly lance-shaped and toothed ; the nerve scarcely reaches the tip of the leaf; leaf-cells hexagonal, elongated; fruit-stalk reddish; capsule pendulous, somewhat pear-shaped; lid convex, with a small point; fringe double. Fruit in May or June.

Polytrichum piliferum will be found abundantly on many heathy waysides in loose dark-green tufts, and may be readily distinguished by its large thick lance-shaped leaves, sheathing at the base, and terminated by a white hair-like toothed point ; the capsules are large, four-angled, with a distinct swelling just below the base of the capsule, called the apophysis; the fringe is formed of sixty-four teeth, which curve over the membranous process closing the mouth of the capsule, (the diaphragm, Plate IV., 21 *c* ;) the calyptra is large, covering the whole capsule, and is clothed with a dense felt of shaggy hairs.

Hypnum cupressiforme occurs on every conceivable habitat, but may often be found forming extensive yellowish or dark-green patches, the foliage somewhat shining. In habit this moss is most variable, being sometimes prostrate, at others erect; but usually the stem is pinnate, (Plate IV., Fig. 5,) the leaves curved to one side, more or less ovate, and suddenly drawn out to a toothed or entire point; the fruit-stalk arises from the side of the stem, and is surmounted by the curved capsule; the fringe is double, and the lid conical. Although this moss varies so much as to be fairly puzzling to the experienced bryologist, I find it may be always readily made out if a few of the leaves are taken from the stem and examined with the microscope. It will then be seen that they are either nerveless or faintly two-nerved, have very narrow elongate leaf-cells, *but the cells at the marginal base are quadrate and opaque.*

[TO BE CONTINUED.]

ERRATA.—Vol. I., page 318, line 18, for *upper* surface read *under* surface; line 19, for *involute* read *revolute.*

RECENT DISCOVERIES IN THE GEOLOGY OF SHROPSHIRE.

II.—THE QUARTZITES OF SHROPSHIRE.

BY CHARLES CALLAWAY, M.A., D.SC. LOND., F.G.S.

INTRODUCTION.

In the August number of the "Midland Naturalist," Vol. I., p. 205, I gave the first of a series of papers on my recent work in Shropshire, when I described a new area of Upper Cambrian Rocks near the Wrekin. In this communication will be found a summary of a second paper read by me before the Geological Society of London in June, 1878, and published in the August number of the *Quarterly Journal.* The reader is referred to that paper for details.

OBJECT OF THE PAPER.

On the flanks of the Wrekin and Caer Caradoc are certain beds of green sandstone and of quartz rock, which in the Survey maps are coloured as "Altered Caradoc." The green sandstone I showed in my previous paper to be the Hollybush Sandstone, (hitherto recognised only on the sides of the Malvern Hills,) and therefore of much greater antiquity than the Caradoc epoch. My present purpose is to prove that the quartzites are older even than the Hollybush Sandstone.

A. WREKIN—CHURCH STRETTON AREA.

1.—GENERAL DESCRIPTION.

(a.) *Wrekin sub-area.*—This district contains by far the largest horizontal development of the quartzites. They are finely exposed on the south-east side of the Wrekin range from its north-eastern extremity, half a mile south of Wellington, to its south-west end, a length of about three miles. The range is composed of three elevations, separated by two narrow gorges. The south-westerly, and by far the largest, mass is the Wrekin proper, and is $1\frac{3}{4}$ miles in length. The north-easterly hill, called the Ercal, is of less height than the Wrekin and of about half the length. The central hump, Lawrence Hill, is still lower, and occupies about a quarter of a mile of the length of the range. The quartzites rest against the volcanic axis in a nearly continuous band, striking to the south-west, parallel to the axis, broken by the above-named ravines, and apparently disappearing towards the summit of the chain. They reappear, however, towards the south-west end, and lap round the south-westerly spur of the mountain. I have taken numerous dips on the flanks of the Ercal, Lawrence Hill, and the Wrekin, and find that the direction of dip is on the average a little to the east of south-east, and its amount about 45°, ranging between 30° and 55°. Other exposures on the flanks of the range are scanty. Judging by the shape of the ground and soil indications, the quartzite is probably continuous all round the Wrekin range, with the possible exception of the two points under the summit, one on each side.

The thickness of the quartzite, measured at the north-east end of the Ercal and at Lawrence Hill, is about 200 feet.

Lying to the west of the Wrekin, and connected with the quartz rocks just described by a narrow isthmus, is an irregular area of quartzite, three miles in length from north-east to south-west, and $1\frac{1}{2}$ miles in its greatest breadth. Through these strata are thrust up four bosses of bedded volcanic rock, the largest of which is Charlton Hill, with two small masses immediately to the south, and a larger exposure a mile to the south-west. The dips of these quartzites are very varied. In the road one-third of a mile south of the spot marked "Charlton Mill" on the Ordnance map, they are displayed in a good section dipping south-easterly at 60°, and resting immediately upon igneous rocks. Two or three hundred yards to the north-east is quartz rock resting on porphyry of the Charlton Hill boss, and dipping to the south at 45°. One-third of a mile to the south of this last spot is another exposure of quartzite, dipping away to the south from the more southerly of the two small volcanic masses. A mile to the east-north-east of Charlton Hill, at the village of Rushton, quartz rock strikes north and south at a high dip; and a little to the north-west of Rushton the dip is westerly. One-third of a mile east of Rushton, in the quarry marked with an arrow on the map of the Geological Survey, the quartzite dips to the south at 30°. These dips are too irregular to be referred to any one upheaving force. Wherever the quartz rock occurs in close proximity to igneous rocks it dips away from them; and it seems not improbable that other dips at a distance from exposed volcanic masses may be caused by local upheavals of volcanic rock which do not appear at the surface.

(b.) *Caer Caradoc sub-area*—The quartzite reappears eight miles to the south-west of the last area, on the south-easterly flank of Caer Caradoc, near Church Stretton, an igneous hill of similar character to some of the Wrekin rocks, and evidently belonging to the same series. It is also less distinctly exposed at the south-west end of the south-east side of the Lawley, a volcanic hill north-east of Caradoc, and separated from it by a gap about a quarter of a mile in width. If the quartzite is continuous under the superficial deposits which lie in the gap, the band will be over a mile in length. At Caer Caradoc it is about 100 feet in thickness, and dips easterly at a high angle. The quartzite is overlaid by the Hollybush Sandstone, which is well exposed in its lower part, dipping south-easterly at 75°; but towards the north-east end of the hill the sandstone shows a tendency to lap round it, and dips to a little north of east. A short distance to the south-west higher beds of the series dip east-south-east at 35°. The Hollybush Sandstone in places is highly quartzose, with grains of green earth and decomposed felspar, and is almost undistinguishable from certain parts of the basement beds of the Caradoc which appear against the same side of the axis a mile to the south-west. This similarity, doubtless, helped to mislead the earlier surveyors, and is paralleled by the equally confusing resemblance between the Shineton and Harnage Shales, which I pointed out in a previous paper.* These sources of difficulty, together with overlaps, inversions, and numerous and heavy faults, render the district a perfect maze of perplexity. Happily, the identity of the sandstones is clearly established by an excellent section exposed in a quarry at the north-east end of Little Caradoc.

In the middle of this section is a thin band which deserves special attention. It is less than one foot in thickness, and is a dark-coloured compact limestone. Associated with it is a little red shale, and near the surface of the bed the limestone assumes the same colour. This band is very fossiliferous, the most abundant form being apparently trilobitic; but it occurs in such a fragmentary condition, and is of such an unusual type, that I cannot express any opinion on its generic affinities. Brachiopoda are not uncommon: two or three species are undeterminable, save that they belong to the Tretenterata. One form, a minute roundish Lingulid, is apparently new. What is of more importance for our purpose is that the bed contains two well-known Malvern species, *Kutorgina cingulata*, Bill., and *Serpulites fistula*, Holl., both of which are found in the same formation on the flanks of the Wrekin. The Hollybush Sandstone is thus shown to overlie the quartz rock, as in the Wrekin district. It is about 300 or 400 feet in thickness, and extends to the south-west for some distance; but I have not traced it quite so far as the quartzite. Indeed, the exact limits of both formations are not ascertained, the exposures towards the south-west being very few and slight.

I have had the good fortune to discover the presence of the Shineton Shales in their true place above the Hollybush Sandstone of this sub-area. They are seen in the road leading up from the gap towards Shoots Rough. The width exposed represents a thickness of about 30 feet, and the dip is east or east-south-east apparently at 35°. They are succeeded by the Hoar Edge Grits, (Lower Caradoc,) which plunge towards them at an angle of 60° or 70°. In the Shineton district the shales are apparently conformable to the over-lying Caradoc, and the chief evidence for the

* Midland Naturalist, Vol. I., p. 206.

greater antiquity of the former is derived from fossils. Here, however, the two formations are separated by a fault, which must be of considerable throw, since, as I have reason to believe, neither the upper part of the shales nor the lower part of the sandstone is represented. Following the shales on the line of strike to the north-east into the ravine between the Lawley and the sandstone escarpment of Hoar Edge, where the escarpment approaches to within a quarter of a mile of the hill, we find them well exposed on the stream, dipping to the east at an angle of 50°, which probably represents the true dip more accurately than the shallow road-section. I have detected in them *Lingulella Nicholsoni* and Shineton Graptolites. From their general appearance, and from the presence of Graptolites, I infer that these beds belong to the middle part of the series. There are slight indications, in the shape of the ground and in the soil, that the shales run parallel to the Hollybush towards the south-west, where both are cut off by the Hoar Edge Grits (Caradoc.)

(c.) *Cardington sub-area.*—A little over a mile from Caer Caradoc to the south-east is an abrupt ridge of quartzite called the Sharp Stones, dipping to the north at from 40° to 50°, and striking east and west for about half a mile. It rests upon the bedded volcanic rocks of Cardington Hill, and is evidently tilted up by the elevation of that mass. Succeeding it to the north is Caradoc Sandstone, with its usual south-west strike, apparently unaffected by the upthrust of the older rocks, and probably separated from the quartzite by a fault.

2.—Relations of the Quartzite to the Associated Rocks.

Along the south-easterly flanks of the Wrekin range the quartz rock rests upon the bedded tuffs and felstones of the volcanic nucleus unconformably, the igneous rocks dipping north, while the quartzite dips south-east. Towards its base the quartz rock contains fragments derived from the older series, consisting of small rounded or unrounded pieces of felstone greatly decomposed, but in some cases showing distinctly the banded structure characteristic of some of the Wrekin felstones. At its base the quartzite is brecciated, both the fragments and their cement being quartzose, with the occasional occurrence of barium sulphate. This breccia can be traced along the line of junction through the Ercal, Lawrence Hill, and some distance along the south-eastern flank of the Wrekin. There are also signs of brecciation on the opposite side of the range, near the ravine between the Ercal and Lawrence Hill. This breccia may be a friction breccia, caused by the upthrust of the rigid mass of volcanic rock which forms the backbone of the range; and the fact that the breccia is not derived from the rock upon which it rests favours this conclusion. There is thus reason to conclude that the plane of junction between the younger and older series is a fault.

In my paper on the Shineton Shales, I have given reasons for concluding that the quartzites are also separated from the overlying Hollybush Sandstone by a fault. See *Quarterly Journal Geological Society*, v. xxxiii., p. 662.

3.—The Age of the Quartzites.

The quartzite is certainly older than the Hollybush Sandstone, for, in every observed case, the sandstone rests upon the quartz rock, or is at least on the outside of it with regard to the axis of elevation. This is well seen in the Wrekin sub-area, and still more distinctly on the south-east flank of Caer Caradoc.

But the age of the Hollybush Sandstone must first be determined. It is commonly placed upon the horizon of the Ffestiniog group, on the ground that it underlies the Black Olenus Shales of Malvern, which are with great probability correlated with the Dolgelly series. But the relations of the Hollybush and Black Shales are very obscure, and it has not been shown that they succeed each other conformably. The late Mr. Belt considered the Hollybush to be a shore deposit of the Menevian sea; but I am willing to accept the former determination till decisive evidence is forthcoming. The quartzite, then, is older than the Ffestiniog period. But the Hollybush sandstone and the quartzite do not succeed each other conformably. In the Wrekin area the dips are so discordant as to suggest a considerable gap. The quartzite, in most cases, dips away from volcanic bosses, and the direction of dip is determined by these local upheavals. But the dips of the Hollybush are subject to no such law. Their general direction on the south-east of the Wrekin, where the quartzite dips south-easterly, is to the south-west; but in one place they appear to conform to the dip of the quartzite, and at a little distance they plunge at a high angle to the north-west (that is, towards the quartzite.) South of Charlton Hill, also, the sandstone dips towards the quartzite. The apparent conformability of the two formations at Caer Caradoc cannot counteract such clear evidence of discordance. Parallelism of strike does not prove conformity, since a strike fault might let down the upper of the formations without producing any alteration in the dip or strike.

It is clear, therefore, that the quartzite is older than the Hollybush Sandstone by a gap, and consequently cannot belong to any part of the Upper Cambrian series.

Three hypotheses now remain. The quartzite may be on the horizon of the top of the Lower Cambrian; or it may belong to the Lower Cambrian; or it may be Precambrian.

(a.) *The top of the Lower Cambrian (Longmynd Series.)*—The Lower Cambrian of Shropshire, as is well known, is a great series consisting of fine-grained slates or hardened shales in the lower part, and of sandstones and conglomerates above. For reasons which I cannot here detail, I believe that neither the base nor the top of the succession is seen, being cut out by faults. Does the quartzite represent a lost capping of the Longmynd rocks? I think the great discordance between the quartz rock and the Hollybush Sandstone decisively negatives this supposition.

(b.) *The Longmynd Series.*—No band of quartzite has been observed in this series from top to bottom. If the quartz rock represents any part of the Longmynd succession, where are the beds which on this supposition should intervene between the quartzite and the Precambrian volcanic series? Or is the quartzite a basement of the Longmynd rocks? If so, there should surely be some concordance of dip and strike. But the Longmynd strata in their lower part almost uniformly dip at very high angles to the west-north-west, whereas the quartzite, as previously shown, dips away from volcanic bosses at the most varied dips and strikes.

(c.) *Precambrian.*—On the rejection of hypotheses *a* and *b*, the balance of probability is decidedly in favour of this supposition.

4.—The Fauna of the Quartzite.

For years I searched for fossils in vain; but recently I detected on the south-east flank of the Wrekin, near the cottage, one good specimen of a worm-burrow, apparently *Arenicolites*, and portions of one or two more. The burrow is a simple loop, resembling a letter U, 2 inches in length by 1 inch in breadth. I have proposed for it the name *Arenicolites uriconiensis*. If my view of the age of the quartzite is correct, this specimen is, with the exception of the problematical *Eozoon*, the oldest known fossil.

B. The Quartzite of the Stiper Stones.

The physical characters of this rock have been so well described by Murchison ("Siluria," chap. iii.,) that it will be unnecessary to make additional observations. I have but to add a suggestion on its geological age. By the author of "Siluria" it is placed on the horizon of the Lingula Flags, on the ground that it is below the Llandeilo, and contains worm-burrows and fragments of a Lingulid, which, it is candidly stated, does *not* resemble *Lingulella Davisii*. Geologists of the present day will hardly be disposed to accept such evidence as conclusive. The shales overlying the quartz rock contain *Illænus perovalis*, *Calymene parvifrons*, *Æglina*, *Placoparia*, and other Arenig forms. There can, therefore, be little doubt that the quartzite is of Arenig age, and, consequently, quite distinct from the quartzite of the Wrekin area. This view is confirmed by my recent discovery of the Shineton Shales (Tremadoc) in the valley to the east of the Stiper Stones. The two rocks can generally be distinguished from each other even in hand specimens; and, when they are conglomeratic, the pebbles of the Arenig quartzite mainly consist of quartz, while the included fragments of the Wrekin quartz rock are felsitic.

THE FERNS OF NORTHANTS.

BY G. C. DRUCE.

As might be expected from the geological and physical character of the county, Northamptonshire is very poor in ferns, only those with a large comital distribution occurring, and then but in few numbers, in widely separated localities; driven by cultivation to take refuge in some shady spinney or damp hedgerow, and most frequently to be found on the western side of the county, where they are favoured with more congenial soil and a larger rainfall than the Ceterach and Ruta-muraria of the eastern portion of the county. Indeed, so infrequent are the ferns that many inhabitants of the district are dubious about the occurrence of such universally distributed ones as *Filix-fæmina* and

Scolopendrium, and can scarcely believe that in a single walk from its chief town as many as twelve species have been noticed. The following is my compilation of the localities of the ferns of Northants:—

Pteris aquilina, L., generally distributed, with the exception of the district drained by the Tove, where it is absent or rare. Plentiful in Harleston, coming to within three miles of Northampton, where, however, last year a plant grew on the brickwork of a wharf, introduced there by some spores carried by the river from Harleston.

Lomaria spicant, Desv., a very rare fern, occurs in Badby Wood and in Harleston Firs. In the latter place it disappeared for a year or two, but is now again abundant. These, together with the old locality of King's Cliff, are in the Nene system. Mr. French records it from near Brackley, and Mr. Beesley from Newbottle, the latter localities probably drained by the Cherwell.

Asplenium Ruta-muraria, L., Wall Rue, occurs at Dallington, within two miles of Northampton, on Brampton Bridge, at Overstone, (Mrs. Birch,) and very plentiful about our President's (Lord Lilford) estate, at Lilford, as noticed in Morton's History, tempore 1700; also at Barnack and Walcot Hall, and in the west of the county at Sulgrave, Astrop, (Mr. E. Walford,) Watford Church, &c.

A. Adiantum-nigrum, L., very rare, at Duston Stone Pits and Harleston Lane, Astrop, (Walford,) and King Sutton, (French,) the two latter drained by the Cherwell.

A. Trichomanes, L., not given in "Top. Bot." for 32. At Lamport, probably an escape; at Great Billing, on Irthlingborough Bridge, Nene drainage, and near Towcester, (Norman,) Tove drainage.

Athyrium Filix-fœmina, B., very fine in Delapre Woods; also, in Harleston Firs, Duston, Badby Wood, Yardley Chase, Overstone, (Mrs. Birch,) Bedford Purlieus, (Mr. Bodger,) all in Nene system, and near Banbury, (T. Beesley.) This is not included in "Top. Botany."

Scolopendrium vulgare, Sm., Harleston stone pits, Badby, Newnham, Clifford Hill, (Law), Nene; Barby, (H. W. Trott), Avon; Eydon, Cherwell; and Wappenham, Yardley Gobion, &c., Ouse. It is very frequently found growing in the stonework of village wells, some splendid plants occurring at Yardley Gobion and Lamport.

Aspidium aculeatum, Sw., plentiful in Harleston quarries, and also in Maidwell Dales, (Law,) the only localities in Nene drainage; it is very frequent in hedgerows in the west of county drained by the Cherwell, Leam, and Avon. I should place Maidwell Dales as the limits of its easterly range.

A. lobatum, Harleston, Astrop, (Walford,) Chacombe, (Beesley,) Newnham Lane (Notcutt).

A. angulare, W., Mr. Griffin tells me he has gathered at Badby Woods.

Nephrodium Filix-mas, Rich., generally distributed, although less frequent easterly. In Delapre Woods occurred a form very near *affine*.

N. dilatatum, Desv., Harleston, Duston, Badby Woods, Delapre, &c., all in Nene system.

N. spinulosum, Desv., Harleston, Badby Woods, Yardley Chase, Nene, and near Banbury, (French.)

N. Thelypteris, Desv., only on authority of Baker's History, at Overstone; now extinct.

N. Oreopteris, Desv., recorded from Harleston, East Haddon, and Badby, Nene, but not recently found; likely to occur at Badby.

Polypodium vulgare, L., generally distributed, but rare in Tove system.

Ceterach officinarum, Willd., on walls at Barnack, Biggin, (Rev. M. J. Berkeley,) Astrop, (J. Beesley.)

Osmunda regalis, L., Moulton, (Baker's Hist.,) now extinct.

Ophioglossum vulgatum, L., generally distributed; Brampton Meadows, nearest locality to Northampton.

Botrychium Lunaria, Sw., recorded from Harleston Heath, (Baker's Hist.,) not recently found; Oldfield, (Morton's Nat. Hist.,) extinct.

None of the Club Mosses occur in Northants, and *Pilularia globulifera* is only recorded in Morton's Hist., from Boro' fen.

Reviews.

The Fairy-Land of Science. By ARABELLA B. BUCKLEY, Author of 'A Short History of Natural Science,' 'Botanical Tables for Young Students,' etc.—London: Edward Stanford, 1878, pp. 244, illustrated.

THE influence of the master over the mind of the intelligent pupil is always manifested. Not that we have any knowledge that the accomplished lady—the Mary Somerville of our day—whose name appears above ever studied personally under Professor Huxley, but there can be little doubt that the public teaching of our greatest English biologist, in addition to her association with the late Sir Charles Lyell as his Secretary, has had much to do in moulding her scientific character, and in developing the very interesting and beautiful work before us. In his admirable "Physiography"—a book which should be in the hands of every scientific student—Professor Huxley proposed "not to trouble his hearers much about latitudes and longitudes, the heights of mountains, the depths of seas, or the geographical distribution of Kangaroos and *Compositæ*," specially as such, but he approached the study of nature after a fashion of his own by giving in very broad and accurate outlines a view of the "place in nature" of a particular district of England—the basin of the Thames, and all the phenomena connected therewith — in fact, a chapter of the history of the Universe.

Here is a little book, a worthy companion of the "Physiography," wherein the author contemplates Nature from her own standpoint, and in graceful fancy attributes to the doings of the fairies in the "Fairy-Land of Science," the wonders and marvels—termed by Philosophers "the forces of Nature"—constantly going on around and among us. The result is that in this attractive guise any child of fair intelligence is held spell-bound in the subject as in the narration of a nursery story, and, what is better, is drawn on to more advanced studies. Every father of a family who wishes his children to know something of Natural Science should buy this little book and present it to them as a New Year's gift. And even "the gray-haired boys" may here read and learn.

In her preface the authoress, speaking of its origin, says:—"The ten lectures, of which this volume is composed, were delivered last spring, in St. John's Wood, to a large audience of children and their friends, and at their conclusion I was asked by many of those present to publish them for a child's reading book. At first I hesitated, feeling that written words can never produce the same effect as *viva-voce* delivery. But the majority of my juvenile readers were so deeply interested that I was encouraged to think that the present work may be a source of pleasure to a wider circle of young people, and at the same time awaken in them a love of nature and of the study of science." The public are much indebted to Miss Buckley for acceding to the wishes of her friends and for the enlarged series of Lectures which she has given us. The titles themselves are sufficiently suggestive of their contents. 1. "The Fairy-Land of Science, how to Enter it, how to Use it, and how to Enjoy it." 2. "Sunbeams and the Work they do." 3. "The Aerial Ocean in which we Live." 4. "A Drop of Water on its Travels." 5. "The Two great Sculptors—Water and Ice." 6. "The Voices of Nature and how we Hear Them." 7. "The Life of a Primrose." 8. "The History of a Piece of Coal." 9. "Bees in the Hive." 10. "Bees and Flowers."

Perhaps the most interesting Lecture is that on "The Two great Sculptors—Water and Ice." It is an old story told in a new dress. As the sculptor fashions his rude block of marble perchance into the image of the lovely Galatea, so we have Water described as fashioning the face of the earth into the steep slopes and gentle curves, "the hills, valleys, gorges, ravines, slopes, plains, caves, grottos, and rocky shores"—and Ice as breaking up the ground, and forming the glacier—its progress and its destiny—with the marks it leaves in its erratic boulders and its striations of hard rocks.

In "The History of a Piece of Coal"—after tracing its existence from the far-off period when the sunbeams developed the ferns, calamites, lepidodendrons and sigillarias to its presence in the mine and its value to our manufactories, industries, and its essential aid to our comforts, the author says:—"All this, then, those plants and trees of the far-off ages, which seemed to lead such useless lives, have done and are doing for us. There are many people in the world who complain that life is dull, that they do not see the use of it, and that there seems no work specially for them to do. I would advise such people, whether they are grown up or little children, to read the story of the plants which form the coal. These saw no result during their own short existences, they only lived and enjoyed the bright sunshine and did their work, and were content. And now, thousands, probably millions of years after they lived and died, England owes her greatness and we much of our happiness and comfort to the sunbeams which those plants wove into their lives. They burst forth again in our fires, in our brilliant lights, and in our engines, and do the greater part of our work; teaching us—

'That nothing walks with aimless feet,
That not one life shall be destroyed,
Or cast as rubbish to the void,
When God hath made the pile complete.'"

The language of the book is simple, graceful, and forcible, and there is a reverent spirit pervading it throughout. The engravings are beautifully executed, and add much to its value, and many are original. The experiments are easy and within reach of average youth. With so much to commend, it seems almost ungracious to make a suggestion, but we think that—as it is intended for youth—the book would be improved by giving, as Professor Huxley has in foot notes to the "Physiography," the Greek roots of all generic and specific names derived therefrom. Authoress, artist, printer, bookbinder, and publisher must be congratulated on producing one of the most charmingly attractive volumes of its kind ever published.

W. R. Hughes.

The Geological Record for 1876. Edited by W. Whitaker, B.A., F.G.S. Published by Taylor and Francis. Price to subscribers, 10s. 6d.

This is the third volume of this most useful and, to every geological worker, indispensable book. It contains 415 closely printed pages, embracing not only the title, but a short abstract of every paper or book bearing upon the science of geology which was published during the year 1876, either in the British Isles or abroad, all properly classified, together with lists of the new fossils described, &c. Some idea of the immense amount of labour involved may be had from the fact that the total number of abstracts amounts to nearly 2,400. The British Association has recognised the need for and value of this publication by making an annual grant of £100 towards its cost, and the extremely low price at which it is published should enable every student to obtain it as a work of reference.

Nowadays it is absolutely necessary to know what other workers have done or are doing in the field of research in which we ourselves are engaged. For want of this knowledge countless blunders have been committed in the past, every science has been loaded with unnecessary synonyms, and much duplicate work has been done.

Mr. Whitaker has long been known as an indefatigable worker both in the library and in the field; but in the preparation of the *Geological Record* he has been ably aided by several of his colleagues on the Geological Survey and by others. Among these we may mention Messrs. Topley, Dalton, Lebour, Drew, Etheridge, jun., Tawney, H. B. Woodward, &c., and Profs. Bonney, Rudler, Miall, and Nicholson.

One of the great difficulties in connection with the work is the fact that many authors and societies do not punctually send copies of their papers, transactions, &c., to the editor, (at the Geological Museum, Jermyn Street, S.W.,) or to the Library of the Geological Society, at Burlington House, Piccadilly, where they might be consulted.

W. J. H.

The Small Heath Literary Magazine. No. 3. January, 1879. Price 1s. Birmingham: Davis Bros.

This excellent magazine, the papers in which are contributed solely by members of the Small Heath Literary and Scientific Society, is a most praiseworthy publication, and we warmly congratulate the editors on being able to issue such an interesting and highly creditable serial. Although the subject-matter of the papers is mainly of a non-scientific character, we do not think it is out of place to record in these pages our warm appreciation of the good work one of the societies in the "Midland Union" is doing by giving publicity to the literary productions of its members. We sincerely hope it may obtain all the success it deserves.

Errata.—Nottinghamshire Conchology, &c.—Vol. I., page 309, lines 1 and 14, for *Testacella Maugei* read *T. haliotidea*; on page 308, line 5, Notts Ferns, for *Polystichum angulare* read *P. aculeatum*. The former is also found in the county.

Microscopy.

The annual report of the POSTAL MICROSCOPICAL SOCIETY for 1878 is an interesting document which every microscopist would do well to read. The Society has been in existence five years, and now consists of 140 members, under the presidency of Mr. Tuffen West, F.L.S., &c. The Society was formed to meet a want long felt of a ready means of communication between Microscopists living at a distance from each other. The members are divided into sections or circuits, twelve in each, arranged geographically. At intervals of a fortnight the Secretary, Mr. Alfred Allen, 1, Cambridge Place, Bath, sends to each of the members whose names stand first in the several circuits a box of microscopical slides. These are retained for three evenings and then forwarded to the names second on the lists, and, after a like interval, are forwarded to the third names, and so on, till the circuits have been completed, the last recipient returning the slides to the Secretary, who then sets them once more in circulation, so that every member in turn sees every collection of slides, and is constantly supplied with fresh subjects for microscopic examination.

But not only are microscopical slides, many of the highest interest, constantly distributed among the members, but very often they are accompanied by MS. descriptions, and elucidatory drawings which materially assist the study and appreciation of the more difficult objects. A society such as this, well and energetically managed, including many of our best microscopists among its members, cannot fail to be very useful. Some idea of the nature and extent of its operations may be gleaned from the Society's last report, and the President's address accompanying it, which, together with list of members, rules, &c., can be obtained from the Secretary.

In consequence of a number of gentlemen of the medical profession having recently joined the Society, it has been arranged to circulate a special series of histological and pathological slides. These special slides will circulate almost exclusively amongst the medical members, at monthly intervals, in addition to the usual fortnightly box of slides which goes the whole circuit of the Society, whether members are medical or otherwise. The Society is also proposing, at the request of many members, to circulate a series of slides devoted to botanical subjects. These, after going the round of the contributors, it is proposed should go the whole circuit of the members.

The Society has recently issued a "Classified List of Objects" circulated among the members from the commencement of its existence to the end of its fourth year, (June, 1877,) and we do not think we are far wrong in stating that the list consists of 2,000 objects, many of them mounted by the members. Some measure of its usefulness and activity is indicated by this statement.

Amongst the rules, which are all carefully drawn up and appear in every way fitted to meet the exigencies of a *Postal* Society, is one which provides that ladies may be members of the society. Another feature of this society, designed expressly for the purpose of promoting friendly feeling, is that each member on admission to the society is requested to send his or her *carte de visite* to the secretary, and as soon as a sufficient number are collected they are grouped together and reproduced in permanent photography, and sold to the members at the lowest remunerative price. We have seen a copy of the last-issued group, which contains seventy-three portraits, excellently arranged and well printed. This group makes us acquainted with the portraits of many well known microscopists, and with several who have contributed to the pages of this magazine. It only remains to mention that the entrance fee is 2s. 6d., and the annual subscription 10s.

Mr. T. Bolton's Agency for the Distribution of Living Organisms amongst Microscopists is, we are glad to find, being widely appreciated and made use of. He has already as subscribers of one guinea for twenty-six tubes, to be supplied in the course of six months, usually one per week, or more rapidly if desired, several Microscopical Societies, Science Schools, and many leading microscopists in all parts of the United Kingdom. We have glanced at the list of objects sent out by him during the past six weeks, and we find amongst them larvæ of the Marine Polyzoon described at page 26, Raphidiophrys pallida, Epistylis grandis, Euglena viridis, Chilodon cucullulus (?), Œcistes crystallinus, Floscularia cornuta, Trout spawn, Stephanoceros Eichhornii, Amœba, Nitella translucens in fructification, Volvox globator, many kinds of Rotifers, &c., of some of which he has also been able to distribute good illustrations and descriptions through the kindness of Professor E. Ray Lankester, Mr. Saville W. Kent, and Mr. H. E. Forrest. We can from personal experience speak of the satisfactory manner in which Mr. Bolton sends out his specimens, and can recommend anyone desiring useful occupation for his microscope to make use of Mr. Bolton's services. His address is 17, Ann Street, Birmingham.

METEOROLOGY OF THE MIDLANDS.

THE WEATHER OF DECEMBER, 1878.

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

December commenced with five or six days of unsettled weather, but on the 7th cold weather set in and continued to the 28th. The severity of the cold during this period was greater than in any year since 1860. Our lowest temperature recorded was at Coston Rectory, near Melton Mowbray, (Rev. A. M. Rendell,) 2° below zero, indicated by *two* registering minimum thermometers, and at Stoney Middleton a temperature of –1° was indicated. This was on Christmas Eve. Of the three weeks' frost the Rev. J. Brooke (Shifnal) writes "By far the coldest December for at least forty-four years;" the Rev. J. M. Mello, (Chesterfield,) "It is forty-one years since such severe weather set in so early, and such a low temperature as 5° (on the 25th) has not been known since 1860 in this district;" Mr. H. E. Bellamy, (Oxford,) "The mean temperature of December was lower than of any month since 1860, except December, 1874, which was about the same." Ice on still water attained from 6in. to 7in. in thickness. "The Trent was frozen over, and at Nottingham, on Christmas Day, hundreds of people were skating on it" (Mr. H. F. Johnson.) From the 11th to the 15th the "ragged rime" on the trees presented a beautiful appearance, the ice-needles being an inch in length, and varying with the direction of the wind, as Mr. Mott has so well pointed out ("Midland Naturalist," Vol. II., p. 22.) A "silver thaw" set in on the 26th, rain falling and freezing on the roads, which became a sheet of ice. Mr. Markham (Pitsford) says, "The people here were able to skate from Northampton to Pitsford and back by Brampton, a distance of ten miles on the road." This was another instance of the fact that atmospheric changes first set in in the higher regions of the atmosphere, and shows the importance of having meteorological stations on the highest points in any country. Rainfall was about an average. It consisted largely of snow, which fell heavily on the 18th and 21st. The barometer was low and unsteady. Northerly and westerly winds prevailed, but there was a marked absence of tempestuous weather.

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.									
Cainscross, Stroud	W. B. Baker, Esq.	1·99	1·36	29	4	56 0	30	11·0	24
Cheltenham	R. Tyrer, Esq.	1·90	·50	25	12	53·5	30	4·8	25
Stroud	T. J. Coley, Esq.	1·74	·58	26	7	53 0	31	15·0	24
SHROPSHIRE.									
Haughton Hall, Shifnal	Rev. J. Brooke	2·16	·32	1	13	51·0	31	11 0	25
Whitchurch	A. B. George, Esq.	3·23	·50	26	11			8·0	24
Woolstaston	Rev. E. D. Carr	2·88	·39	28	15	50·0	31	18·0	14,15,17, 25 (25
Leaton Vicarage, Shrewsbury	Rev. E. V. Pigott	1·70	·29	28	17	52·3	31	7·1	
More Rectory, Bishop's Castle	Rev. A. Male	2·72	·34	28	18	50·0	30 & 31	6·0	25
Bishop's Castle	E. Griffiths, Esq.	2·40			16	50·0	30 & 31	11·0	24
Cardington	Rev. Wm. Elliott	2·73	·39	28	18				
Adderley Rectory	Rev. A. Corbet	2·28	·38	1	15				
Stokesay	Rev. J. D. La Touche	2·19	·41	28	17	52·4	31	4·2	24
HEREFORDSHIRE.									
Whitfield	W. Wheatley, Esq.	2·15	·53	28	15			6·0	25
Stoke Bliss	Rev. G. E Alexander	1·84	·34	24	13	52·0	31	10·0	24
WORCESTERSHIRE.									
Orleton, Tenbury	T. H. Davis, Esq	2·08	·39	28	15	54·0	31	7·7	25
West Malvern	A. H. Hartland, Esq.	1·93	49	25	11	44·5	28	16·5	13
Pedmore	E. B. Marten, Esq.	1·78	s)·32	25	16	50·0	31	10 0	24
Stourbridge	Mr. J. Jeffries	1·79	·35	25	13	50·0	30 & 31	10·0	24
St. Johns, Worcester	G. B. Wetheral, Esq.	1·88	·80	26	9	51·0	31	11·0	24
STAFFORDSHIRE.									
Thorganby Villa, Wolverhmtn	G. J. C. Broom, Esq.	1·89	·25	29	13				
Amblecote	Mr. J. Robins	1·59	·30	26	15				
Dudley	Mr. J. Fisher	1·68	·28	26	12	56·0	29	18 0	23 & 24
Sedgley	Mr. C. Beale	1·72	·52	26	17	48·0	30 & 31	20·0	24
Kinver	Rev. W. H. Bolton	1·81	·29	28	16	46 0	30 & 31	10 0	24
Walsall	Mr. N. E. Best	2·22	·40	25	17	49·0	31	26·0	14
Grammar School, Burton	C. U. Tripp, Esq.	2·41	s)·16	26	17	53·0	31	9·0	25
Weston-under-Lyziard R'tory	Hon. and Rev. J. Bridgeman	2·47	s) 33	27	15	52·0	31	3·0	25
Wrottesley	E. Simpson, Esq.	1·95	·36	26	15	49·8	31	10·6	25
Tamworth	W. Arnold, Esq.	2·35	s)·[illegible]0	25	12				
Heath House, Cheadle	J. G. Philips, Esq.	2·5[illegible]	·43	18	13	49·0	30	17·0	14 & 25
Alstonfield Vicarage	Rev. W. H. Purchas	0·66	·35	1	5	48·7	31	12·0	11
WARWICKSHIRE.									
Coundon, Coventry	Lieut.-Col. R. Caldicott	1·93	·46	25	16	51·0	31	14·0	24
Coventry	J. Gulson, Esq.	1·93	·42	25	17			14·0	25
Bickenhill Vicarage	J. Ward, Esq.	2·01	·45	27	16	44·0		13·0	
St. Mary's College, Oscott	Rev. S. J Whitty	2·04	·44	25	20	51·1	30	12·7	25
Henley-in-Arden	T. H. G. Newton, Esq.	2·15	s)·52	26	14	53·0	31	4·0	25
Rugby School	Rev T. N. Hutchinson	1·99	·42	26	15	52·4	30	11·0	24
DERBYSHIRE.									
Stoney Middleton	Rev. U. Smith	1·68	·37	28	11	49·0	31	--1·0	24
Brampton St. Thomas	Rev. J. M. Mello	1·32	·56	25	7	4[illegible]·0	30 & 31	5·0	25
Fernslope, Belper	J. G Jackson, Esq.	1·89	s).58	25	18	49·0	30	10·0	25
Linacre Reservoir	C. E. Jones, Esq.	1·54	·65	25	11				
Willesley Gardens	J. Tissington, Esq.	2·29							
Spondon	J. T. Barber, Esq.	2·29	·65	24	13	51·2	31	6·9	24
YORKSHIRE.									
Hesley Hall	B. J. Whitaker, Esq.	1·53	1·32	30	6	49·0	31	9·0	21
NOTTINGHAMSHIRE.									
Tuxford	J. N. Dufty, Esq.	1·53				49·0	31	13·0	24
Highfield House, Nottingh'm	E. J. Lowe, Esq.	2·50	·75	26	15	59·1	31	5·9	25
Hodsock Priory, Worksop	H. Mellish, Esq.	1·54	·70	25	15	53·1	31	9·8	25
Park Hill, Nottingham	H. F. Johnson, Esq.	2·33	·60	26	15	52·5	31	13 5	24
LEICESTERSHIRE.									
Loughborough	W. Berridge, Esq.	1 87	·45	26	12	61·1	31	5·8	25
Ashby Magna	Rev. E. Willes	1 77	·46	26	10				
Market Harborough	S. W. Cox, Esq.	1·63	1·00	27	10	50·0	31	8·0	25
Kibworth	T Macauley, Esq.	1·86	·65	25				11·0	24
Town Museum, Leicester	W. J. Harrison, Esq.	1·81	·42	26	15	52·5	31	6·9	25
Belmont Villas, Leicester	H. Billson, Esq.	1·88	·46	26		52·8	31	9·8	25
Syston	J. Hames, jun., Esq.	1·77	·70	26	14	47·0	30 & 31	10·0	25
Waltham-le-Wold	E. Ball, Esq.	1·94	·42	25	14	48·0	30	16·0	24
Little Dalby Hall	G. Jones, Esq.	1·54	·41	26	16	51·0	31	7·0	25
Coston Rectory, Melton	Rev. A. M. Rendell	1·73	s)·37	25	15	52·1	31	--2·0	25
NORTHAMPTONSHIRE.									
Towcester Brewery	J. Webb, Esq.	1.81	s r).45	25	15				
Castle Ashby	R. G. Scriven, Esq.	1·53	·48	25	9	50·0	31	15·0	24
Pitsford	C. A. Markham, Esq.	1·78	·42	26	14	51·0	31	9·0	25
Kettering	J. Wallis, Esq.	1·66	·41	26	16	50·0	31	14·0	25
Althorpe	W. F. Jakeman, Esq.	1·53	·35	25	15	52·0	31	10·0	25
RUTLAND.									
Burley-on-the-Hill	W. Temple, Esq.	1·63	s r)·98	25	6	49·0	30	16·0	14
West Deyne, Uppingham	Rev. G. H. Mullins	1·65	s)·40	25	13	51·6	31	17·9	25
Northfields, Stamford	W. Hayes, Esq.	1·39	·49	26	14	41·5	5	13·0	25
Radcliffe Observatory, Oxford	Mr. H. E. Bellamy	1·51	·40	25	11	53·6	29	5·6	24
Spital Cemetery, Carlisle	T. Bell, Esq.	1·52	1·04	(r s) 29	4	51·0	81	5·0	23
Ventnor Hospital	H. Sagar, Esq.	1·89	·30	29	20	50·7	31	24·1	15
Altarnun Vicarage	Rev. G. Tripp	6·08	1·08	29	13	53·0	30 & 31	8·0	11

Thunder was heard at Stokesay on the 30th, and a lunar rainbow was seen there on the night of the 31st. The birds suffered greatly from the cold. From many places they disappeared altogether, doubtless going southward in search of a warmer climate. Mr. Ball, of Waltham, says: "Previous to the frost, great numbers of small birds were observed going southwards. Numbers of rooks, crows, sparrows, and robins perished here during the frost." At More Rectory, (Rev. A. S. Male,) "Winter birds, fieldfares, &c., were abundant and very tame. One hawfinch was killed on the 31st. The rooks were so tame with hunger that they came to feed with the small birds at the window." At Nottingham, (Mr. Johnson,) "Great quantities of small birds have died in this neighbourhood, and we have had some fresh arrivals, as bramble-finches and redwings."

Rainfall of 1878.—We have received the following returns:—

Coventry	34·81in.	Stoke Bliss	36·92in.
Leicester (Town Museum)	29·73in.	Nottingham (E. J. Lowe, Esq.)	32.97in.
Spondon................	32·32in.	Ashby Magna	27·16in.
Hodsock Priory..........	24.88in.	Syston	28·76in.
Kettering	27·16in.	Coston Rectory..........	28·27in.
Tuxford	29·73in.	Cheltenham	33·18in.
Cheadle	37·57in.		
Adderley Rectory........	32·16in.		

For observers' names and counties see the monthly list. These returns show an average excess of about ten per cent., chiefly due to the months of May and August. It was the fourth year of excessive rains, the last "dry season" having been in 1874.

Correspondence.

Snow Crystals.—Information how these may be observed under the microscope would be most acceptable.—Enquirer.

Freshwater Polyzoa.—Will some one kindly describe a good method for preserving these interesting objects, with tentacles expanded for examination under the microscope?—M.

Rotifers.—I have tried in vain to preserve these interesting animalcules as microscopical specimens, but have, so far, been most unsuccessful. Will some reader of the "Midland Naturalist" communicate a method which has stood the test of experience?—J. N.

Wild Goose.—It may interest some of the readers of the "Midland Naturalist" to know that one of the boys in this village captured, on Christmas Day last, a wild goose. The bird lighted in a field near to where the lad was singing carols, and was too exhausted to fly further. It weighed 10lbs., and measured 7ft. between the tips of the wings.—Wm. Elliot, Cardington.

Tablets to Mount Specimens on.—Referring to a note on tablets for mounting specimens at page 25, I may say that the pasteboard recommended by Professor Miall answers admirably. But his plan of indicating formations or classes by different colours does not answer so well, since most of the colours fade very soon. In my own cabinet I have, for that reason, adopted one quiet permanent colour.—C. Callaway. D.Sc., Wellington.

A Rare Bird.—A fine specimen of the bittern *(Botaurus stellaris,* Selby,) was shot near Leicester, on December 28th, and is now in the possession of Messrs. W. Adcock and Son, Taxidermists, 96, Dorset Street, Leicester.—C. A.

How are the Shells of Garden Snails Formed?—Will Mr. Tye or some other conchologist give a description of the mode in which the common garden snail developes its shell? By what means does the tiny thing by which the baby snail is protected grow with its growth, enlarging and yet retaining its proper form, enriched by its typical markings? The history cannot fail to prove intensely interesting.—H. Cole.

What is the cause of Hardiness in Plants?—Why does frost kill some plants and produce no effect on others? I should be much obliged if some one will enlighten me on this most interesting subject. Are there any published papers in which the question is well discussed? It seems to me a subject of great importance; but I am unaware that anything of real value concerning it has yet appeared. Information will be valuable to many besides myself.—W. E.

Aquaria.—Will some of the readers of the "Midland Naturalist" kindly inform me what is the best artificial food for freshwater fishes, viz., carp, minnows, perch, tench, dace, roach, &c., as I find a difficulty in feeding them properly at this time of the year. Two or three of my gold carp were covered with a sort of white fungus, and died in a few days after that made its appearance. Can anyone explain this, and if there is any cure? Any information on the management of Aquaria generally would be esteemed a favour.—H. M., Derby.

The Midland Union and the "Midland Naturalist."—I have been making enquiries as to the number of members who subscribe for the magazine, and I am astonished to find how few show any willingness to support a publication which has already done much useful work for our Natural History Societies. I desire to offer a suggestion. Let every member who is already a subscriber make up his mind to get one, or, better still, two fresh subscribers for the current year. To do this need involve very little trouble, as among his fellow-members every one can surely influence some one by his recommendation. It will be a poor return for the gratuitous labours of the editors, and for the enterprise and good nature of the publishers, if the Societies in the Union will not, each and all, lend a helping hand to ensure the permanent publication of the "Midland Naturalist." Every student of any branch of Natural History in the Midland Counties ought to feel himself bound in honour to do what he can to increase the circulation of our valuable monthly.—F. E. L.

Frost Phenomena.—At page 22 is a very interesting account by Mr. F. T. Mott, of Leicester. I will add a line or two as to a very beautiful phenomenon which I noticed here on Christmas night last. The first great frost of the memorable winter of 1878-9 commenced on the 6th and terminated on the 25th of December by a thaw and subsequent rain in the afternoon and evening. To this succeeded, about ten o'clock at night, a sharp frost. The partially melted snow on the trees and hedges, and apparently the rain itself, formed a mass of icicles, covering almost every twig and branch of hedge and tree. They were variously club-shaped, spindle-shaped, or coral-shaped, and in the gaslight sparkled like brilliants. Moreover, as a gentle wind sometimes passed through the trees, a peculiar grating sound was heard as the icicles ground against each other, not of an unmusical character, as though calcareous matter in the nature of coral had been gently rubbed together. This was observed between eleven and twelve o'clock at night.—W. R. Hughes, Handsworth Wood, near Birmingham.

Hedgehog.—My garden is entirely walled-in, and near the bottom there is a raised bank supported by a wall of casting pots placed with the open ends outwards. In November, 1876, a friend gave me a young hedgehog about one-third grown. He lived in the garden, but was only visible at intervals of a month or six weeks. Desiring to find where he hid himself I carefully searched the garden, and on examining the casting pots I observed one about 15in. from the ground filled to the very mouth with dead leaves, of which there was a large quantity on the ground near. On removing the leaves from the casting pot I found them *quite densely packed together*—not as if they had been loosely cast in, but as if they had been subjected to both arrangement and pressure—and about 5in. from the mouth of the casting pot appeared the prickles of the hedgehog. Query—How came he there? I had no other domestic pet to "tuck him up" after he had got into his cosy bed, and the cats of the neighbourhood can hardly be credited with it. Probably some Naturalist can solve the question. My own guess is that he filled the hole with leaves, and then with a screwing motion of his body used his prickles to draw in the leaves after him as he bored his way through them.—R. Hugh Burman, Handsworth.

Northampton Castle.—Many readers of the "Midland Naturalist" are aware that with the progress of the new line of the North-Western Railway, by which Northampton is placed on the main line of their system, the old Castle of Northampton, built by Simon de St. Liz, will be completely destroyed, the site being required for the sidings of the new station. Excavators have for some time been at work, and have now laid bare the foundation of the western walls and postern gate, and a memorial has been signed asking the North-Western Company to incorporate or utilise in some way this block of masonry if possible. A committee of Archæologists has been formed to watch the excavations in case anything of interest should be unearthed. The walls of the Castle, and particularly the south bastion, were interesting, as being the only Northants locality for *Diplotaxis tenuifolia* &c.; and among other interesting plants growing on them may be mentioned *Echium vulgare*, *Linaria vulgaris*, *Sedum album* and *reflexum*, *Poa compressa*, *Antirrhinum majus*, *Cheiranthus cheiri*, &c. Burgess, in his Wild Flowers, I believe, alludes to the profusion of *Malva sylvestris* growing in the Castle moat, but this has disappeared, nor can *Fritillaria meleagris* be now seen in the meadows near, although *Colchicum autumnale* still appears, making the fields gay in September within a few hundred yards of this site.—G. C. Druce.

Gleanings.

Ornithology.—We have received from Dr. E. Rey, of Leipzig, the first and second parts of a general (priced) catalogue of birds. The prices appear moderate, as the skins are guaranteed to be in good order.

Molluscan Threads.—Mr. G. Sherriff Tye contributed to the November number of "The Quarterly Journal of Conchology" a most interesting paper on the threads spun by Mollusks. The paper was read before the Birmingham Natural History and Microscopical Society.

Photography.—We have received from Mr. J. Vincent Elsden an excellent photographic enlargement of the diatoms *Triceratium favus* and *T. megastomum*. These are enlarged to a diameter of from 1in. to 1½in., and the details are brought out with considerable clearness.

Geological Survey.—The mapping of sheet 70 (N.-E. Leicestershire, East Notts, and South Lincolnshire) has been all but completed by Mr. W. H. Holloway, F.G.S. Very little local work has been done in this region, and we trust that a full descriptive memoir will be published concerning it.

Petrology.—We are glad to hear that Mr. F. Rutley, F.G.S., has written a book upon this subject, which will be published in a few weeks. We pointed out the necessity for such a work in our review of Mr. Rutley's memoir on "Brent Tor," last month, (page 17,) and are glad to find that he has anticipated our wishes.

Natural History of the Ant.—The Rev. Henry McCook, of the Academy of Natural Sciences, Philadelphia, announces the proposed publication, by subscription, (four dollars,) of a Monograph of the Agricultural Ant of Texas. From the syllabus of the work the doings of these creatures appear to be of a very extraordinary character, and have been minutely studied by the author "while encamped in the midst of a large colony of formicaries." There are twenty-four plates, containing a large number of illustrations, drawn from nature.

Norwich Geological Society.—The prosecution of the Geological Survey in the Eastern Counties has naturally given an impetus to the work of the various scientific societies of that district. As one result of this movement, we are glad to see that the Norwich Geological Society has commenced the publication of their "Proceedings." Part I. contains a list of papers communicated to the Society from its establishment in 1864 up to November, 1877, and also abstracts of several papers read during the session 1877-8. Part II. consists of a very able address delivered by the President, H. B. Woodward, Esq., F.G.S., in which much valuable information on glacial topics is contained.

The Birmingham Reference Library, which included the deservedly-famous Shakespeare Library, the Cervantes Library, and the unique Staunton Collection (relating to Warwickshire history,) was destroyed by fire on the afternoon of Saturday, January 11th, 1879. The loss is one deplored by everyone, and many of the treasures destroyed can never be replaced. With characteristic energy, Birmingham at once set to work to provide funds for the formation of another library as good as money judiciously spent can provide. Within a week of the fire more than £10,000 was subscribed. There is no doubt that £15,000 will soon be raised, which is the sum required in addition to the insurance money to reinstate the buildings and fill them with the necessary books, &c. We have reason to believe that scientific literature will be fully represented in the new Reference Library.

The Present Severe Winter seems to have been plainly foreseen by Professor Piazzi Smyth, the Astronomer Royal of Scotland, so long ago as 1872. In a communication made by him to *Nature*, of February 22nd, in that year, commenting on the observations made with the rock thermometers at the Royal Observatory, Edinburgh, during many preceding years, he states that the most striking features of the observations are (1) the great heat-wave which occurs every eleven years and a fraction, and nearly coincidently with the beginning of the increase of each sun-spot cycle of the same eleven-year duration, and (2) the extreme cold found on either side of the great heat-wave, and he points out that the next occurrence of the minimum temperature of the then next cold wave might be looked for at the end of last year, (1878,) and the early part of the present year, and that the next heat-wave will occur in or about 1880.

Reports of Societies.

BIRMINGHAM AND MIDLAND INSTITUTE SCIENTIFIC SOCIETY.—January 1st.—The Annual Soirée was held in the Bristol Street Board School. 140 tickets were issued, and the meeting proved a very enjoyable one. Mr. G. T. Cashmore exhibited an arrangement of mirrors for illustrating the law of symmetry in crystals. Messrs. P. Harris and Co. lent an induction coil and vacuum tubes. Various members contributed telephones, microphone, electro-thermoscope, and microscopes. Mr. C. Pumphrey exhibited a number of beautiful stereoscopic views of remarkable scenery. At eight o'clock an amusing scientific farce, interspersed with experiments and songs, was performed by Messrs. A. Cresswell, R. Birbeck, and C. E. Crick. Refreshments were then served under the superintendence of Mrs. Cresswell, and dancing commenced and was kept up with much spirit until midnight.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—December 17th.—MICROSCOPICAL GENERAL MEETING.—Mr. Graham exhibited the Cat's-Eye Pearl from Japan. Mr. W. R. Hughes read the seventh of a series of papers on "The Entozoa and Ectozoa," by T. Spencer Cobbold, M.D. January 7th.—GENERAL MEETING.—Mr. J. E. Bagnall exhibited *Œdipodium Griffithianum* from Snowdon, and capsule of Sphagnum to show the stomata.—Mr. R. M. Lloyd exhibited some live specimens of the river lamprey *(Petromyzon fluviatilis.)* Mr. W. Southall read the first part of a paper on "The Flora and Fauna of Edgbaston," but, after having read the first part, at the request of the Chairman, he promised to read the entire paper at a future meeting.

CHELTENHAM NATURAL SCIENCE SOCIETY.—January 16. Geo. Ferguson, Esq., M.D., M.A., read a most interesting paper on the "Planet Mars and its Alleged Habitability." The paper was well illustrated by diagrams.

NOTTINGHAM LITERARY AND PHILOSOPHICAL SOCIETY.—NATURAL SCIENCE SECTION.—December 20th.—Mr. Jas. Shipman read an interesting report of a Geological excursion made by the members on the 5th October to Froghall, Caldon Low, Weaver Hills, and Alton Towers. January 17th.—Mr. H. M. Ward gave a lecture on "Green Leaves."

SMALL HEATH LITERARY AND SCIENTIFIC SOCIETY, BIRMINGHAM.—The annual Conversazione was held in the Board Schools, Jenkins Street, on New Year's Day. A very interesting exhibition was made, including specimens from the South Kensington Museum, lent by the India Office; Microphone, Microscope, Dichroic liquid, Trap-door Spiders, &c., exhibited by Mr. Lawson Tait; a collection of Biological specimens, exhibited by Mr. Aaron Franklin; microscopes, revolving stereoscope, &c., exhibited by Miss R. Bailey; Circulation of Blood in Frog's Foot, exhibited by the President (Mr. Jacob Rowlands;) Collection of British Birds' Eggs, exhibited by Mr. C. E. Rowlands; specimens of Freshwater Life, exhibited by Mr. Thos. Bolton; and many other objects of interest, exhibited by various gentlemen. There was also an amateur dramatic performance.

EXCHANGE.

Will give good collection of land and freshwater shells for any volume of "Science Gossip." Want all volumes since commencement of publication. Also want "Turton's Land and Freshwater Shells," and other books on shells.—C. T. MUSSON, 68, Goldsmith Street, Nottingham.

THE PREDACEOUS WATER BEETLES (HYDRADEPHAGA) OF LEICESTERSHIRE.

BY G. ROBSON.

Whilst the sciences of Geology and Botany are favourite subjects of study with those who possess a taste for Natural History, very few care for working up, with anything like thoroughness, the science of Entomology, particularly some of the obscurer branches, such as the order *Coleoptera.* Botany is regarded as being a very beautiful science, and Geology has powerful attractions; but, Beetles! why the very name is too much for the sensitiveness of ladies, and even gentlemen shrink from handling them. Butterflies and moths have many admirers of both sexes, but Beetles, particularly Water Beetles, live almost totally undisturbed in their native habitats. A short account of some of the Water Beetles of the county of Leicester may, therefore, be of some use, and tend to excite an interest in these little creatures. I am sure this branch of Natural History would well repay the labours of any earnest worker. Very little seems to be known by the people generally about the *Hydradephaga* or Predaceous Water Beetles, in proof of which it may be stated that in all my rambles in search of specimens I never met with any, amongst the mass of those who stopped to look on, who could divine my object. The pursuit of Natural History is little appreciated by the common people. My vasculum has often been mistaken for a candle-box, and I am frequently asked questions like this—"I say, master, what have you brought your candle-box out for this warm day?" My answer has been—"Because we want more light."

I have been induced to look up the *Hydradephaga* of Leicestershire at the instigation of my friend and patron, F. T. Mott, Esq., F.G.S. Furnished with "Stephens' Manual of British Coleoptera," a water-net, killing-bottle, and other apparatus, all complete, I looked anxiously forward to the day when I could try my hand upon this, to me, new branch of Natural History. The hoped-for day came at last, and found me, with laurel bottle and net, and some misgivings mingled with my hopes, ready to take my way, guided partly by instinct, to those hunting grounds where I had many times before, with much pleasure, engaged in pursuits of a kindred nature. It was rather a cold morning in May when I started on my way to Anstey, and, the season not being very forward, my doubts as to my probable success were strengthened rather than dispelled. All animated things seemed to be still wrapped in their winter sleep, and, standing by the cold, glassy waters of the first pond I arrived at, I could not help a half shudder of hopeless feeling creeping upon me as I thought I should certainly fail in my new undertaking. There was, however, no help for it, but to try my best; so down I got to the water's edge, where I could obtain the most favourable sweep with the net. I watched the water drain through the net, anxiously asking myself—Is there anything in it? Yes, sure enough, there was—strange creatures, which, in all my boyish wading, I had never before seen.

Amongst other curious things were some of the beetles I had come to seek—a small species, with four light-coloured spots on the elytra, which I afterwards made out to be the common *Hydroporus palustris.* I was, however, much pleased with the insect at the time. The same day I caught several specimens of *Hyphydrus ovatus,* and one of *Dyticus marginalis,* and thought myself well repaid for my trouble. I learned one lesson from this first trial, namely, that laurel leaves are of no use as a killing agent.* So I obtained some cyanide of potassium, placed it in a bottle, and poured over it some plaster of Paris, to keep it in place and make a level bottom.

My next day out, which was in about a week after the first, was spent in the same district, but I extended my field of operations. Nothing very uncommon was met with this time, excepting *Hygrotus (Hydroporus) pictus;* several specimens of *Acilius sulcatus* also occurred, but this species I afterwards found to be common. I next tried the Charnwood Forest district, but soon discovered that if I wanted water-beetles I must keep in the valley of the Soar. After this, on every fresh excursion, my net brought up some new species. In the Abbey Meadow I first found *Hydroporus depressus;* from Barkby Brook were captured *Hydroporus 12-punctatus, (duodecimpustulatus,)* and *Colymbetes (Agabus) maculatus* and *nebulosus*—the latter being common in all clear water. Early in June I brought from the Anstey ponds *Haliplus obliquus, Laccophilus hyalinus,* and *Colymbetes fuscus;* from Thurmaston Sandhole, *Hydroporus planus* and *H. memnonius.* This last place yielded the rarest species, and, excepting the tributaries of the Soar, was the most prolific. It is a large extent of land from which ballast has been obtained, and is full of bright pools, which, as the summer advanced, became covered with a rich growth of *confervæ.* It was here I obtained the single specimen (of the season) of *Pelobius Hermanni.* I tried many times, but never succeeded in taking any more *Pelobius.*

As the season advanced, I became better acquainted with the particular habitats of the various water-beetles, and could almost tell at sight, by the appearance of the water, what species were likely to occur. I seldom found anything in black muddy ponds except *Colymbetes (Agabus) Sturmi* and *bipustulatus,* and noticed that all the brightly coloured and spotted beetles were found in running or clear water; thus I had *C. (A.) vitreus (didymus)* from Barkby Brook, and *C. (A.) maculatus* from a brook near Syston. I scarcely ever found many beetles in ponds where *Lemna trisulca* grew, but in those covered with *L. minor* I was generally very successful. In streams by which *Œnanthe* grew, bright beetles were plentiful. I do not know in what relation these plants stand to water-beetles; it might be only an accidental circumstance, but I always regarded these characteristics as signs. I never found *Laccophilus hyalinus* with *L. minutus.* The latter, which is the brighter

* Mr. Robson must have been unfortunate in the laurel he used: or, perhaps, he did not keep it dry. Good laurel, properly used, is certainly the best "killing agent" for Coleoptera, and it is to be hoped that Mr. Robson will try again. Cyanide of potassium is bad in many ways, but principally because it renders the beetles stiff and hard to set.—EDS. M.N.

coloured of the two, being found in the clear water of the Soar, amongst the *Ænanthe*, and the former in the Anstey ponds.

One of my best and most successful days was spent in the neighbourhood of Syston. It was there, in the tributaries of the Soar, that I first found *Colymbetes (Ilybius) ater*, *guttiger*, and *fenestratus*, although I afterwards found them plentiful all along the Soar, and also at Blaby, along with *Hygrotus (Hydroporus) confluens* and *Haliplus fulvus* and *flavicollis*. At the latter place I accidentally broke my net, and as I could not subsequently revisit the place, am unable to say what other species might have been caught. There is a deep hollow in the Anstey fields at one end of which is a wide pond overgrown with duckweed, except in the middle, where it is kept clear by the drainage. From this I always obtained good specimens, including, besides those already mentioned, *Hydrobius fuscipes*, *fulvus*, and *(Helochares) lividus*.*

Altogether I obtained some fifty species, but did not nearly exhaust the field, in which, no doubt, there is still good work remaining to be done. My experience taught me the important fact that whilst some species appear to be generally distributed others are only to be found in certain localities. Everywhere, for example, in clear water, I found *Helophorus aquaticus* and *granularis*, but *Hygrotus (Hydroporus) reticulatus* was confined to a pond in Glebe Lane, Belgrave, and *H. lineatus* to a pond at Blaby.

Hunting for the beetles, under the invigorating influences of fresh air and sunshine, was all pleasure; the real work began when I got them home. In the first place Water Beetles are most difficult to mount, and I should be glad of any hint that would enable me to improve upon my plan. I use gummed card, relaxing the insects by putting them either in a damp place or in water.† The cyanide would relax (and spoil) them if left in a long time. There is a strong contractility in the legs of the *Hydradephaga*, and this, combined with the position in which they are articulated to the body, renders them more difficult to mount than other insects. In naming my captures I found the species of *Haliplus* most difficult to make out, but, with the aid of the beautiful microscope belonging to the Leicester Museum, all my difficulties were gradually overcome. The species of this genus are all small, ovate and convex, mostly light testaceous in colour, and have their hinder coxæ produced behind into a large plate, the effect of which is to make the legs appear to be very wide apart. Many species of this and allied genera approach each other very nearly and require close examination and study before they can be separated. The descriptions in Stephens' Manual are, moreover, so short and vague that no student would be able to get on with that alone. A good and cheap Manual of *Coleoptera* remains to be written.‡

* These three beetles do not belong to the family *Hydradephaga*, but to the *Palpicornia* or *Hydrophilidæ*.—EDS., M.N.

† Both these plans are bad. If kept in the chopped-laurel jar the beetles would be perfectly relaxed and ready to set at any time. Cyanide must be avoided. —EDS. M.N.

‡ Cox's "Handbook of Coleoptera," 2 vols., 17s. 6d., would be a great improvement on "Stephens." It is the best published, and is used by all Coleopterists. See "Mid. Nat.," Vol. I., p. 100.—EDS. M.N.

In concluding these notes I would urge that none should be deterred from the pursuit of knowledge, even amongst the beetles of our ponds and streams, by any false notions of distastefulness for the objects to be studied. It is our want of knowledge that makes us dislike such things; the more knowledge we obtain respecting them the more interested we shall become, and, though we may not see beauty in everything, we shall certainly see it in Beetles.*

SYNOPSIS OF LEICESTERSHIRE HYDRADEPHAGA.

HALIPLUS:	
Obliquus, *Fab.*	Anstey Ponds.
Fulvus, *Fab.* (ferrugineus.) ..	Blaby and Thurmaston Sandhole.
Fluviatilis, *Aubé*	Anstey Ponds.
Ruficollis, *De Geer*, (fulvicollis.)	Common in clear ponds.
Lineatocollis, *Marsh.*	Common in clear ponds.
PELOBIUS:	
Hermanni, *Fab.*	Thurmaston Sandhole.
HYPHYDRUS:	
Ovatus, *Linn.*	Anstey Ponds.
HYDROPORUS:	
Reticulatus, *Fab.*..	Glebe Lane, Belgrave.
Inæqualis, *Fab.*	Anstey Ponds.
Confluens, *Fab.*	Blaby.
Pictus, *Fab.*	Anstey Ponds.
Duodecimpustulatus, *Ol.*	Barkby Brook and Thurmaston Sandhole.
Depressus, *Fab.*	Abbey Meadow, Barkby Brook, Syston.
Dorsalis, *Fab.*	Common.
Memnonius, *Nic.*	Thurmaston Sandhole.
Planus, *Fab.*	Thurmaston Sandhole.
Nigrita, *Fab.*	Eventon, (muddy pond.)
Vittula, *Er.*	Blaby.
Palustris, *Linn.*	Common.
Lineatus, *Fab.*	Blaby.
NOTERUS:	
Sparsus, *Marsh.* (semipunctatus.)	Thurmaston Sandhole.
LACCOPHILUS:	
Minutus, *Linn.*	The Soar.
Hyalinus, *De Geer.*	Anstey Ponds.
COLYMBETES:	
Fuscus, *Linn.*..	Anstey Lane Ponds.
ILYBIUS:	
Fenestratus, *Fab.*	Ayleston, Sileby, Syston.
Fuliginosus, *Fab.*	Blaby and the Soar.
Ater, *De Geer.*	Syston.
AGABUS:	
Bipustulatus, *Linn.*	In muddy ponds.
Chalconotus, *Pz.*	Kirby Moat, Blaby.
Sturmi, *Schon.*	In all muddy ponds.
Didymus, *Ol.* (vitreus.)	Running streams, Syston, Barkby.
Nebulosus, *Forst.*	Common everywhere.
Maculatus, *Linn.*	Streams, Syston, Barkby.
DYTICUS:	
Marginalis, *Linn.*	Common in ponds.
ACILIUS:	
Sulcatus, *Linn.*	Common in ponds.

* It is to be hoped that Mr. Robson will continue to observe the Water Beetles of Leicestershire. There certainly must be many more species, even of the *Hydradephaga*, to be obtained and reported.—EDS. M.N.

PARASITES OF MAN.*

BY T. SPENCER COBBOLD, M.D., F.R.S., ETC.

[Continued from page 9.]

The last two, or rather, I should say, three nematode parasites that remain for the Society's consideration are Ascarides properly so called. It has long been the habit of medical practitioners and others to speak of the obnoxious little threadworms as Ascarides, whilst they call the large roundworms Lumbrici. Both terms are erroneous and misleading. The true Ascarides are readily recognised by their three prominent lips, associated with a more or less uniform thickness of the body, and a short tail which is not finely pointed. The Oxyurides on the other hand have a spindle-shaped body, which is finely drawn out behind. Hence their generic name. As to the large roundworms, it was, perhaps, not unnatural that in early times they should have been called Lumbrici—on account of their general external resemblance to earthworms—but it is hardly necessary to remark that, as regards their internal organisation, they differ essentially from the setigerous annelids; whilst, with rare exceptions, the nematodes are unisexual, the oligochætous Terricolæ are hermaphroditic. In the minds of unscientific and non-professional persons the Lumbrici are not only still frequently regarded as genuine earthworms, but, from time to time, sensational paragraphs find their way into the newspapers asserting that live eels have been ejected by the mouth; these so-called "eels" being lumbricoid Entozoa. Thus it is that the undisciplined mind, incapable of correct observation, conjures up and gives expression to notions which, though uttered in times of comparative enlightenment, are just as absurd and untrustworthy as certain statements which I have previously referred to in this relation as occurring in ancient writings, both sacred and secular.

NEMATODA CONTINUED.

40.—*Ascaris lumbricoides*, Linneus.

Synonymy.—*Fusaria*, Zeder; *Lumbricus teres hominis*, Tyson.

Larvæ.—As vermiform embryos, (developed within the egg,) they attain a length of nearly $\frac{1}{100}$ of an inch. As sexually immature worms they have been found by Heller in man, *post mortem*, up to the sizes of $\frac{1}{9}$in. and $\frac{1}{2}$in. respectively. The intervening stages have not been traced.

Intermediate host.—Probably not necessary.

Experiments.—Davaine, myself, and others have frequently reared the embryos in water; and whilst still enclosed within the egg-shell the embryos have been kept alive by Davaine for five or more years. The administration of eggs by Leuckart to swine, dogs, rabbits, and mice gave negative results. Davaine

* Communicated to the Microscopical General Meeting, (Birmingham Natural History and Microscopical Society,) February 18th, 1879. On Dr. Cobbold's behalf Mr. Hughes exhibited specimens of *Ascaris lumbricoides*, and an example of *A. mystax* taken from the human body. A large *Ascaris megalocephala* was shown, in order to compare the human and equine lumbricoids; other roundworms from a chimpanzee, and also from a cat, being likewise exhibited. Mr. Hughes also exhibited, from his cabinet, a slide of ova of *A. lumbricoides*, put up at the General Hospital in 1863.

also employed eggs, containing the embryos, in a similar set of experiments on rats and dogs. He also introduced them into the stomach of a cow, in linen-covered flasks. Some embryos escaped their shells, but nothing further transpired. Leuckart's experiments on insects also failed. Numerous worm-feedings with allied species of Ascaris have given similar general results at the hands of Leuckart, Davaine, Verloren, Unterberger, and myself. Heller says that the first moult of the larva occurs within the egg itself; a second ecdysis taking place before the worm arrives at sexual maturity.

Remarks.—There is every reason to believe that infection commonly occurs by persons carelessly drinking water into which the eggs of the worm have been accidentally or otherwise introduced, and within which medium the embryos have been hatched during warm weather. Pigs being infested by the same worm, the water from streams or ponds in the neighbourhood of pigstyes becomes a dangerous source of infection when employed for domestic purposes. Local endemics are traceable to this source. Careful filtration of water containing larvæ, before use, would probably of itself be an amply sufficient safeguard against infection. The determination of the identity of Dujardin's so-called *Ascaris suilla* of the hog with *A. lumbricoides* of man is due to Schneider. The large lumbricoid worm of the horse *(A. megalocephala)* is an entirely distinct species. In consequence of the tendency of lumbricoid worms to wander, they frequently give rise to grave symptoms and severe suffering to the human bearer; and they occasionally cause death by perforating the walls of the intestine. This fact implies the possession of great muscular strength. In the year 1863 Mr. Hughes read a paper to the Birmingham Natural History Association, in which he described the remarkable contractile powers of *Ascaris lumbricoides*. Mr. Hughes and Mr. C. J. Bracey, (House Surgeon to the General Hospital,) acting together, placed living specimens of the worms in water, raised to a temperature of about 100° Fahrenheit. This had the effect of keeping the parasites alive for several hours, during which time they displayed remarkably vigorous movements, their bodies contracting violently.

Literature.—Standard Works. See also Heller *(loc. cit.*, "Midland Naturalist," Vol. II., p. 8.) In connection with sanitary questions, it may be useful to refer to my memoir "On Sewage and Parasites, especially in relation to the dispersion and vitality of the germs of Entozoa," in the *Medical Times and Gazette* for Feb. 25th, 1871, p. 215, *et seq.*

41.—*Ascaris mystax*, Rudolphi.

Syn.—*Ascaris alata*, Bellingham; *A. cati*, Schrank; *A. teres felis*, Goeze.

Larvæ.—As intra-ovular embryos, the early stages are developed whilst the eggs are still within the body of the parent female worm. After hatching, and a subsequent residence in the outer world, so to say, their passive transference to the ultimate host is attended with rapid growth and a final ecdysis. Leuckart has traced these stages of growth in the cat, in whose stomach specimens of the larvæ were found, measuring only $\frac{1}{62}$ of an inch. The final skin is cast when the larvæ are about $\frac{1}{3}$ of an inch long. From Hering's observations, it would seem probable that a period of three weeks is amply sufficient for the production of sexual maturity after the larvæ have gained access to the body of the ultimate bearer. The bearer may be either man himself, or it may be a cat, dog, lion, or some other feline carnivore.

Inter. Host.—Not necessary.

Exper.—Leuckart and others have made direct feeding-experiments with the ova, but they have always been attended with negative results.

Remarks.—The determination of the identity of this worm with Bellingham's *Ascaris alata* rests with myself. In this matter I had to oppose the great authority of my respected friend and senior, Professor Leuckart, and I had also to overcome the opposition of Küchenmeister, who sought to throw doubt on Bellingham's original discovery, characterising the so-called *Ascaris alata* as merely a young worm, "if indeed," he added, "it were a worm at all." At length, due acknowledgment of the correctness of my views has been made; and no less than seven instances are now on record of the occurrence of this parasite within the human body. Historically, this entozoon possesses a special interest in the fact that it supplied Dr. Henry Nelson with the data on which his remarkable thesis was based. In this thesis an important advance was made in reference to our knowledge of the embryogenetic process undergone by the nematodes.

Lit.—Bellingham, *Dublin Journal*, 1839; Nelson, Phil. Trans., 1851-52; Heller *(l. c.*, s. 361;) Cobbold, *Lancet* for January, 1863, and in "Entozoa," p. 316, *et seq.*

42.—*Ascaris maritima*, Leuckart.*

Syn.—None.

Larvæ.—Unknown.

Exper.—None.

Remarks.—A solitary sexually immature specimen supplied Leuckart with the means of determining the existence of this worm as a distinct species. It measured about 1¾ of an inch in length. The specimen was discovered in April, 1865, by Dr. Pfaff, at Jacobshavn, near Godhavn, West Greenland. It had been ejected from the mouth by a child.

Lit.—Leuckart, Die menschlichen Parasiten, Bd. II., s. 877.

[TO BE CONTINUED.]

HARDINESS IN PLANTS.

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

W. E. (p. 53) asks the interesting, and not very easily answered question, "What is the cause of hardiness in plants?" The subject has been partially investigated by several German botanists, and a good

* When in the introductory remarks prefixed to my former communication I spoke of only "five more human nematodes" as remaining to be noticed, I had forgotten this comparatively unimportant species.—T. S. C.

account of what is known about it may be found in Sachs' "Text Book of Botany," p. 653. It appears that the capacity to resist frost may be due to several causes, either singly or in combination. Among these are:—1. The proportion of water to solid matter in the cellular tissue. 2. The chemical constitution of the solid matter and the cell-sap, which varies slightly in different species. 3. The proportion of foliage to roots, and of stomata to leaf-surface. 4. The more or less dense structure of the epidermal tissue. Plants are killed by frost not so much through the rupture of their tissues in consequence of the expansion of the water into ice, as was formerly supposed, but rather through the structural and chemical changes which take place in consequence of the normal proportion of water being removed from the cell-walls, the cell-sap, and the protoplasm. Death is due quite as often to the *thawing* as to the *freezing*. A rapid thaw will kill many plants which would have survived a slow one, because the water which has been separated from the other constituents of the vegetable substance may be *re-absorbed* if the thawing is sufficiently gradual, but cannot be re-absorbed if it is too sudden.

Take a cup-full of starch-paste. Freeze it into a solid mass, and then thaw it quickly. It will not return to the condition of paste, but will have become a soft sponge, with water in the interstices. So the cellular tissue of the plant, when its normal proportion of water has been once frozen out cannot always re-absorb it, or return to its original condition. The cells shrink, become disorganised, and unable to carry on the functions of life.

It is well known that some chemical solutions will freeze much more easily than others. River water is coated with ice sooner than sea water. In like manner the sap of some plants freezes, no doubt, at a lower temperature than that of others. It is almost impossible to freeze a moss.

The solid cell-walls and protoplasmic bodies contain "water of imbibition" as crystals contain "water of crystallisation." This water is held between the molecules of the solid by the force of cohesion. If the proportion of water is large as in succulent plants and young foliage, the force of cohesion is weak, and the water is easily separated. Hence such plants and foliage are less hardy than those of a denser and dryer nature. Again, some plants "transpire" or exhale watery vapour more rapidly than others. This seems to be a frequent character of plants indigenous to warm climates. To maintain the supply of moisture from the roots the soil must be damp and *warm*. In a climate where the soil becomes cold or frozen such plants would die from thirst.

Plants may become "acclimatised" by a gradual modification of some of their original functions, so as to adapt themselves to the average temperature of a new climate. The Portugal cabbage, *(Couve Tronchuda,)* which some years ago was a comparatively tender variety, is now much hardier.

A LEPIDOPTERIST'S NOTES ON THE SEASON OF 1878.

BY JOSEPH ANDERSON, JUN.

That the season of 1878 was but an indifferent one for the Lepidopterist seems to have been the general report; nevertheless, as is always the case even in the worst of years, some good species turned up in greater or less abundance. In the first place, the most striking circumstance was the almost total disappearance of *Colias Edusa*, whilst in 1877 it literally swarmed, appearing too in places where it had never before been observed. In one field, near Chichester, I could have taken double, nay, treble the number of clouded yellows than of the common whites—Brassicæ, Rapæ, or Napi; and, what is more, my brother and I, in this same field, captured the surprising number of forty of the beautiful variety to which Haworth gave the name of Helice. The specimens exhibit a great variety of tint, some being greenish white, others by daylight a rich primrose yellow; in the size of the marginal spots also there is much diversity, in some they are reduced to the merest specks. The central spot in the hind wings varies from bright orange to cream colour, in nearly every case the whitest insects possessing the most deeply coloured spots. I saw but one Edusa throughout last year, and that was on the 25th October. Truly, the species of Colias are most erratic in their movements. This strange appearing and disappearing, however, is not confined to Colias; we may find the same taking place with many species—such as Cardui, Stellatarum, Convolvuli, &c. What is the reason? Possibly the same that causes the seeds of divers plants to remain for years dormant in the soil, and then suddenly to spring forth into rank luxuriance—the fortuitous combination, namely, of certain external circumstances—as moisture and heat.

The past year will certainly be noted for some very successful working in the fen districts of Cambridgeshire, such rarities as *Meliana flammea*, *Nonagria brevilinea*, and *Hydrilla palustris*, having been obtained in some numbers. Several specimens of the beautiful *Dianthœcia albimacula* were captured at Folkestone, and *Pachnobia hyperborea (carnica*, Heer, Newman,) in the locality where it occurs in Perthshire. These are only a few instances of the "plums" which fell, not into the mouths, but into the nets of the more fortunate collectors. I cannot myself boast of such captures, my collecting having been confined to the immediate neighbourhood of this place—Chichester; still, I am induced to think that a record of my own experience may not be without interest to others.

I may mention then first a beautiful buff variety of the small copper butterfly, *C. Phlœas*. The larvæ of *Vanessa Polychloros* were excessively abundant on elms in our garden. On one little bough which I broke off I counted as many as fifty. Some of these produced imagos of a remarkably dark and handsome tint, with the first spot on the costa not suffused as is usually the case, but divided into two circular spots, the insect, save that it wants the yellow legs, bearing a great resemblance to the continental variety *Xanthomelas*. Perhaps some may not have noticed the liability to variation in the spots on the hind wings of *Cynthia cardui*. One which I took on the wing last July has a bright white pupil in one of the spots on the left lower wing, and in another the spots amalgamate in such a manner as almost to form a band. This butterfly and *Vanessa Atalanta* were as common as any during the past season. In one corner—and in that limited situation only—of a field where they were discovered many years since by my friend Mr. Jeffery, *Lycæna Alsus* was tolerably plentiful when we visited it last Whit Monday. Here were to be seen also, in almost as confined an area, any number of the lovely *Ophrys apifera* and *Orchis conopsea* in full flower.

During June and the first week of July I bred eight fine *Acherontia Atropos* from larvæ found in the preceding autumn, and in the first week of October I obtained three equally good imagos from larvæ found in July. All of these were very noisy insects—one especially, which squeaked in the three stages of its existence. With one exception they emerged between five and seven o'clock in the evening.

Geometers were by no means so plentiful this season as last. I can record no good species, the best being *Anticlea rubidata*, *Phibalapteryx tersata*, *Asthena luteata*, *Timandra amataria*, and *Acidalia emarginata*. Mr. Jeffery took several *Selidosema plumaria*, and a splendid melanic variety of *Boarmia abietaria*.

My sugaring operations were confined to the trees surrounding the house, my visitors to the sugary feast prepared for them including *Grammesia trilinea* and *Miana strigilis*, (very abundant,) the latter in every variety. Of the Mianas, indeed, I captured all except *Photedes captiuncula*. *Bryophila glandifera* came sparingly, but one was a pretty variety, having the upper wings powdered thickly with shining metallic scales of a bright green. *Dipterygia pinastri*, *Orthosia upsilon*, *Caradrina cubicularis*, *Caradrina blanda*, *Hadena oleracea*, *Amphipyra pyramidea*, *Anchocelis lunosa*, *Miselia oxyacanthæ*, *Acronycta rumicis*, and *Mania Maura*, were tolerably common; *Cosmia diffinis*, *Cosmia affinis*, *Agrotis puta*, *Noctua plecta*, and *Xanthia cerago*, less so. Of the gaily coloured *Catocala nupta* several put in an appearance for many nights together, and of *Agrotis saucia* I secured a good series both of the type and varieties. My most successful evening, however, was that of August 23rd, when I had the good fortune to "box" a fine *Leucania albipuncta*. The instant the light was thrown on the tree it fell to the ground, and I feared was lost; but on my second round, to my great delight, there it was again, and the next moment safely deposited in my poison-bottle. The "ignobile vulgus" *Anchocelis pistacina*, *Phlogophora meticulosa*, *Tryphæna orbona*, *Tryphæna pronuba*, *Leucania pallens*, with many others, mustered in full force even on the coldest nights.

Perhaps after this severe weather we may not be wrong in anticipating a good season for Lepidoptera next year, as it seems to be the general opinion that cold, hard winters, are more favourable than warm ones to the subsequent development of vegetable and insect life.

Reviews.

The Geology of East Somerset and the Bristol Coal Fields. By HORACE B. WOODWARD, F.G.S. Nine plates, twenty-three woodcuts, 271 pp. Price 18s.

THIS Geological Survey memoir contains the results of the re-survey of a country which has long been classic ground to geologists. It was first mapped about thirty years ago by De la Beche, Ramsay, Phillips, and others. The revision of the Bristol area (sheet 35) was done by Mr. Bristow in 1864, whilst that of the southern part (sheet 19) is chiefly the work of Messrs. H. B. Woodward, Blake, and Ussher.

The area described includes a wonderful variety of formations, ranging from the Silurian Rocks of the Tortworth district, which may be regarded as a continuation of the Malvern and May Hill ridge, up to the Cretaceous Rocks, which come on in the south near Chard, and in the south-east at Mere, &c.

The physical features of the country are then described. The Severn and Bristol Channel form the western boundary; while on the east we have the Oolitic escarpment, rising to a height of about 800 feet. The principal rivers are the Little Avon, Bristol Avon, Yeo, Axe, and Parret.

The Old Red Sandstone rests upon the Silurian Rocks near Berkeley. It also forms the central axis of the Mendip Hills, rising at Blackdown to 1,067 feet above the sea-level.

The Carboniferous system is much more extensively developed. The Mountain Limestone has a thickness of 3,000 feet. From the north of Bristol, at Chipping Sodbury, it curves round to the west by Thornbury and Clifton, where the remarkable gorge cut by the Avon is well known. Thence it passes southwards by Backwell and Brockley Castle; turning rather abruptly to the east it forms the greater part of the Mendip Hills, which may be considered to extend from Uphill on the Bristol Channel by Axbridge to near Frome. The scenery of this southern portion is bare and rugged, with remarkable combes and ravines, as at Cheddar, Burrington, &c. Fossils are numerous, especially brachiopods, crinoids, and corals, the latter resembling those which form the fringing or shore reefs of the present day.

The Millstone Grit or Farewell Rock is on an average 1,000 feet in thickness, but in the Mendip district becomes reduced to half this amount. The Coal-measures proper comprise one main tract—the Bristol and Radstock coal-field—and two smaller basins which lie westward of it, viz., the Nailsea basin and that of Clapton-in-Gordano, which has lately been found to extend northwards under the Severn. Mr. Woodward also shows the great probability that a covered-up coal-basin exists south of the Mendips, about Wedmore, Glastonbury, &c., whilst eastwards such a series of basins probably extends by Oxford and the neighbourhood of London to connect with the coal-fields of Belgium and the north of France. The Bristol Coal-measures exhibit three well-marked divisions—an *upper series*, about 2,000 feet thick, containing sixteen coal-seams, and a *lower series*, 2,500 feet thick, with twenty-six coal-seams. These are separated by a thick mass of sandstone, 2,000 feet thick, called the *Pennant Grit*, which contains only two or three thin seams. Altogether there are twenty seams which exceed two feet in thickness, producing an aggregate thickness of from seventy to one hundred feet of workable coal. The production is about one million tons per annum, at which rate of consumption the coal within a depth of 4,000 feet would last for 4,219 years.

The Permian Rocks are absent, and so are the Bunter Beds. The Keuper marls consequently rest directly upon the Coal-measures. They are about 300 feet thick, and the well-known bed, known as the dolomitic conglomerate, forms the base. The Penarth or Rhætic Beds are well exposed; they obtain a maximum (for England) thickness of 150 feet near Castle Carey. A valuable list of British Rhætic Fossils is also given. It includes three species of mammals, seven reptiles, thirty-one fishes, seven insects, four crustaceans, two annelids, seventy-five mollusks, four echinoderms, two corals, and three plants.

The Lias is very fully described. It is not in this area of great thickness, (not exceeding 300 feet,) but palæontologically is very interesting. The Midford Sands, classed by Professor Phillips with the Oolites, and by Dr. Wright with the Lias, are considered by Mr. Woodward to be true passage beds, linking the two great formations together.

The Oolitic Beds of East Somerset have long been famous for the excellent building-stone they furnish. The Inferior Oolite is quarried at Doulting, near Yeovil, and at Ham Hill. The chief quarries in the Great or Bath Oolite are at Corsham, Combe, Bath Hampton, Farley Downs, and Box. We mention these places, as it is usually possible to ascertain from the workmen on any new building where the stone comes from, but not so easy to obtain a reference to its exact geological position.

The alluvial deposits are also described at length. Bath bricks we note derive their name from the discoverer of their manufacture, a Mr. Bath, of Bridgwater. They are made from the slime of the river Parret. A good account is given of the minerals of the district, of its caverns, water supply, fissures, faults, cliffs, combes, and coast. Mr. Rutley describes the igneous rocks, which are illustrated by five beautiful plates (three in colours.) Lastly, there is an appendix prepared by Messrs. Woodward and Whitaker, including no fewer than 750 titles of papers which have been written on the Geology of Gloucestershire and Somersetshire.

Altogether this work does Mr. Woodward great credit. By the judicious use of large and small type he has been able to classify his information in a way which shows great mastery of detail, combined with method and power of generalisation, qualities which are indispensable to the field geologist, and which are not less necessary to the writer who undertakes to make known to the public the results of original research of a nature so complicated as those which we have here clearly set before us. The price of the work compares favourably with that of several Survey memoirs lately published, a fact which we suspect is also owing to the author's care in the preparation of his manuscript, so as to avoid those subsequent alterations which add so greatly to the cost of printing. It was said of Sir Roderick Murchison that he "wrote in type," and it may be that some of the officers of the Survey imitate their late illustrious leader in this respect.

W. J. H.

Botanical Locality Record Club. Report of the Recorder for 1877, with Quinquennial Appendix, 1873-7. London: West, Newman, and Co., 1878.

The part now issued completes the first quinquennial volume of the Reports of this Club, and appended to it is a summary of all the new county-records published by the members of this and the Botanical Exchange Clubs, up to the end of 1877. The five reports and appendix will form a volume of 308 pages, containing a mass of information upon the horizontal and (occasionally) the altitudinal range of British plants, additional to that comprised in Watson's "Topographical Botany." The greater part of these additions has its origin in the breaking up, since the time when the details of that work were collected, of many of the old so-called variable species into numerous "segregate" forms, the distribution of each of which required investigating afresh. But, besides these, there are, in fact, new county-records for such plants as *Campanula rotundifolia* and *Mercurialis perennis*, in cases where (*e.g.*, in South Somerset and Leicestershire) one would have thought there must have been abundant evidence of their occurrence. This serves to show that there is still work to do before the distribution of common and well-marked species will be fully known, to say nothing of the newer segregates, in regard to which little has yet been done.

By some the utility of such investigations is doubted, and it may be, perhaps, admitted that there is very little probability of any practical result from them, but still enquiries of this kind throw light upon questions of great geologic and biologic interest, and on that account approve themselves to those to whom the pursuit of knowledge, merely as knowledge, is fascinating. The theories of Edward Forbes upon the succession of Floras in Great Britain, and the classification of the British plants into *types* by Hewett C. Watson, are very little known to the average botanical student; but that is, I apprehend, owing to the absence of any ready access to them. So long as this knowledge is shut up in books which can be obtained only with difficulty, it is scarcely possible to expect any wide-spread acquaintance with it. Mr. Watson at one time complained that "there are hardly fifty botanists in England who sufficiently comprehend the philosophy of plant-distribution to take any living interest" in the work which the Record Club pursues. This estimate is, of course, now far too small, but the number would be much increased if there were more easy means of learning what is already known or imagined concerning the "philosophy of plant-distribution."

There is a reflection which cannot but be forced upon the mind of one who reads these reports, even if he has not already come to the same conclusion from his own experience, in regard to the minute differences of many segregate species. The botanical world is divided into two great camps, each other's mortal foes, the "Lumpers" and the "Splitters." The latter discovered the inconsistency of many of the views held by the former about species, and there is no doubt their discovery was a genuine one. But in their anxiety to avoid one extreme they have, not unnaturally, fallen into another. To prove this, one has only to observe the divergent conclusions often arrived at by two equally competent "authorities" anent a common bramble-bush, or any of the other puzzling genera. The cause lies in the supposed necessity of assigning a name to every specimen which may be collected, and when, as happens now and then, some unusually perverse plant will not fit in with any described species, and the discoverer has not sufficient weight to force a new name upon it, it must forsooth be assigned to that to which it comes nearest. And of course different botanists may, and do, hold different opinions on that point. Many examples of this may be found in the pages of these reports, but the members are slow to adopt, or at least to express, the natural conclusion, namely, that these segregates are often only a selected few out of a continuous chain of forms.

No botanist now believes in the old theory of fixed species; all admit that Variation *has* acted to produce the many diverse types of plants. But, if so, it is still acting; we know that when two species are separated by well-marked differences, it is only that the intermediate forms have disappeared, but there are cases in which the intermediate forms have *not* disappeared, in which species are forming under our very eyes. When we gather a Ranunculus, or an Hieracium, or a Rubus, which does not agree with any of the forms selected to be honoured with the title of species or sub-species, instead of doing violence to nature by (more or less arbitrarily) fixing on a name for it, we should rather admit the fact as it stands before us. As an example of what I mean, I will take a simple case. The old *Glyceria fluitans* is now divided into two species, *G. fluitans* and *G. plicata*, which differ considerably in some respects. But there are also found certain intermediate forms, to some of which the name of *pedicellata* is given, and these are ranked as a variety of *fluitans*. A very slight search will, however, enable one to find some form which agrees entirely with none of these three; yet according to present practice nine out of ten botanists would inflict one or other of the names upon it.

Somewhere may be read:—"A few naturalists deny the existence of those intermediate forms which the theory of Variation requires; but practical field-workers know that they exist, and are a puzzle and a torment to the collector." This is a false view; they are no torment when their true meaning is recognised, and we give up the vain attempt to bind infinite Nature in our narrow bonds of "described species." In the minute investigation of these varying forms lies the key to much that now puzzles us in the theory of Variation.

The Botanical Locality Record Club has during the last two years been making efforts to extend its work to the lower

Cryptogams, for which purpose it has already published a "Catalogue of British Mosses," (a second edition of which will include the Hepaticæ,) and, in the last report, a preliminary list of stations for the Characeæ. What is required is more members who will take up this branch of enquiry. It is probable that, for the purpose of the investigations of which these county-records are intended to form a basis, the lower Cryptogams will furnish more reliable data than the Phanerogams as being less directly influenced by human agencies.

The "Recorder" also proposes a scheme for future work in the publication of a series of maps, indicating by colouring the counties in which each of a selected number of standard species occurs as a native, thus "fixing types of distribution on the brain through the eye." It is intended, if possible, to publish them with the yearly reports, and it is to be hoped that this plan will be carried out. "Concurrently with such illustration of distribution would come a partitioning of our native British Flora into squads—Geographical Allies, presenting striking points of agreement in comital range." For instance, the "Recorder" says that *Cerastium arvense*, *Centaurea Scabiosa*, and *Echium vulgare* have, in West Yorkshire, "an almost identical horizontal distribution," but he doubts, and with reason, whether the same will hold good of all other counties. The subject is one which will furnish abundant scope for further enquiry.

Finally, while congratulating the "Recorder" upon the improvement in the later reports, which shows that the errors of the earlier ones have been carefully taken to heart, it remains only to recommend the Club earnestly to those botanists, who, having time for the work, desire to have some object in view to supply a constant stimulus to their labours, by showing them "what there is to do, and how they can help to do it." The former objections against the members, that they were mere "conscienceless grubbers-up of rarities," or "a kind of Co-operative Society for the repetition of already published plant-stations," have been disproved, if they ever required disproving, by the really useful work which the Society has done, and the way in which it has done it.

W. B. Grove, B.A.

On the Real Character of the Early Records of Genesis. By the Rev. Rayner Winterbotham, M.A. London: W. B. Whittingham and Co., 1878.

This excellent little pamphlet is written evidently with a sincere desire to smooth the difficulties which beset the subject; better still, the writer has shaken himself free from the fetters which usually clog the well-meant but futile efforts of his fellow-workers in the same field, and boldly accepts the established truths of Science. He recognises the importance of these early records as lying at the root of Old and New Testament theology. Also, that their "extreme difficulty" "exposes them to assaults, made in the name of Science, which are, to a large extent, unanswered and unanswerable."

Christians, happily, no longer oppose Science. It is freely admitted that God reveals himself in the Book of Nature as truly as in the Book of Revelation, and any apparent conflict between the two records is owing to misinterpretation. Many teachers of the Faith, nevertheless, unaware how well-founded are the conclusions of Science, shelter themselves under the conviction that scientific opinion may change in the direction they desire; but their ground is untenable. "Some of these well-established conclusions cut right across the statements" of the Mosaic Record "as generally understood, and we ought to face the fact." Two instances are given as types—the Creation of the World in six days and the universality of the Deluge of Noah.

Geology has plainly proved that the present order of things was brought about only after the lapse of vast ages, and all the plausible attempts to torture the Mosaic narrative into meaning something different from its literal sense, which might make it and the geological record agree, have had, one after another, to be abandoned.

The universality of the Deluge, and the utter destruction of animal life outside the Ark, are plainly asserted, but scientific evidence disproves the statements. The fact that the quadrupeds of "Australia are marsupials, and are the only marsupials in existence saving one family in North America," is convincing. "Will any one maintain that the ancestors of the marsupials of Australia really came out of the Ark?" "Journeyed together across land and sea from Ararat, nowhere settling, nowhere breeding, until they (and they alone) reached their future home?" Probably no one acquainted with Natural History believes that the Noachian Deluge was more than local, confined, it may be, to the tract inhabited by a particular race of Man. The evidence that man antedates the antiquity assignable to Adam and Eve "as historical personages" is fairly conclusive; and that difference of language existed long prior to the Tower of Babel Science has proved.

The solution of the difficulty suggested by the writer is that, as in all other histories, the earliest sacred records are told in mythical form. This, in no respect, necessitates the rejection of their *inspiration.* "Is it not at least possible," he asks, "however strange at first sight, that the Holy Spirit should have employed *myths* in the first instance, even as He employed poems, parables, visions, in other places?" Grant that the early Biblical Record is mythical, and the conflict with Science ceases. "Science and History are left in possession of the territory which belongs to them;" "Faith and Religion are left in undisturbed sovereignty within the domain of moral and spiritual truth." "It would be folly to say there is no element of historic truth in the first ten chapters of Genesis. Unquestionably there is, only that element is not distinctly assignable." As to where myth ends and history commences, our author considers there is abundant evidence.

We regret our space forbids our following the argument further, but we trust the foregoing will awaken the interest of our scientific friends, and induce them to read the pamphlet carefully themselves.

S. S. R.

Microscopy.

Micro-fungi and other Microscopical Preparations.—The Editors of the "Midland Naturalist" have placed in my hands for examination a series of beautiful microscopical objects, prepared by the Rev. J. E. Vize, of Forden Vicarage, Welshpool, and I am able to say that they are very neatly and artistically mounted, and present quite a pleasing appearance in one's cabinet. The medium in which the objects are preserved is one well adapted for displaying their minuter structures, and is evidently well suited for these organisms, as it does not deteriorate with long keeping. Similar preparations by Mr. Vize which I have had in my possession for a long period look as well now as they did when first prepared. But Mr. Vize's preparations are not merely beautiful objects for the microscope, they not only gratify the eye by the great variety of form to be observed in them, but also possess the higher merit of being truly educational. All that I have examined are type specimens, and will serve the tyro in science as reliable guides to specific identification.

The Micro-fungi Mr. Vize has made a specialty, and speaks with authority on this branch of botanical science. Hence such preparations emanating from him will have a permanent value, and be of constant service as reference slides. In mosses, lichens, algæ, and hepaticæ I believe I am right in stating Mr. Vize does not depend upon his own judgment, although I know that he has done good work in some of these, but he has his specimens from our best British and Continental authorities. Hence in these cases also the slides will be reliable as type specimens.

Apart from their value, too, in this respect, many of these preparations will be valuable and instructive to the biological student, and will serve well to illustrate some of the phases of cell development. The reader of Sachs' "Text Book of Botany" will better appreciate some portions of the text of that work after an examination of some of these preparations than he could do from the study of woodcut illustrations, however carefully drawn. For instance, one of the objects at which I have just been looking, viz., a section of *Peziza badia*, shows at a glance the whole process of free cell formation. The sections are well cut, being sufficiently thin to show well with the $\frac{1}{6}$ or $\frac{1}{8}$ objectives every detail. The moss preparations are also very good; they are thoroughly clean, and have evidently been treated with the reagents necessary for bringing out the details of cell structure, a matter of great importance in this study; and have been made so delicately transparent that the spores may be seen, perfectly, through the walls of the capsule. As objects for black background illumination, with low powers, these moss slides are truly beautiful. As I have had much experience in similar preparations, I can say with truth that to prepare these objects in so able a manner requires both skill and patience.

The following is an enumeration of the slides submitted to my notice.

Mosses.

Fissidens bryoides, showing perfect plant; leaves dissected from stem to show barren flower, capsules, peristome, and operculum.

Tortula mucronata, leaves dissected from stem and stem sections.

Jungermanniæ.

Frullania Tamarisci, whole plant; beautiful object for black back-ground illumination.

Lichens.

Phlyctis agelæa, section of hymenium, showing asci and spores.

Ricasolia læte-virens, a local species; section of hymenium, showing asci and spores.

Solorina saccata, similar section, showing asci, spores, and paraphyses in various stages of development.

Schizoxylon corticola, a very lovely object; rare; showing the granulose apothecia in various stages.

MICROFUNGI.

Arcyria punicea, section of capillitium and spores.
Endogone microscopica, showing vesicles; a very singular object.
Xylaria polymorpha, uniseriate spores and asci.
Patellaria rhabarbarina, asci and spores; very beautiful.
Xenodochus carbonarius, showing articulated spores.
Myxotrichum chartarum, showing branched flocci and spores.
Triphragmium ulmariæ, showing trilocular spores.
Phragmidium bulbosum, showing echinulate spores.
Peziza badia, ,, *granulata*, *Ascobolus furfuraceus*, *Sphæria acuta*. ,, *acuminata*, — all sections of hymenium; showing asci, spores, and paraphyses in various stages of development.
Stegonosporium cellulosum, unilocular spores.
Peronospora infestans, (potato disease,) resting spores.
Puccinia conii, ,, *epilobii*, — spores in various stages of development.

JAMES E. BAGNALL.

METEOROLOGY OF THE MIDLANDS.

THE WEATHER OF JANUARY, 1879.

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

New Year's Day was fairly warm and fine, but in the evening the wind shifted to N.E., and a severe frost set in, which lasted to the 13th. On this day the wind shifted to S.W., (blowing hard,) and a rapid thaw took place. This, however, was not to last. On the 16th the wind returned to its old quarter; the thermometer again fell below freezing point, and frost continued to the end of the month. The continuance of easterly winds was very remarkable, with, in consequence, a high barometer. Snow fell heavily on the 3rd and 18th, but there were frequent falls of minute ice spicules and some snow as fine as sand. The rain-fall was decidedly below the average, not exceeding one-half the usual amount in many localities. It fell almost entirely as snow and sleet. The sun was hardly ever visible, in fact was never seen during the last eight days of the month at most stations. At Stokesay a solar halo was seen on the 1st, and a lunar halo on the 2nd. A mock sun, bright with prismatic colours, was seen at More Rectory at one P.M. on the 16th. Several deaths of human beings, from exposure to the cold, falling into snow-drifts, &c., have been recorded in the newspapers. So severe and protracted a wave of cold as that which has lately passed over us is considered to swell the death-rate greatly. Mr. Wetheral, however, writes, "It is a fact, so far as Worcester is concerned, that during the coldest weather fewer deaths took place than have been known at the same period of the year for a long time, in some parishes none whatever." Vegetation was extremely backward. In this respect January, 1879, was a marked contrast to the same month in 1878, in the first week of which the Rev. J. Caswell (see "Midland Naturalist," Vol. I., p. 77) found eighty species of wild-flowers in blossom near Birmingham. Mr. Caswell says of the present year: "The only species of plants I found in flower in the first week of January, 1879, were two, the common chick-weed and a few stunted specimens of the daisy." Small birds were either conspicuous by their absence, or came daily to be fed. From Shifnal the Rev. J. Brooke writes:—"The starlings and throstles have all left us; blackbirds came to be fed and remained; rooks dying unless fed."

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.									
Cainscross, Stroud	W. B. Baker, Esq.	3·00	1·45	2	4	50·0	15		
Cheltenham	R. Tyrer, Esq.	2·51	·94	1	13	50·1	1	12·8	12
Stroud	T. J. Coley, Esq.	3·50	1·02	2	8	55·0	1	12·0	12
SHROPSHIRE.									
Haughton Hall, Shitnal	Rev. J. Brooke	1·60	·33	14	8	48·0	1	16·0	12
Woolstaston	Rev. E. D. Carr	1·54	·41	17	2	46·0	13	14·0	11
Leaton Vicarage, Shrewsbury	Rev. E. V. Pigott	1·47	·51	17	10	49·0	1 & 13	9·4	12
More Rectory, Bishop's Castle	Rev. A. Male	1·86	·48	2	13	52·0	14	10·0	12
Larden Hall	Miss F. R. Boughton	1·75	·35	17	10				
Bishop's Castle	E. Griffiths, Esq.	1·60	·30	17	12	47·0	13	15·0	11 & 12
Cardington	Rev. Wm. Elliott	1·88	·45	14	19				
Adderley Rectory	Rev. A. Corbet	1·77	·48	18	8				
Stokesay	Rev. J. D. La Touche	1·34	·45	17	7	49·9	1	8·2	6
HEREFORDSHIRE.									
Whitfield	W. Wheatley, Esq.	2·67	·47	14	14			6·0	11
Stoke Bliss	Rev. G. E Alexander	2·37	·53	17	13	46·0	14	17·0	11
WORCESTERSHIRE.									
Orleton, Tenbury	T. H. Davis, Esq	2·31	·54	17	10	49·5	13	10·0	12
West Malvern	A. H. Hartland, Esq.	2·83	·62	17	14	47·5	13	16·5	9 & 10
Pedmore	E. B. Marten, Esq.	2·16	·43	2	11	45·0	14 & 15	13·0	11
Longlands, Stourbridge	J. Jeffries Esq.	1·85	·41	18	9	46·0	14	12·0	11
Stourbridge	Mr. J. Jeffries	1·85	·41	18	9	46·0	14	12·0	11
St. John's, Worcester	G. B. Wetheral, Esq.	2·06	·48	17	9	42·0		25·0	6
Dennis, Stourbridge	Mr. C. Webb	1·98	·52	18	8	44·0	14	7·5	12
STAFFORDSHIRE.									
Thorganby Villa, Wolverhmtn	G. J. C. Broom, Esq.	1·82	·50	14	9				
Amblecote	Mr. J. Robins	1·80	·39	14	9				
Dudley	Mr. J. Fisher	1·55	·40	14	8	46·0	13	18·0	11 & 22
Sedgley	Mr. C. Beale	1·36	·40	17	8	44·0	14	19·0	11
Kinver	Rev. W. H. Bolton	1·97	·43	17	8	50·0	1	12·0	11
Walsall	Mr. N. E. Best	1·71	·38	18	7	42·0	14	21·0	22
Grammar School, Burton	C. U. Tripp, Esq.	1·74	s).41	3	10	53·0	1	15·0	6
Weston-under-Lyziard R'tory	Hon. and Rev. J. Bridgeman	1·59		17	8	45·0	14	13·0	11
Wrottesley	E. Simpson, Esq.	1·90	·50	14	8	51·5	1	14·8	11
Tamworth	W. Arnold, Esq.	2·00	s)·93	18	6				
Heath House, Cheadle	J. G. Philips, Esq.	2·24	·59	14	6	45·0	13	17·0	11
Alstonfield Vicarage	Rev. W. H. Purchas	2·00	·64	12	4	39·5	15	3·1	9
WARWICKSHIRE.									
Coundon, Coventry	Lieut.-Col. R. Caldicott	2·64	s)·69	15	11	43·0	14	19·0	11
Coventry	J. Gulson, Esq.	2·53	·68	18	10	45·0	14	18·0	12
Bickenhill Vicarage	J. Ward, Esq.	2·14	s)·54	18	9	42·0	2	20·0	
St. Mary's College, Oscott	Rev. S. J Whitty	2·04	·45	18	10	49·1	1	17·5	23
Henley-in-Arden	T. H. G. Newton, Esq.	2·61	·69	17	10	46·0	14	15·0	6 & 12
Rugby School	Rev T. N. Hutchinson	2·15	s).50	18	9	47·0	13	15·5	12
DERBYSHIRE.									
Buxton	E. J. Sykes, Esq.	2·38	·79	14	7	46·4	2	10·0	11
Stoney Middleton	Rev. U. Smith	1·41	·54	14	5	46·0	14	9·0	4, 5, 16
Brampton St. Thomas	Rev. J. M. Mello	1·28	·53	14	6	44·5	13	9·0	20
Fernslope, Belper	J. G Jackson, Esq.	1·94	·55	14	8	44·0	14	17·0	20
Linacre Reservoir	C. E. Jones, Esq.	1·46	·48	18	5				
Willesley Gardens	J. Tissington, Esq.	2·26							
Spondon	J. T. Barber, Esq.	1·46	·47	17	7	44·5	1	15·2	
Duffield	Wm. Bland, Esq.	1·82			9				
NOTTINGHAMSHIRE.									
Tuxford	J. N. Dufty, Esq.	1·75				41·0	14	18·0	10
Hodsock Priory, Worksop	H. Mellish, Esq.	1·17	·36	14	14	47·8	13	6·3	4
Park Hill, Nottingham	H. F Johnson, Esq.	1·51	·44	14	7	44·3	14	20·0	5
LEICESTERSHIRE.									
Loughborough	W. Berridge, Esq.	1·56	·44	18	7			13·0	7
Ashby Magna	Rev. E. Willes	1·54	s)·24	18	10	40·0	1	15·0	22
Market Harborough	S. W. Cox, Esq.	1·82	s)·59	18	9	43·0	14	12·0	6
Kibworth	T Macauley, Esq.	1·82	·50	18	10			20·0	
Town Museum, Leicester	W. J. Harrison, Esq.	1·33	·29	15	13	50·6	1	17·0	11
Belmont Villas, Leicester	H. Billson, Esq.	1·26	·24	18	9	45·8	14	17·0	11
Syston	J. Hames, jun., Esq.	1·01	·45	3	5	48·0	1	12·0	6
Waltham-le-Wold	E. Ball, Esq.	1·19	·36	14	8	44·0	14	18·0	23
Little Dalby Hall	G. Jones, Esq.	1·09	·36	14	6	45·0	14	13·0	10 & 23
Coston Rectory, Melton	Rev. A. M. Rendell	1·18	·35	14	9	44·5	14	6·5	6
Belvoir Castle	W. Ingram, Esq.	·96	·37	15	s) 9	46·0	15	15·0	6
NORTHAMPTONSHIRE.									
Towcester Brewery	J. Webb, Esq.	2·27	s)·65	1	10				
Castle Ashby	R. G. Scriven, Esq.	2·15	·54	1	8	46·0	14	16·0	11
Kettering	J. Wallis, Esq.	1·92	s)·30	18	10	52·0	1	18·0	11 & 12
Althorpe	G. S. Groom, Esq.	1·87	·47	2	9	45·0	14	16·0	5
RUTLAND.									
West Deyne, Uppingham	Rev. G. H. Mullins	1·49	·40	14	9	44·8	14	17·7	11
Northfields, Stamford	W. Hayes, Esq.	1·31	·33	14	10	54·0	1	16·0	12
Radcliffe Observatory, Oxford	Mr. H. E. Bellamy	3·00	·98	1	9	46·8	14	16·6	12
Spital Cemetery, Carlisle	T. Bell, Esq.	1·18	·92	12	4	47·1	13	11·8	22
Ventnor Hospital	H. Sagar, Esq.	4·31	1·45	1	16	49·2	3	22·2	12
Altarnun Vicarage	Rev. G. Tripp	6·73	2·10	3	14	52·0	1	12·0	12

Correspondence.

Rectangular Prism.—Will some one kindly inform me where I can obtain the prism mentioned at p. 18?—W. H. C., Folkestone.

[Of Mr. James Swift, 43, University Street, London, W.; and probably any of the London opticians.—Eds. M. N.]

Snow Crystals.—The easiest way to examine these is to take the microscope into the open air. If snow is falling, place it under some screen, or get a friend to hold an umbrella over it. In a few minutes the instrument will be of same temperature as the air, and snow-flakes may then be caught on a glass-slide, held by a clip, (so that the warmth of the hand shall be kept at a distance,) and examined one after another.—H.

Snow Crystals under the Microscope.—An apparatus suitable for observations of this kind is described and figured in Sachs' "Text Book of Botany," p. 658. Perhaps a simple method would be to place a lump of ice in a saucer, close under the stage, and let the snow crystal fall upon a glass slip, whose temperature had been reduced to 32°.—F. T. Mott, Leicester.

Mounting Polyzoa and Rotifers.—Some of your correspondents (p. 52) enquire how Freshwater Polyzoa and Rotifers can be mounted. I have mounted them very successfully by the following process:—Place the Polyzoa in a deep cell with some of the pond water; let them remain undisturbed till they have expanded their tentacles, then suddenly let fall a drop of alcohol into the cell. This kills them instantly. The cell is then filled up with distilled water or glycerine, and sealed in the usual way. Rotifers may be treated in the same manner, but the cell may be shallow.—Thos. Lisle, Wolverhampton.

Early Signs of Spring.—A specimen of the Small Tortoiseshell Butterfly was captured in the garden of Mr. Lee, Sparkenhoe Street, in this town, on the 12th of February. On the same day the first Snowdrop opened its blossom in my own garden, Crocuses being an inch or two above the ground, Lilacs, Flowering Currants, and Deutzias showing green tips to their leaf-buds; and the Nuts (Fill-basket) putting out the red styles of their female blossoms. Laurustinus, Sweet Bay, and Magnolia have suffered slightly from the long frost, but less damage appears to have been done than I expected.—F. T. Mott, Leicester.

Circulation in Embryo of Trout.—On Saturday, February 15th, I received from Mr. T. Bolton, 17, Ann Street, Birmingham, a tube containing the Embryo of the Trout in the "Alevin stage," accompanied by an admirable descriptive diagram, drawn by Mr. H. E. Forrest. This is one of the most beautiful and instructive objects for the microscope I have ever seen, and in my opinion is a far better subject for showing the circulation of the blood than either the web of a frog's foot or the tail of a tadpole, inasmuch as without the least trouble or preparation, beyond placing it in a small zoophyte trough, the whole system of circulation, from the heart to the farthest capillaries and back again, can be observed in the most perfect manner. The pulsative motion of the blood in the arteries, as distinguished from that in the veins, which flows in a steady, unvarying stream, is made patent to the most superficial observer. I have no doubt most of Mr. Bolton's subscribers derived very great pleasure from this interesting specimen, and, as I did, congratulated themselves on the result of their subscription to his microscopic agency.—John F. Goode, Handsworth.

Unusual Departure of Birds.—During the late hard weather the Fieldfares, Missel Thrushes, and Redwings quite left us, a most unusual circumstance. Up to the middle of December the first two were plentiful, but after that they began gradually to lessen in numbers, and from the 1st of January to the 8th inst. (when I observed a small flock of about twenty of the former flying over) I did not see one. Redwings left earlier, about the second week in December, and I have only seen one (on the 11th instant) since. Song Thrushes have been very scarce, and Blackbirds not nearly so numerous as usual. We have had more berries on the trees this time than some years when the birds did not leave us. Have any of your readers observed a like migration of the Thrush family? It would, I think, be interesting to know if it was general, and if the birds left England or merely went south. Five Hawfinches and two Snow Buntings *(Emberiza nivalis)* have been observed here this season, the latter is a very rare winter visitor.—O.V.A., Bodicote, Oxon, Feb. 12.

The Ancient Inhabitants of the Cotteswolds.—In the neighbourhood of Cheltenham and Stroud there are distinct remains of the existence of four different races of men before the Roman occupation of the country. 1.—A small, long-headed race, not exceeding 5ft. 5in., occasionally discovered doubled up beneath a heap of earth or clay. 2.—A tall, long-headed race, exceeding often 6ft., found in round barrows, with central kist made of unhewn stone walling, and covered with slabs, several bodies being placed together in the kist. 3.—A mixed race, varying in stature from 5ft. 4in. to 5ft. 6in. or 8in. Their remains are found in the chambers of long or heart-shaped barrows. No traces of metal have been discovered in any of the above burial places. 4.—The remains of a short-headed athletic race. They are connected with the dressed stone kists, with cinerary urns, burned bones, and metals. The first race, the most ancient, may be represented by the Eskimos; the second race the same people, located under more favourable circumstances; the third race may represent the Ancient Gaels, who named the rivers and most conspicuous objects, and were the constructors of all the unhewn stone works at Avebury, Stanton Drew, &c., &c. The fourth race may be said to represent the Welsh Cymri, the Belgæ of Cæsar, or what are called the Ancient British. They introduced metals, practised cremation, and erected Stonehenge, and all the other dressed-stone works. They were followed by the Romans, &c.—Henry Bird, Bath.

Garnets in Charnwood Rocks.—Garnets are of frequent occurrence in metamorphic rocks such as gneiss, talc-schist, dolomite, &c. The best known British localities are the neighbourhood of Dartmoor, Botallack in Cornwall, and Saddleback and Keswick, in Cumberland. I have long felt rather surprised that this mineral could not be detected in the rocks of Charnwood Forest, and their absence in the coarse slates and grits seems confirmatory of the view so ably advocated by Professor Bonney and the Rev. E. Hill that these rocks have really not undergone very intense metamorphism, and that the crystals of felspar, quartz, &c., which they contain were ejected with the other material from volcanic vents, and are not products of subsequent alteration. To-day, however, in minutely examining some specimens I collected last summer, I was pleased to find many small garnets in the curious rock we call gneiss, which is found at one point only, viz., Brazil Wood, about half-way between Mountsorrel and Swithland. Here this gneiss is in contact (unless a diorite dyke intervenes) with the edge of the great granitic mass which forms Mountsorrel and Buddon Wood. In the specimen I have before me the garnets are very small, (not more than one-tenth of an inch in diameter,) almost black in colour, and so thickly crowded that there are about fifty in a square inch. It is possible that this gneiss may turn out to belong to a distinct series of rocks from those which form the rest of Charnwood Forest, but unfortunately it is entirely isolated by the surrounding red marls of the Trias, so that its relations to the slaty series cannot be traced.—W. J. Harrison, F.G.S.

Microscopic Camera-obscura.—At page 18 an account is given of a method of drawing objects under the microscope, by means of a rectangular prism. This method has been in use for a long time. In "Science Gossip" for 1866, p. 233, the following full directions (which some of your readers may find useful) are given by Mr. Geo. W. Hart:—"I remove the cover of the eye-piece, and in place of the camera-lucida reflecting-glass I substitute a right-angled prism, fitted in a short tube, so that it can be placed close to or removed from the eye-piece for adjustment. I have had constructed a wooden frame, exactly like a box without a lid. Placing this on a table on end, with the open side next the observer, I pass the tube of the microscope through a slit in front, this opening being covered with a dark cloth to prevent light entering. I also nail another dark cloth on the top of the box, and allow it to fall over my head and shoulders; this should be large enough to enable me to use both hands. Now, placing the microscope horizontally, and putting on the tube so as to throw down a circle of light when the object is illuminated, the image will be seen beatifully defined on a sheet of paper placed in front of the draughtsman. When it is wished to make a coloured drawing, it is well to trace the outline, and then moving the paper a little on one side, colour the sketch to correspond with the image, which will then be reflected by the side of the tracing. I have used the camera in this form for many years, and have wondered that it has never been generally used."—F. Abell, Hampstead.

Aquaria.—At page 53, H. M., Derby, asks the best artificial food for freshwater fishes when the natural food, &c., is not easily to be procured. I beg leave to call his attention to vermicelli; nearly all freshwater fish will eat it and thrive thereon. Carp of all kinds take it greedily, especially the gold, tench, dace, roach, gudgeon, and minnows, &c. Vermicelli has the advantage of being clean, and not discolouring the water, as bread does if given too profusely. Of course a little change of diet is welcome when it can be got: small red worms or minced raw meat; mutton is best, but must be given very sparingly. White fungus on carp, roach, &c., is very troublesome, and I think arises principally from debility; the fish should be removed as soon as the disease is noticed to a separate vessel, if possible. I sometimes take the patient out of the water, wipe the fungus off with a silk handkerchief, then sprinkle with white sand, and return to the water quickly. The sand adhering to the fish causes it to rub itself against stones, &c., which is very beneficial. I have had fish quite recover after being treated in this way. I can strongly recommend "The Book of the Aquarium," by Shirley Hibberd, to the notice of H. M.; he will find it a handy little volume, and full of practical information, *re* Aquaria both Sea and Freshwater.—R. G.

Aquaria.—Your correspondent (page 53) will find that the small crustacea, aquatic larvæ, and worms, which may be taken by means of a fine net from nearly every pond, pool, or river, are excellent food for freshwater fish. If the tank is already sufficiently full of water, take some out, and then empty in its place the contents of the can or bottle containing your catch of small fry, when it will at once be observed that the fish have become very busy in making the acquaintance of their newly introduced friends, which they most greedily devour. The spawn of snails is also very good food, and may be readily supplied by keeping plenty of those interesting creatures as companions in the aquarium. Some keepers of aquaria are opposed to the introduction of artificial food, as bread, meat, or earthworms; but this will be found to answer well, if given in small quantities, and care taken not to leave any uneaten portion to decay in the water, which is probably the only source of mischief. Carp, roach, and dace are very fond of bread, which should be pressed in the hand and made pasty, so that it will not fall to pieces when put in the water; drop in small pellets, if possible, not more than the fishes will take. I used to keep a number of carp, which always became excited when bread was on the table at meals, and would continue wriggling and swimming against the glass, as though they meant to come through, until I gave them a supply, which I never failed to do. A pair of wooden forceps which will reach conveniently to the bottom of the aquarium are exceedingly useful for removing either dead animals, or any other matter which requires to be taken out. I believe there is no cure for the fungus which attacks and destroys the fish, but it is highly necessary to remove at once any that may be so diseased, and to examine well all new specimens introduced to see that they are perfectly healthy.—J. L.

Aquaria.—Some of your readers may be interested in the following facts:—I have a small bell glass aquarium, which, as a marine aquarium, has been very successful, there having been no deaths for upwards of two years, and the anemones have throughout maintained a high standard of vitality, attributable, I consider, to regular feeding, aeration, and scrupulous cleanliness. Numerous young have been cast off, and one stone is closely covered with what are apparently larval forms of the starfish. During this winter the anemones have been unusually errant in their dispositions, and I have three times, on different occasions, observed what seem to be conjugations. In each case the first sign was the appearance round the base of the animal of the spermatic cords, and these in some cases reach the length of an inch and a half. They float in the water, and that they are perceived by other anemones is proved by the animals moving up, and with their base partially covering the extended base of the first. They remain in this state for about twelve hours; the emission of the spermatic cords is increased till both are enveloped in the coils, which are perfectly visible, and between thirty and forty in number. At least I have counted as many. After some interval—about twenty-four hours since the first contact—the one that has moved up moves away, each closes, and remains in a state of quiescence, from which they do not emerge for some days, no matter how tempted by food or aeration. I shall be glad to learn if any of your readers have noticed similar occurrences.—G. L. B., Denmark Hill.

[We refer our correspondent to Mr. Gosse's "Actinologia Britannica," (Intr. pp. xxi.—xl., the Reproductive System and the Teliferous System,) and he will see that what he calls spermatic cords are the ordinary *acontia*, which have nothing to do with generation.—Eds. M. N.]

Gleanings.

Palæontographical Society.—Mr. A. H. Scott White, B.Sc., B.A., of the High School, Nottingham, has been appointed local secretary for Nottingham and neighbourhood.

The Phonograph.—The London Stereoscopic Company (who hold the sole patent) are now offering to supply Edison's speaking phonograph, to be worked by hand, at a price of ten guineas each, "subject to their non-exhibition for money payment."

Geological Society.—The Woollaston Fund.—We have much pleasure in stating that the Council of the Geological Society have unanimously presented to Mr. Samuel Allport, F.G.S., a former president of the Birmingham Natural History and Microscopical Society, the balance of the Woollaston Fund at their disposal in recognition of his researches on British Igneous Rocks.

Melicerta Tyro.—Dr. Hudson thinks that the name of this rotifer should be changed to *M. Tubicolaria*, for a reason which we give in his own words: "I have now little doubt, in spite of the errors in his figures and description, that it was this rotifer out of which Ehrenberg framed his genus *Tubicolaria*."

Œcistes Umbella and other Rotifers is the subject of a most interesting paper by Dr. Hudson, in the current number of the "Journal of the Royal Microscopical Society." This is the rotifer figured by Mr. A. W. Wills, in Vol. I., "Midland Naturalist," p. 317, for which he there suggested the name of *Œ. longipes*. There are plates representing the above-named *Œcistes* and also *Conochilus volvox*.

Royal Microscopical Society's Journal.—We cordially recommend our microscopical readers to become subscribers for this admirable journal. The current number, besides the paper above mentioned, contains one entitled "A further Enquiry into the Limits of Microscopic Vision," by Dr. Royston-Pigott, F.R.S.; one "On some Recent Forms of Camera Lucida," by Mr. Frank Crisp, LL.B. (Editor of the Journal;) and several others; more than fifty pages of "Notes and Memoranda," of great interest; and a most useful "Bibliography of recent Scientific Publications."

Foraminifera.—Microscopists who study the Protozoa will be pleased to learn that a "Catalogue of Recent British Foraminifera" for the use of collectors has been compiled by Mr. J. D. Siddall, of Bridge Street, Chester, with the assistance of Mr. H. B. Brady. This useful compilation contains a complete bibliography of the order, together with a well-arranged list (founded on that propounded in Dr. Carpenter's "Introduction to the study of the Foraminifera") of the various families, genera and species. Blank spaces are also left for the collector's notes.

Scientific Soiree.—The learned societies at Liverpool held a very successful soirée last month at St. George's Hall, which was attended by over 3,000 persons. The large assembly had abundant material provided for their entertainment and instruction. Besides an almost endless display of natural history specimens, scientific and other objects of interest, there were several lectures delivered in different rooms by the Rev. W. H. Dallinger, Mr. Waterhouse Hawkins, Mr. James Birchall, and others, while in other rooms there were scientific experiments, concerts, &c.

Geologists' Association of London.—We have received from this popular and useful society a copy of a new catalogue of their library, compiled with great care and fulness by the honorary librarian, B. B. Woodward, Esq. The headquarters of the association are at University College, Gower Street, London, E.C., where the monthly evening meetings are held. The great feature of the association's work, however, is the opportunity offered for field-work by the numerous excursions which take place during the summer under the direction of highly competent leaders, to points of geological interest in various parts of the kingdom. The terms of subscription are moderate—10s. 6d. entrance fee, and 10s. per annum—an outlay for which the printed "Proceedings" are alone a fair return. We are glad to see that the valuable services of Professor Morris, as director of excursions and as president, are to be recognised by a testimonial.

Lichens.—We are able to announce that the Rev. W. A. Leighton has nearly completed the printing of the third edition of his Lichen-Flora of Great Britain, Ireland, and the Channel Islands, which, it is expected, will be ready for issue early this month. This new edition is rendered necessary by the surprising discoveries of Mr. Larbalestier in the West of Ireland; those of Mr. Crombie, Dr. Stirton, and others, in the North of Scotland; and Mr. Leighton's own researches in North and South Wales; whereby the Lichen-Flora of the former editions, amounting to 1,156, has been raised now to 1,706, thus rendering our lichens in number, rarity, and novelty quite equal to those of any country in Europe.

MIDLAND UNION OF NATURAL HISTORY SOCIETIES.

The Annual Meeting of the members of the Midland Union of Scientific Societies will this year be held at Leicester, on Tuesday and Wednesday, the 20th and 21st of May. On the first day there will be a meeting of the Council, the General Annual Meeting in the afternoon, and a Conversazione in the evening; whilst the chief feature of the second day will be an excursion to Charnwood Forest. Further details will appear in our next number.

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—January 21st, Microscopical General Meeting.—This meeting was made special for the purpose of considering the best steps to be taken to induce the members personally to assist in contributing to the Birmingham Reference Library Restoration Fund. The action of the committee in voting twenty guineas from the funds of the Society for that purpose was approved, and it was resolved that a circular, with a list of subscriptions already promised, and requesting further subscriptions, be sent to each member of the Society. A sub-committee was appointed to consider the question of the establishment of a Town's Museum, with authority to take action in conjunction with the other scientific societies. January 28th.—Geological Section.—Dr. Callaway, of Wellington, delivered an address on "The pre-Cambrian Rocks of Shropshire," in the course of which he gave the reasons which have led him to conclude that the series of devitrified pitchstones and volcanic agglomerates which form the axis of the Wrekin and of some other elevations in Shropshire, and the quartzite which flanks them, are of pre-Cambrian age. They probably correspond with the Pebidian series of St. David's in South Wales, as described by Dr. Hicks, and with the Huronian of Canada, and are more recent than the crystalline schists and gneissose rocks of Malvern, a patch of very similar character having been mapped by Dr. Holl as "burnt rocks" to the east of the Herefordshire Beacon. A vote of thanks was passed to Dr. Callaway for his interesting address. February 4th.—Annual General Meeting.—The report and balance-sheet for the year 1878 were read and approved. The following officers were elected for the current year:—President, Walter Graham; Vice-Presidents, E. W. Badger and W. Southall; Treasurer, C. Pumphrey; Librarian, J. E. Bagnall; Curators, J. Levick and W. H. Cox; Secretaries, J. Morley and H. E. Forrest. The delivery of the retiring President's address was postponed to a future meeting, of which due notice will be given.—February 11th.—Biological Section.—Several microscopic objects were exhibited. Mr. W. G. Blatch gave some very interesting notes on the rare insects, chiefly Coleoptera, which he had taken during the past year. He alluded to the curious fact that severe winters seem to be more favourable to the production of rare insects during the following summer than mild ones, and pointed out that the coming season may, therefore, be expected to be a very rich one, entomologically speaking.—February 18th.—Microscopical General Meeting.—Mr. J. E. Bagnall exhibited a number of rare mosses from Dr. Lindberg, among others *Dicranella Grevilleana;*

also some fine mosses from Mr. Cotton, collected near Barmouth. Mr. W. H. Wilkinson exhibited the white Christmas rose *(Helleborus niger)*, to show the tubular petals, which are assumed to secrete some fluid attractive to insects and so to serve as aids in fertilisation. Mr. Thomas Bolton exhibited the fine rotifer *Rhinops vitrea*, and a newly hatched Trout, showing the circulation of the blood both in the body and on the surface of the yolk-sac. Mr. J. Levick exhibited some remarkably large *Amœbæ*, and a free-swimming freshwater alga. Mr. W. R. Hughes, by request, re-exhibited six beautifully mounted slides recently presented to the Society by Mr. F. W. Sharpus. Mr. Hughes read the eighth of a series of papers on "The Entozoa and Ectozoa," by Dr. T. Spencer Cobbold, F.R.S., illustrated by specimens preserved in spirit, and a slide of ova of *Ascaris lumbricoides* put up at the General Hospital by Mr. Hughes in 1863.

BIRMINGHAM AND MIDLAND INSTITUTE SCIENTIFIC SOCIETY. —January 22nd.—Mr. C. J. Woodward, B.Sc., read a paper on "Spherical Projection applied to Crystallography." The different methods of projecting on to a plane surface the different points on a globe were first explained. A crystal was then defined as a body which has precisely similar properties in parallel planes, and it was shown that the various planes of a crystal were related to certain imaginary lines termed *axes*. The planes of a crystal might be considered each as touching a sphere in a point, and a map of these points constitute a spherical projection of the crystal. Reference was also made to symmetry in crystals, and some apparatus was shown to illustrate this branch of the subject. February 5th.—Mr. C. J. Watson gave a brief description of the phenomena of the Glacial Drift, illustrated by specimens and photographs. A resolution was afterwards passed that the members should take part in the examination of the drift deposits of the neighbourhood according to the scheme propounded by the Midland Union. February 12th.—Mr. J. T. Sprague, M.S.T.E., read a paper on the "Relations of Electromotive Force and Resistance to Current." In the course of it he said that it was much to be regretted that the British Association had used the word "resistance" to represent what was really only the reciprocal of conductivity. The term resistance should have been kept to express the work done in any part of the circuit, which varies as the square of the current passing. In consequence of this confounding of ideas essentially distinct much confusion existed in the minds of physicists as to the conditions under which electric force was really transmitted.

BIRMINGHAM PHILOSOPHICAL SOCIETY.—February 13th.—A paper was read by Dr. Saundby, on "Recent Metalloscopic and allied Researches."

BIRMINGHAM SCHOOL NATURAL HISTORY SOCIETY.—January 24th.—First General Meeting, Half-year.—C. E. B. Hewitt having resigned his post as Hon. Sec. to this Society, H. F. Devis was elected Hon. Sec., *pro. tem.*, in his place. February 14th.—Paper read by A. B. Badger on "The proposed Union of the two Sections, Botanical and Entomological, under the name of the Biological Section." It was then proposed, seconded, and carried by a large majority, "That the Society comprise two Sections, for the study of Biology and Geology respectively." Mr. Turner was unanimously elected President of the Biological Section, and J. Chapman Curator.

BURTON-UPON-TRENT NATURAL HISTORY & ARCHÆOLOGICAL SOCIETY.—January 21st.—Mr. W. Molyneux, F.G.S., F.R.Hist.S., read a paper on "The pre-Norman History of Repton." After alluding to the grounds for thinking it had in turn been occupied by the Ancient Britons and the Romans, he next referred to the Saxon ecclesiastical foundation at Repton, in A.D. 653. He was of opinion that in the beautiful crypt there still remains a portion of the original edifice. A detailed description of the crypt was given. Mr. Molyneux further said that in dealing with the pre-Norman History of Repton it must always be borne in mind that the River Trent was at that time a larger river, and occupied considerably more space in the valley that it does now. It was navigable for boats, of what was then large tonnage, from its mouth at Gainsborough, over its main course as far as Stone, and over its two tributaries, the Sow as far as Stafford, and the Tame as far as Tamworth, a condition, he might add, by no means difficult of restoration. It was to these conditions that the Danes were indebted for their successful attack upon the place, as they were enabled to ascend the river in fleets of vessels reckoned by hundreds in number. The same facilities were, of course, open to the early Britons and the Romans, and also to the Saxons; and there could be no doubt that the white sails and double oars or galleys of the two latter races were as frequently seen as those of the Danes. At this meeting were exhibited half a dozen specimens of the Death's-head moth, *(Acherontia Atropos,)* three male and three female, the larvæ of which were found last summer by Mr. George Baker, of Waterloo Street, feeding in his garden on *Lycium barbarum*, (the tea tree.) February 11th.—Mr. H. G. Tomlinson read a paper on "Birds and their Habits." After giving some interesting details as to the structure of birds and the varied ways in which the different kinds are fitted for their modes of life, some particulars were given about nests and eggs. Birds were next considered as divided into five orders—birds of prey, perchers, fowls, waders, and swimmers—the characteristics of each order being mentioned. Mr. Tomlinson then spoke of the habits of some of the birds frequenting Staffordshire and neighbourhood. Of birds of prey, the common buzzard was the largest seen there; the hobby-hawk was a rare summer visitor, but had been found at Dovedale; the kestrel, which might be known by its hovering in the air when in search of food; and the sparrow-hawk, a brave little fellow, formerly used in the art of falconry. While speaking of hawks, he remarked, as a noticeable fact, that in all birds of prey the female was the larger. The reason for this was not obvious. With one exception, and that not British, there were no songsters in this class of birds. They had also in the neighbourhood the white or barn owl and the tawny or wood owl. Owls, in addition to having great powers of sight and hearing, have a noiseless flight owing to their external wing feathers being detached and made to curve outwards, so that the air can pass through them. Of the perchers he first described the habits of the titmouse family, including the tom-tit, blue-tit, great tit, and long-tailed tit; the fly-catchers—spotted and pied—the kingfisher, the crow, rook, magpie, jackdaw, and jay; the tree-creeper; and the wood-pecker—the green or "laughing" wood-pecker being found at Bagot's Park and Bretby Park, and two other kinds—the lesser spotted and the greater—being occasionally found in the neighbourhood. Mention was made of the peculiarities of the cuckoo, one being that the young bird has an indentation in the middle of the back to assist it in ejecting from the nest in which it has been hatched the eggs of the rightful owner of the habitation, or its foster-brothers. This cavity fills up when the bird is about twelve days old, and the back becomes the same as that of other birds. The habits of the swallow, of which four species visit us; the wagtail, of which we have three varieties; larks and pipits, including skylarks and woodlarks; the buntings, of which we have the yellow-hammer; the finches, of which we have six varieties; the common brown linnet, the starling, the sparrow, the thrush, including the field-fare, red-wing, and missel-thrush; the blackbird, and a few others were also briefly noticed.—Mr. Tomlinson promised to continue the subject in another paper.

CHELTENHAM NATURAL SCIENCE SOCIETY.—February 20th.—Dr. Julius Maier read a paper on "The Spectroscope and its application to Solar Research," which was well illustrated.

NORTHAMPTON NATURAL HISTORY SOCIETY.—A meeting was held in December for the purpose of hearing a paper read by the Rev. Wm. Thornton, F.G.S., on the circumstances of the Liassic strata among the volcanic rocks of the West Highlands of Scotland. By request it was of an elementary character. It described the physical and geological character of Arran, the coast of Argyle, and more particularly Ardnamurchan Point, and the Cuchullin Hills, and Glen Sligachan in Skye. It was rendered the more interesting by being illustrated by a capital section of the coast of Skye, and some very high class water-colour drawings of Ben Cruachan, Glen Sligachan, &c. A hearty vote of thanks was awarded to the lecturer. Six new members were elected. Jan. 14th.—Mr. C. Jecks read a paper, entitled "A few Thoughts on Darwinism," in which Mr. Darwin's leading arguments were very clearly explained. Mr. Jecks referred to the insectivorous habits of certain plants, the electric power of the *Gymnotus*, &c. A discussion followed, in which the Rev. S. J. W. Sanders, the Rev. Canon Scott, and Messrs. Scriven, Eunson, and Druce, took part.

NOTTINGHAM HIGH SCHOOL NATURAL HISTORY SOCIETY.—Of this thriving society some very interesting particulars are given in the last number of "The Forester, or Nottingham High School Magazine," a publication of which, we may say in passing, the school may well be proud. It contains some capital papers, one in the number before us on "Mounting Insects as Microscopic Objects" being particularly good and practical. The Natural History Society consists of nearly eighty members, divided into sections, in which some good work is being done. Although only in its infancy, it possesses the nucleus of a good natural history library. At a recent meeting it was decided to offer prizes to the members for—(1) Type collection of British Phanerogamic Plants; (2) Collection of Minerals, Rocks, and Fossils, illustrating the geology of the Carboniferous formation, with especial reference to the neighbourhood of Nottingham; and (3) Type collection of British Insects. A lecture is delivered to the members every week, and the list of those announced for the present term is a most admirable one.

NOTTINGHAM LITERARY AND PHILOSOPHICAL SOCIETY.—NATURAL SCIENCE SECTION.—January 24th.—Mr. G. B. Rothera, the president, read a paper on "The senses and their environment." February 14th.—MICROSCOPICAL MEETING.—Subject, "Comparative Anatomy and Physiology." Messrs. Burton, Jennings, and others showed specimens.

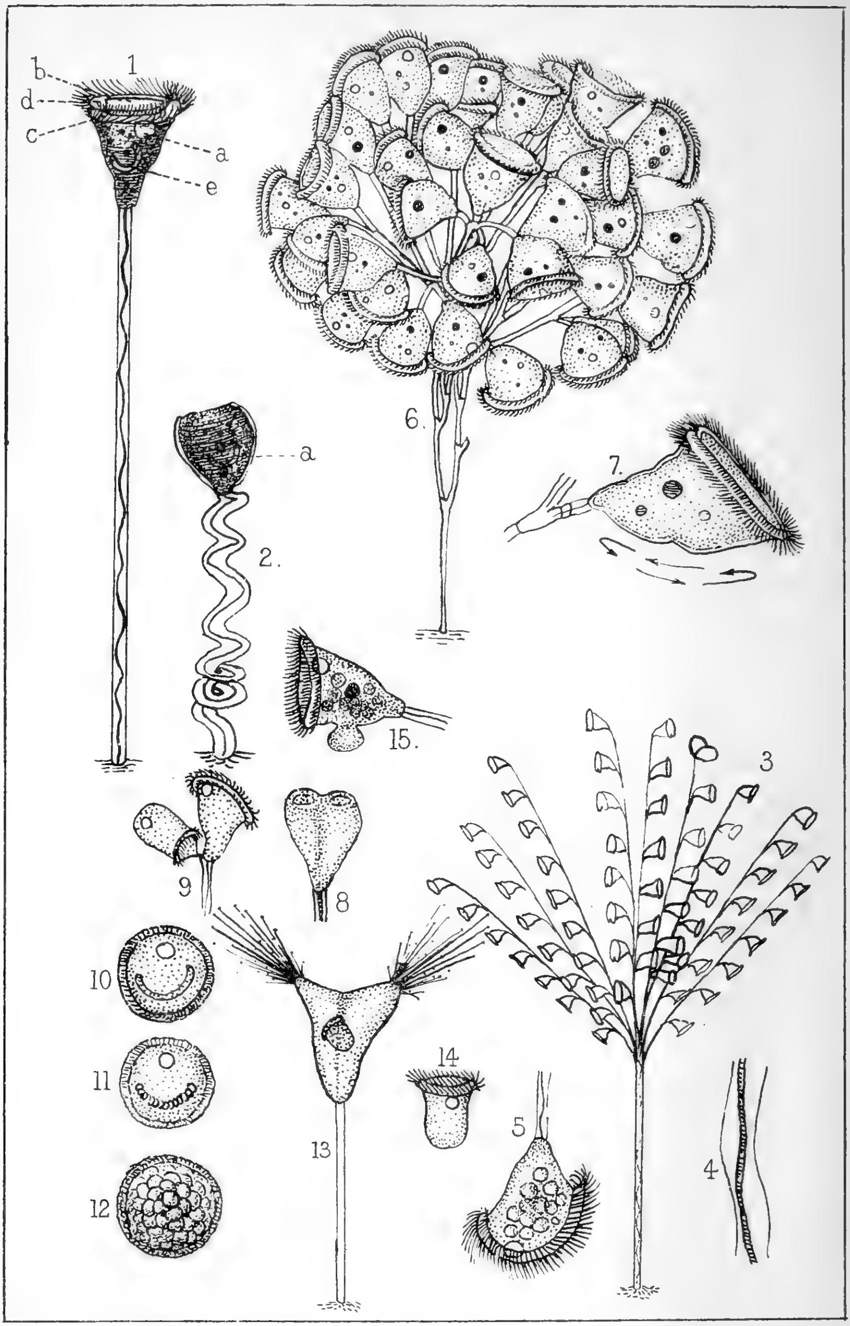
RUGBY SCHOOL NATURAL HISTORY SOCIETY.—February 1st.—Exhibited: Various Indian curiosities, by T. B. Oldham, (M.,) including bangles or hoops put round the arm by the Burmese. Papers: The President read portions of the Meteorological Section's Report for 1878; also, the Entomological Section's Report, 1878. T. B. Oldham (M.) read a paper, by his brother in India, on "The Growth of Shoots from the Roots." This paper arose from Mr. Cumming's note on the subject last term. A discussion followed. The President read a communication from W. E. Home (C.) on "The Royal Observatory at Edinburgh." The President read an anonymous paper on "The Zulus," describing their history and military organisation. February 15th.—Donations announced: Concise Glossary of Architecture and Introduction to Gothic Architecture, by J. H. Parker, C.B., F.S.A., from C. E. Sayle, (M.); Mediæval Sepulchral Antiquities of Northamptonshire, by M. H. Bloxam, Esq., F.S.A., (H.,) from the author; Roman Pottery, Tripontium, now Caves Hill, from T. B. Oldham and C. E. Sayle. Exhibited: Pencil Iron Ore, from Lydal-in-Furness, and Lias Limestone, Portrush, by E. Solly, (M.); a new form of the Telephone, or rather a Galvaniphone, by Rev. T. N. Hutchinson, (H.,) who explained the invention. It was used before the society. A distinct though non-articulating sound was audible to all, and it was pronounced a decided success. Papers: Mr. Bloxam (H.) read portions of a paper on some "Roman Sepulchral Slabs," now in a fireplace in Warwick Castle. Of these he exhibited a set of casts. He pronounced them to be mere "rough copies," from a Roman slab-cutter's yard, probably in Italy; R. D. Oldham (C.) read portions of a paper on some "Experiments to determine the Modulus of Cohesion of Ice, and their Bearing on the Glacial Erosion of Lake Basins." A considerable discussion followed. The President read a continuation of the paper on "The Zulus."

STROUD NATURAL HISTORY AND PHILOSOPHICAL SOCIETY.—On February 11th, Mr. J. T. Fisher delivered a lecture on "The Solar and Stellar Systems."

EXCHANGE.

Wanted, a Vase, or any example of ancient British pottery, large or small, from a tumulus, earthwork, or other position; or a Roman or Romano-British pot. Will give in exchange a good collection of correctly-named Lichens from the Scottish Mountains, or a collection of well-mounted and named slides of microscopic fungi for the microscope.—WORTHINGTON G. SMITH, 15, Mildmay Grove, London, N.

Plate I.



H. E. Forrest. del.

On the Development of the Vorticellidæ.

THE NATURAL HISTORY AND DEVELOPMENT OF THE VORTICELLIDÆ.*

BY H. E. FORREST.

The Vorticellæ are familiar objects to almost everyone who possesses a microscope. Wherever there is water, salt or fresh, the various species are to be met with, differing in minor points, but all bearing a strong and unmistakable family likeness to one another. They are seen to the best advantage with a black background illumination, and when thus shown are perfectly lovely. The light seems to ripple and dance over their delicate milk-white forms, as the cilia lash the water into a hundred eddying whirlpools. With lightning rapidity, first one and then another darts backwards, each tiny stalk coiling up like a python, then slowly but gracefully unwinds till at full stretch, when the ciliary wreath again displays itself. All is done, too, with the most perfect grace; nothing is clumsy or unwieldy in all their various actions, and few, if any, natural objects can vie with them for beauty.

But their charms seem powerless to secure from Naturalists the amount of attention which they deserve, and they are usually passed over with merely a cursory glance, simply because they are common. It is the object of this paper to show that the history of the Vorticellidæ is a deeply interesting, as well as a fascinating study, and by describing what is already known of them to point out what a vast field for original research lies open here for those who have the zeal and patience to penetrate a little more deeply into the subject than they have hitherto done.

In order to render it as clear and concise as possible, my paper will be confined to four species, typical of four genera, and each will be treated of separately. These four species are:—

(1) *Vorticella nebulifera*, [Plate I., Figs. 1 and 2.] Stalk long, contractile, not branched; usually gregarious.

(2) *Carchesium polypinum*, [Plate I., Fig. 3.] Stalk long, contractile, branched, spreading. Bells on one side of branch only.†

DESCRIPTION OF FIGURES.—PLATE I.

1.—*Vorticella nebulifera*, expanded, ×250 diameters. *a* contractile vesicle, *b* disc, *c* rim, *d* vestibule, *e* nucleus.
2.—*Vorticella nebulifera*, contracted, ×250 diameters. *a* nucleus.
3.—*Carchesium polypinum*, ×100 diameters.
4.—*Carchesium polypinum*, stem of, ×250 diameters.
5.—*Carchesium polypinum*, individual, ×250 diameters.
6.—*Epistylis leucoa*, ×100 diameters.
7.—*Epistylis leucoa*, individual, ×250 diameters. The arrows indicate the movements of the contents.
8 and 9.—*Vorticella*, showing self-division, ×200 diameters.
10, 11, and 12.—*Vorticella*, showing encystation, ×350 diameters.
13.—*Vorticella*, showing acinetation, ×250 diameters.
14.—*Vorticella*, free embryo, ×300 diameters.
15.—*Carchesium*, showing gemmation, ×200 diameters.

* Abstract of a paper read before the Birmingham Natural History and Microscopical Society, December 10th, 1878.

† Ehrenberg figures this species with bells on both sides of the branch, but this is incorrect.—H. E. F.

(3) *Epistylis leucoa*, [Plate I., Fig. 6.] Stalk shorter, rigid, not contractile, branching irregularly at the top, so as to form a large head of bells.

(4) *Zoothamnium arbuscula*. Stalk thick, tapering, contractile, and branched horizontally at the top, each branch subdividing in the same plane. Bells of two kinds on both sides of branches.*

(1.) *Vorticella nebulifera*. The name Vorticella, diminutive of the Latin vortex, a whirlpool, was given to the genus in allusion to the currents which they produce in the water, and this species was called nebulifera, cloud bearing, because, from its gregarious habits, it imparts a cloudy appearance to the objects to which it is attached. In its normal condition [Plate I., Fig. 1] the Vorticella is a little bell supported on a long, slender, hollow stalk, which contains a well developed muscle, easily seen with an oblique light. Although no nerves have been detected in connection with it, its powers of sensibility and contractility are very great. When expanded the tube is straight, but the enclosed muscle is always spiral, and when contracted the tube is also thrown into a spiral, [Fig. 2,] and thus shortened. The act of contraction is very sudden, but the re-expansion much slower. During contraction the ciliary wreath is withdrawn into the body. As it slowly uncoils, first the stem straightens, then the centre of the bell rises up, and the edges curl over outwards, and, lastly, the cilia are set in motion. Of course the converse of this takes place when the animal contracts, but then the action is so swift that the eye cannot follow it.

The body consists of (1) an outer layer, the cuticle, marked with fine, dense, parallel striæ [Figs. 1 and 2;] (2) an inner cortical layer, in which are imbedded a contractile vesicle [Fig. 1*a*] and a nucleus, [Fig. 1*e*,] the latter usually invisible unless reagents are employed to show it; and (3) an interior mass of sarcode, containing several globular bodies called food-vacuoles. At the top margin of the bell there is a projecting rim [Fig. 1*c*] surrounding a circular space called the disc, [Fig. 1*b*,] at one end of which is a depression called the vestibule, [Fig. 1*d*,] and at the bottom of this the mouth and anus are situated, the latter, however, only visible when in use. There is a short æsophagus leading from the mouth into the interior. The rim is plentifully supplied with cilia, which, by their constant action on the surrounding water, sweep a succession of minute particles of food into the vestibule, where they accumulate into a kind of pellet. When sufficient is collected the animal gulps it down, together with a small portion of water, and this mouthful floating into the sarcodous interior becomes a food-vacuole.

It is in the processes of multiplication and reproduction that we meet with the most interesting phases of the life-history of the Vorticella. These are four in number, viz., fission, gemmation, encystation, and acinetation. The first of these, fission or self-division, is by far the most frequent, and I have witnessed it many times. When this is about to take place, an adult bell begins to alter its shape, becoming first globular,

* This will be illustrated in a subsequent number.

then flattened at the top. Presently a constriction appears, extending from the top downwards, [Fig. 8,] and this deepens till the bell is cut into two halves, only connected by the stem, which is common to both. The one which is to remain on the old stem now re-opens its ciliary wreath, but on the other, which will ultimately break away, a new wreath is formed *at the end nearest the point of attachment*, [Fig. 9.] The new cilia appear first as loose hairs, moving listlessly to and fro in the water, but these soon lengthen, their strokes increase in vigour and rapidity till the bell trembles as if impatient to be off. It now begins to revolve, slowly at first, then gradually faster and faster, till the slender point of connection snaps, and away shoots the bell, gliding swiftly and merrily through the water. After whirling about for some time, it chooses a place of rest, settles down, and after brooding over it for some time, begins to rise by the growth of a new stalk, which soon attains a considerable length. The cilia have by this time disappeared, and a third set is formed at the top, so that now the animal resembles in every respect the parent from which it sprang.

Gemmation, or budding, is not of nearly so frequent occurrence. I have not seen it myself in Vorticella, though it does occur, but I have seen it in *Carchesium polypinum*, [Fig. 15.] The process is very similar to the last, but the new animal, instead of being formed from one-half of the old one, is produced near its base by the expansion of the cuticle into a kind of protuberance or bud, which is nourished, as in Hydra, by the parent, the body cavities of both being continuous with one another. As in the last case, the bud develops a circle of cilia near its attached end, and breaks away to find a home elsewhere.

The two remaining reproductive processes are inseparably connected with the organ called the "nucleus." This organ is present in all the Infusoria, and is almost universally believed by zoologists to be of a sexual nature, but what are its precise attributes remains at present a mystery. But whatever may be its function, the part it plays in the two following events is very remarkable. In all the Vorticellidæ it is long and band-like, and in the species now under consideration it is curved like the letter C.

The Vorticella at an earlier or later period of its existence withdraws the disc and circle of cilia, and contracting itself into a ball secretes a gelatinous covering or cyst, which gradually solidifies. The body of the animal [Fig. 10] now appears almost homogeneous, but still contains the nucleus unchanged, and the contractile vesicle, which has now lost all power of contraction, and remains permanently expanded. The nucleus next breaks up into a number of oval discs, [Fig. 11,] which move about in the thin, gelatinous mass into which the substance of the parent has become dissolved. The cyst now becomes filled with separate little sacs, which finally break through its walls and eject their gelatinous contents with the included embryos into the water, there to give rise to a new generation of Vorticellæ. I regret that I have never been able to see this mode of propagation, and the only author who really appears to have observed it is Stein, on whose authority I give it. The same author is also responsible for the following account, which is the most extraordinary of all. The process has never received any name, but it is that which I called acinetation on a former page, and the meaning of the term will be evident from the following description :—It commences, as in the last, by the encystation of the Vorticella, which in this case remains on the old stalk, or develops another. The bell then, by a series of almost imperceptible changes, assumes the forms drawn at Fig. 13, and from its two upper extremities sends out pseudopodia like those of an Actinophrys, and knobbed at the ends. This stage has long been known to microscopists under the name of Acineta. The nucleus, which is distinctly observable, divides into two, and one half becomes converted into an active Vorticella, acquiring an ovate form, a circle of cilia round one end, and a distinct mouth at the other, and inside it we may observe a nucleus and contractile vesicle. When mature it tears its way through the membraneous coat of the Acineta, and so becomes free, [Fig. 14.] The latter, however, immediately closes up, the nucleus divides again, and the process is repeated *ad lib.*

When this extraordinary history was first given to the scientific world by Stein, it was contradicted, and at the present day is so much doubted that Huxley, in his recent work on Biology, when treating of the Vorticella, does not even mention it; but I think that Stein's account is doubted chiefly because it lacks confirmation, and I therefore add just one grain of evidence in favour of its truth. One evening in October last, while examining some Acinetæ from Barnt Green, I saw a small Vorticella burst from the body of one of them and swim away.

In this last series of events we have an example of the phenomenon known as the alternation of generations. The Vorticella, instead of producing another being like itself, gives rise to an independent animal of totally different character, and this in the next generation, instead of giving birth to offspring of the same type, produces a Vorticella like the original.

(2.) *Carchesium polypinum,* [Fig. 3.] The name Carchesium is from the Greek *karchesion*, and signifies a goblet or drinking cup, which is narrower in the middle than at the top or bottom; polypinum, from *polypus*, a polyp, referring no doubt to the appearance of the colony when expanded. It only differs from Vorticella in being branched, all the branches converging downwards to a single stem, [Figs. 3 and 4,] which is spirally waved. Each branch contains a muscle, which is not connected directly with the one in the main stem, but is attached to the inside of the stalk; every bell, too, has a separate muscle. By this arrangement every branch is able to contract without the whole colony doing so, and even a single bell may contract without its fellows being affected. The colony originates from a single individual, by a continuous process of self-division, [Fig. 9;] the new animals, however, instead of breaking away, as in Vorticella, remain permanently on the old stem. I have observed gemmation in this species, but the two other methods of reproduction, viz., encystation and acinetation, I have not yet witnessed.

(3.) *Epistylis leucoa*, [Fig. 6.] This is a magnificent species, perhaps the largest of all the Vorticellidæ. The main stem is slender, branching out at the top into a large cluster of bells. It contains no muscle, and is therefore quite rigid, hence the name, from *epi*, upon, and *stulos*, a pillar. Each bell is nevertheless provided with a short rudimentary muscle, [Fig. 7,] which enables it to give a slight twitch when alarmed. On account of their large size the bells of Epistylis are first-rate objects for showing the protoplasmic movements. The whole contents of the bell may be seen marching slowly up one side and down the other steadily and without intermission—an overwhelming proof of the fallacy of Ehrenberg's theory that the vacuoles are independent stomachs all connected together, and to the mouth by an intestinal canal—for it is obviously impossible that such should be the case, when the whole cell-contents, vacuoles and all, revolve within it.

[TO BE CONTINUED.]

MOSS HABITATS.

BY JAMES E. BAGNALL.

(Concluded from page 39.)

"Pleasant both to eye and mind, is an old garden wall, dark with age, gray with lichen, green with mosses of beautiful hues and fairy elegance of form," and on such habitats a great variety of species of moss will often be found; an old wall is the bryologist's botanic garden, where he may leisurely study his pet plants. A slight shower followed by bright sunshine, such a day as we often get in May, will often give him a pleasurable sight, such as he will long remember, for these alternations of wet and dry call into full play the peculiar properties of the annulus, and if he have only patience to watch and wait, he will see the little lids of many of the capsules thrown off by a sort of magic force; and if the moss he is watching be a Bryum or a Hypnum, the outer fringe will be thrown back like the rays of a beautiful star fish, the inner fringe all the while opening and closing, and the spores shot forth, by some hidden force within, a little cannonade of tiny balls, seeming as though the fairies were practising their minute artillery. Or, if continued dry weather has shrivelled up the mosses, so that they look more dead than alive, a slight shower will at once reanimate the shrivelled tufts, and he will see every moss as it drinks in the grateful fluid, waken again into life, the shrivelled-up leaves once more assume their natural habit, the whole mass looks like a new growth, and the sudden resurrection calls to one's mind that wonderful desert plant *Anastatica*, the Rose of Jericho. But why direct one's attention to walls for watching phenomena that must be common to all moss habitats? Simply because a wall is so convenient, and the whole phenomena may be watched in such places without the fatigue of stooping. Stone walls, mud walls, and walls of every sort and degree, are all worthy of the bryologist's particular attention, and the older the walls the richer the spoils as a rule. So prolific, however, in mosses are these habitats, that I shall not be able to mention a tithe of what may be found by an industrious worker, and hence shall confine my remarks to a few of the more frequent species, such as *Tortula muralis*, *T. marginata*, *Grimmia apocarpa*, *G. pulvinata*, *Bryum capillare*, *B. cæspiticium*, *B. argenteum*, *Didymodon rubellus*, and *Pottia lanceolata*.

Tortula muralis is one of our most frequent mosses, often filling up the interstices between the bricks of an old wall from its base to its top, growing in hoary, bluish-green tufts; the leaves are oblong with blunt tips, terminated by white hair-like points, very hoary in some of the varieties; the leaf-margin is recurved, leaf-cells minute and opaque in upper part, transparent and elongated below; the capsule is erect; lid shortly beaked; fringe of thirty-two teeth, beautifully twisted.

Tortula marginata is a more local species, partial to damp stone walls, and usually growing on the surface of the stone. At first sight not unlike the foregoing, but has narrower leaves, with the margin *thickened*, not recurved, and terminated by a minute green point. The fruit-stalk, too, is yellow in this species; reddish in *muralis*. Fruit characters similar to the last.

Grimmia apocarpa is a not unfrequent denizen of wall tops, forming deep green loose tufts. The upper leaves are hair-pointed, with recurved margins. The capsules are sessile among the surrounding (perichætial) leaves. Lid slightly beaked; fringe of sixteen teeth, dark red, marked with transverse bars and sometimes perforated.

Grimmia pulvinata is a very common species, growing on walls, and often in great masses on thatched roofs, forming round, hoary, cushion-like masses. The leaves are densely crowded, and suddenly terminate by long white hair points. Fruit-stalk longish and bent downwards, so that the capsule is often hidden among the leaves. The lid has a straight beak; the teeth of the fringe sixteen, deep red and sometimes cloven at the tips. Calyptra mitriform, five lobed at the base.

Bryum capillare is very fond of old walls, and is very frequent; often occurs in large dense dark green masses. The leaves are spreading when moist, but strongly twisted when dry, somewhat oblong and abruptly hair-pointed. Capsule somewhat pear-shaped, and pendulous; lid conical, with a minute point; fringe double; outer fringe reddish-brown, beautifully barred; inner fringe membraneous, paler; spores small, green. The peristome of this common moss is a most beautiful object for the microscopist.

Bryum cæspiticium is also very frequent, growing in close compact tufts, of a yellowish or green colour. Usually very much like the last at first sight; but in this the leaves are erect (not twisted) when dry, the lid yellow, not red as in *capillare*, and the spores minute and yellow.

Bryum argenteum may be readily known by its beautiful silvery foliage. The leaves are closely imbricate, (overlapping;) capsule pendulous, and passing abruptly into the fruit-stalk. Green forms, however, occur; but may at once be known by the closely-imbricated leaves, with large cells.

Didymodon rubellus, so far as my own observations serve, is somewhat local; is usually fond of old shady walls; and fruits from November to February. Grows in dull green tufts, which are reddish below; the leaves lance-shaped, somewhat clasping the stem at their base; margins recurved; leaf-cells minute in upper part, towards the base elongated and transparent. The leaves, too, are spreading when moist, but twisted when dry; the capsule is cylindrical; fringe of sixteen simple teeth; lid slightly curved and beaked.

Pottia lanceolata I have usually found abundantly on the mud-capped walls in the Lias districts of South Warwickshire; growing in rather loose dark green patches, often of great extent. The leaves are variable in size and form, generally oval-oblong, tapering, with longish green points; and slightly keeled on the back. Leaf-cells rather large, quadrate above, longer and transparent below; capsule erect; fringe of sixteen teeth; lid beaked.

A true bryologist should never be afraid of damp and dirty boots; if he be, I am afraid he will scarcely care to follow me to the habitats I have next to mention, that is, the marshes and bogs, and will thereby lose some of the rarest and most beautiful of the mosses. The odours of a marsh are not always of so grateful a nature as one would desire for a bouquet, but the gems which cluster round its margin, or more boldly brave its deeper depths, are worthy to be placed among the fairest of the floral world, and speak as loudly of the marvellous skill of the Great Designer, as the most beautiful and complicate of God's creatures. He who doubts this should examine with the microscope the wonderful structure of a Sphagnum leaf; and if the delicate network that he will then have revealed fail to charm, it will be because his power of appreciating beautiful objects is limited. Among other denizens of these watery situations he will find the Sphagnums most abundant, and such mosses as *Bartramia fontana*, *Mnium subglobosum*, *Hypnum cuspidatum*, *Aulacomnion palustre*, and many other species, which space will not permit me to name.

Many species of *Sphagnum* will be found in these habitats, but the species I find most widely diffused is *Sphagnum cymbifolium*. This often forms extensive masses, of a pale green colour, and may readily be known from the other species by the obtuse leaves, and by the elongated cells which coat both stem and branches, (the utricles,) being lined with spiral threads.

Bartramia fontana is a frequent denizen of our Warwickshire marshes, but rarely in fruit. It occurs in more or less dense tufts of a glaucous green colour, and has the stems much matted together by reddish rootlets; the leaves are mostly ovate, with a prolonged point, have reflexed margins, and are slightly plicate at the base; the cells are small and quadrate; the leaf-margin bluntly toothed; the capsule is roundish, curved, marked with deep longitudinal furrows, and reddish-brown when ripe; fringe double; lid convex.

Mnium subglobosum is a more local moss, but abundant in some marshes, occurring in dark-green tufts. The leaves are large, roundish, blunt, bordered with one or two series of elongated cells, the principal portion of the leaf being formed of largish, roundish, hexagonal cells; the capsules roundish, with a small, shortly-beaked lid; fringe similar to that of the Bryums.

Aulacomnion palustre is closely allied to the last, is fond of boggy or marshy places, and is usually abundant where it does occur; rarely, however, found in fruit. This species grows in large yellow tufts; the stems are coated by numerous reddish rootlets, and hence are much matted together; the leaves are crowded, spreading when moist, much twisted when dry, somewhat lance-shaped, roughened with minute projections on the surface, and toothed at the tips; leaf-cells roundish; the capsules are very rarely formed, but not unfrequently little green stalks are produced, which bear at their tips minute balls of gemmæ-like bodies, by which the plant is perpetuated.

Hypnum cuspidatum is a very frequent inhabitant of marshes and other damp places, and usually fruits abundantly. This species grows in tall greenish or reddish brown tufts; the stems are often 4in. to 6in. long, pinnately branched ; branches remarkably cusp-like at the tips; leaves large, oblong, rather blunt, and nerveless; leaf-cells narrow and elongated; fruit-stalk lateral; capsule curved and turned to one side; fringe, consisting of an outer row of sixteen beautifully barred teeth, and an inner membrane of sixteen tooth-like processes; lid conical.

The foregoing notes on moss habitats are, I am convinced, full of faults; they have, however, been given in the hope of calling the attention of some of the students of Nature to a vast and very beautiful family of plants, and, if they should induce any one to give some of his spare moments to this study, they will have served the purpose for which they were written.

NOTES ON COLEOPTERA, &c.

BY THE REV. W. W. FOWLER, M.A.

Much has been said about the scarcity of Coleoptera in the Midlands, but though the southern districts of England undoubtedly produce more species, yet the midland districts, if thoroughly worked, are by no means unproductive of good things, and in some genera are very rich.

The fact of the matter is, that while Lepidopterists may be counted by the hundred or the thousand, Coleopterists may almost be numbered by units. It is natural that this should be so, for the butterflies and moths are emphatically "common objects of nature." They are conspicuous objects for the most part, and thrust themselves upon our notice; they are, too, except a few groups, easily made out and easily arranged. Beetles, on the other hand, are obscure in their habits, and in many cases are very hard to name; the number of British species too—more than 3,000—is alarming to the beginner; and yet if one really does begin in earnest the interest never seems to flag. Work can be carried on at all times and seasons without a long idle time in the winter, which falls to the lot of Lepidopterists; a very little work and perseverance will suffice to give a knowledge of the chief genera, and when this knowledge has been acquired, and the student begins to make out his own specimens, when the first drudgery has been passed through, he will not be likely to give up his study, but will find it ever growing upon him, and opening out new fields of interest.

The scarcity of workers at present has of course the effect of limiting the discoveries made, but I need only mention three beetles, all discovered in the midland district by one indefatigable worker—Mr. J. T. Harris, of Burton-on-Trent—to show that the fields are well worth the labour. *Macronychus 4-tuberculatus*, (new to Britain,) taken in the Dove, near Burton-on-Trent; *Bagous diglyptus*, (recorded in the *Entomologist's Monthly Magazine*, for March, 1879, as new to Britain and rare even on the Continent,) taken near Burton-on-Trent; and *Cryptocephalus 10-punctatus*, taken in Staffordshire a year after its first discovery at Rannoch by Dr. Sharp.

I would strongly advise any one who takes up the Coleoptera to join with it the study of the Hemiptera or bugs. They are found for the most part under the same conditions, and in the same places as the beetles, and are very easily mounted and preserved. Still more remains to be done in this group than among the Coleoptera, and any one working them thoroughly will be very likely to discover new species.

By ordinary persons beetles and bugs are resolved into one species apiece—the black-beetle or cockroach, and the *Cimex lectularius*, to give it its polite name. But it will not take much study to find out that the former insect belongs to the Orthoptera, (grasshopper and cricket tribe,) and not to the Coleoptera, and is, therefore, not a beetle at all, and that the latter is an obscure member of a most beautiful and varied group of insects, whose usual habitat is widely different from that of the obnoxious insect referred to.

Believing that many more people would take up this study if they knew how to set about it, I venture to offer a few hints as to apparatus, mode of preservation and setting, localities, &c., and shall hope in a future paper to say more about beetles generally.

1.—Apparatus.—This is very simple. An old umbrella and a good stick for beating, a brass Y to carry a round of cane for sweeping and water nets (the former to be made of unbleached calico and the latter of coarse cheese cloth) will be all required for summer work; while a fern-trowel, a sheet of brown paper, and, if possible, a sieve will be ample for winter. The bottle for holding the captures should have a wide cork, through which a quill or glass tube should be inserted, corked at the top, and through this tube all the beetles caught should be bottled, as some will be sure to escape if the large cork be frequently removed. A separate bottle should be carried for the larger beetles, as they are sure to injure the smaller ones if placed with them.

2.—Modes of Killing, Preservation, and Setting.—The most merciful way of killing all invertebrate animals is by boiling water, and, if it is wished to set the beetles caught at once, it must be the method adopted; for very delicately formed Coleoptera and Hemiptera it is by far the best plan in any case; but laurel is the great agent. A few words may be spent on this subject with advantage, as the proper use of laurel seems very seldom understood. Only the young shoots and leaves must be used, and these must be gathered on a dry sunny day, as if gathered wet the beetles will soon turn mouldy. The laurel must be chopped very fine and kept tightly corked. Beetles killed in laurel cannot be set at once, but must be kept for three or four days or more in the laurel until the collector finds that they are thoroughly relaxed. If a jar of good dry chopped laurel be kept, and after each day's work the beetles obtained be removed from the bottles and placed in muslin bags, and laid in the jar, they will keep for any length of time. They must, however, be given air every now and then, and the laurel examined for mould; with a little care, however, in this way, they will be quite fit to set a year or more after their capture. For setting, two camel's hair brushes—one blunt, the other with a hard fine point—a pin with a bent point, some gum tragacanth, and some card with a slightly rough surface are required. When the beetle wished to be mounted is thoroughly relaxed lay it on its back, brush out its legs and antennæ with the blunt brush, put a little gum on the card, take up the beetle with the hard brush, lay it on the card, brush the legs and antennæ into their natural positions, cut the beetle out, and insert a pin through the card behind it, not however too near the body; raise the card half-an-inch up the pin, and the specimen, after a thorough drying, will be fit for the box or cabinet. The larger species must not be carded, but pinned through the right elytron, and *not* through the thorax.

The third point, that of localities, would here take up too much space, so I will continue the subject in another paper.

I would, however, mention that the best books for all students of Coleoptera and Hemiptera are the following:—"Rye's British Beetles," which may be obtained for 7s. 6d., from Mr. Joel Rowsell, 9, King William Street, Strand, London, a very useful book for beginners; "Cox's Handbook of Coleoptera," 2 vols., 17s. 6d.; "Saunders' Synopsis of the British Hemiptera," price 5s. The two last may be obtained from Mr. E. W. Janson, 35, Little Russell Street, Bloomsbury, London.

RARE ORNITHOLOGICAL OCCURRENCES IN SOUTH LEICESTERSHIRE.

BY THOMAS MACAULAY, M.R.C.S.L., KIBWORTH.

I send the following ornithological notes in the hope that they may act as a stimulus to others to make observations in this most interesting subject, and report upon them in the "Midland Naturalist."

The district over which these observations extend is a very limited one, and moreover is little calculated to yield fruitful results by reason of its character—almost entirely destitute of woodland and water, it presents but few opportunities for collecting notes, or for observing the migration of rare birds—yet with all its drawbacks I have succeeded in obtaining sufficient observations to justify me in the hope that they may at least prove interesting.

Many of the facts recorded below are due to the observations of my friend, the Rev. A. Matthews, Gumley Rectory, whose name alone in the world of Natural History is a sufficient guarantee for their accuracy.

The observations extend over the last twenty-five years, and the most rare birds are given as nearly as possible in the order of date, and a list is added of others not so uncommon.

Rose-coloured Pastor, *(Pastor roseus,)* seen amongst a flock of starlings, near Foxton, no date.

Raven, *(Corvus corax,)* once seen near Gumley, no date.

Great Snipe, *(Scolopax major,)* shot near Lutterworth.

Snow Bunting, *(Plectrophanes nivalis,)* one shot at Laughton, no date.

Pied Flycatcher, *(Muscicapa atricapilla,)* seen at Kibworth, 1859.

Gray Phalarope, *(Phalaropus lobatus,)* shot near Foxton, 1860.

Temminck's Stint, *(Tringa Temminckii,)* shot at Saddington Reservoir, 1860.

Stormy Petrel, *(Thalassidroma pelagica,)* found dead near Gumley, 1862.

Goosander, *(Mergus castor,)* a female, shot near Smeeton, 1862. This bird was also seen in 1866 and 1877.

Golden Eagle, *(Aquila chrysaëtos,)* seen flying W. by Rev. A. Matthews, 1863.

Black Tern, *(Sterna fissipes,)* shot at Saddington Reservoir, 1865.

Manx Petrel, *(Puffinus Anglorum,)* picked up exhausted near Gumley, 1867.

Sand Grouse, *(Syrrhaptes paradoxus,)* five seen near Laughton, 1867.

Garganey, *(Anas circia,)* four shot at Saddington Reservoir, 1868.

Great Northern Diver, *(Colymbus glacialis,)* seen on Saddington Reservoir, where it remained for a fortnight, 1872.

Black-throated Diver, *(Colymbus arcticus,)* shot on Saddington Reservoir, 1874.

Red-necked Grebe, *(Podiceps rubricollis,)* shot on Saddington Reservoir, 1874.

Scaup Duck, *(Fuligula marila,)* shot on Saddington Reservoir, 1874. This bird is not an unfrequent visitor.

Peregrine Falcon, *(Falco peregrinus,)* a pair seen near Saddington, 1877.

Small Spotted Woodpecker, *(Picus minor,)* a pair nested at Gumley, and hatched off on 26th May, 1878. Unfortunately their nest was discovered by a boy, who captured and killed the old one and destroyed the young.

I now pass on to the less rare birds which appear deserving of notice:—

Great Black-backed Gull, *(Larus marinus,)* has been seen occasionally.

Herring Gull, *(Larus argentatus,)* has been seen occasionally.

Common Gull, *(Larus canus,)* often seen.

Kittiwake, *(Larus tridactylus,)* often seen.

Curlew, *(Numenius arquata,)* often seen.

Whimbrel, *(Numenius phœopus,)* often seen.

Green Sandpiper, *(Totanus ochropus,)* a constant winter visitor.

Common Sandpiper, *(Totanus hypoleucos,)* a constant summer visitor.

Merlin, *(Falco æsalon,)* often seen in winter.

Ring Ousel, *(Turdus torquatus,)* occasionally seen, one shot at Gumley a few years ago.

Spotted Rail, *(Crex porzana,)* has been frequently shot, one this year

Pochard, *(Fuligula ferina,)* occasionally seen and killed.
Golden Eye, *(Fuligula clangula,)* occasionally seen and shot.
Quail, *(Coturnix communis,)* often seen.
Wild Goose, probably the Bean Goose, *(Anser segetum,)* occasionally seen, but no specimen has been obtained so as to verify the species.

I will also add, though not belonging to Leicestershire, the appearance of five Avocets, *(Recurvirostra avocetta,)* from the note book of my friend Mr. Matthews. They were seen on the Trent, near Newark, in 1860.

CRYSTALLISATION OF WATER.

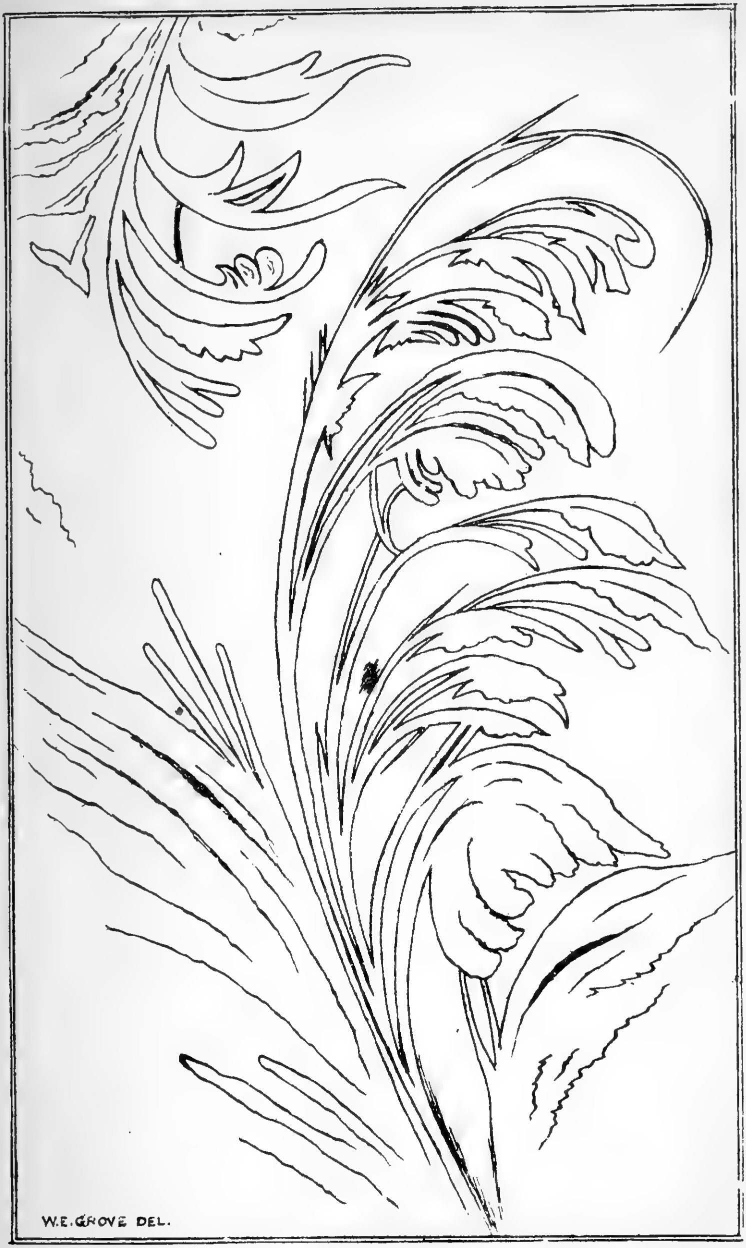
By W. B. Grove, B.A.

The frontispiece of Professor Tyndall's "Light" is an engraving from a photograph of what he calls "a surprising case of crystallisation." The following is the account given of it by Professor S. H. Lockett, of Louisiana State University. "In my drawing room I kept a wash-basin in which to rinse out the colour from my water-colour brushes. This colour gradually formed a uniform sediment of an indefinite tint over the bottom of the basin. On the night of the 26th of December last, (1873,) which was an unusually cold one for this climate, the water in the basin froze. On the melting of the ice the next day, the beautiful figure you see on the photographs was left in the sediment. I carefully poured the water from the basin, let the sediment dry, and thus perfectly preserved the figure."

During the severe weather of last December a quantity of rain-water was left in a jug in my room, and the impurities of the water were deposited in a grayish sediment on the bottom. One night the water froze, not only at the top, but also round the sides and bottom where it was in contact with the jug. The ice-crystals on the curved bottom, as they grew, removed the thin layer of sediment from the smooth surface. Consequently, when the ice was melted and the water poured out, a beautiful design was seen, in white on a black ground, consisting chiefly of gracefully-curved slender plumes. I made a sketch [Plate III.] of one of the most exquisite of these; it is slightly enlarged, but is otherwise as faithful a copy as I could produce. It is remarkable how similar it is in many points to one of the plumes in Professor Tyndall's engraving. The repetition of the same general plan in the details of successive parts is especially a feature in which the two agree, as also the backward prolongation of many of the spicules.

The great interest of these forms lies in the beautiful curves of which they consist. With the idea of a *crystal* we usually associate that of straight lines and plane surfaces, and, although instances to the contrary are not uncommon, it is but seldom we meet with curves so graceful as those here depicted. They arise from the varying play of the molecular forces combined with the adhesion between the molecules and the surface on which they are deposited. They form one of the links connecting the forms of inorganic with those of organic nature, and recall to us Professor Tyndall's words:—"Who is the builder in the case of a crystal (of the plumes in our frontispiece, for example?) Either a detached architect does the business, or these wonderful structures are self-erected, in virtue of their inherent forces. In building a crystal nature makes her first real effort as an architect. Here we have the first gropings of the so-called vital force; but the most wonderful manifestations of this force, though depending upon processes of higher complexity, are, I hold, of the same quality as those concerned in the growth of a crystal."

Plate III.



Crystallisation of Water—Ice Plumes.

Microscopy.

Insects Mounted without Pressure.—The mounting of whole insect preparations, or special organs, for examination under the microscope has always been a favourite pursuit with amateurs. The usual method is so well known as to need no description; probably no microscopist is without specimens prepared by himself, by friends, or by professional mounters. But how few of the objects are really of value to the biological student? As usually prepared the "insect preparations" are merely flattened-out and feeble reminiscences of what they were when alive; their more minute organs are frequently obscured, or if any attempt at arrangement has been made so as to display the noticeable parts of their structures, the conditions of the "squashed" mounting almost invariably prevent anything like naturalness in the appearance of the object. Mr. Frederic Enock, of 30, Russell Road, Seven Sisters Road, London, a well-known entomologist, has recently presented to the Birmingham Natural History and Microscopical Society a number of preparations of insects of a very different kind from those we have referred to. Some of them are mounted in deep cells without pressure, and in these more particularly the characteristic features of the living insect are wonderfully preserved. Not only is the exterior aspect of the insect presented unimpaired, but very much of its internal structure also can be clearly made out when suitably illuminated. The following is a brief description of the exceedingly beautiful slides presented to the Birmingham Natural History and Microscopical Society:—

1.—Head of Sand Wasp, *(Cerceris arenaria,)* mounted in fluid for examination by paraboloid or as an opaque object. In this preparation all the parts of the head and mouth of the insect are skilfully and beautifully displayed, and an observer could profitably spend some hours in its study. Amongst other interesting organs to be easily made out are the two kinds of eyes, "compound" and "simple," the semi-club-like antennæ, the powerful jaws, with their fringe of fine hairs, and the wonderful labium, with its tiny palpi and delicate ciliated ligula.

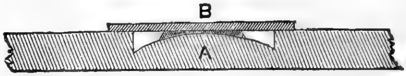
2.—Lace-wing Fly, *(Chrysopa perla,)* mounted in balsam. Every part of this interesting insect is well shown, especially the strongly-spined wing-rays.

3 and 4.—The Common Gnat, (male and female,) *(Culex pipiens,)* exquisitely mounted so as to be attractive to the ordinary observer, and useful to the student of insect anatomy.

5 and 6.—Garden Spider, *(Epeira diadema,)* (male and female.) The mouth parts, spinnerets, and other important organs all well arranged for examination by any powers.

Mr. Bolton sends us the following list of living microscopic objects sent out by him during the last nine weeks to his subscribers:—"Specimens of embryo trout and salmon, *Œcistes crystallinus*, *Rhynops vitrea*, *Hydatina senta*, *Euglena viridis*, *Spirostomum ambiguum*, *Spongilla fluviatilis*, and *Plumatella repens*, just emerging from the statoblast or winter egg. With most of these I have sent drawings from life by Mr. H. E. Forrest, or copies of published illustrations. I have now coming forward *Cristatella mucedo*, the curious locomotive polyzoan, the colonies of which creep about aquatic plants.—Thos. Bolton, 17, Ann Street, Birmingham."

The Weber Slide is a simple but useful contrivance which students of fresh-water life will find a most helpful addition to their appliances. "The ordinary concave slide, though better than a plain slip of glass, does not fulfil all the requirements of the microscopist, and with such a slide it is difficult to keep the object in focus except with very low powers. To obviate these difficulties Mr. Weber has reversed the form of the cell, and forms his slide as shown in the accompanying woodcut,



where A is the convex bottom of the cell, and B the thin glass cover, a drop of water being held between them by capillary attraction. When the cover is cemented down by means of a little waterproof cement the water cannot evaporate, and the whole arrangement forms an air-tight aquarium on a minute scale. The open space forms a chamber which retains a supply of air, and if the animal and vegetable life are properly balanced life may exist in one of these slides for weeks. In the woodcut the thickness of the slide &c., is magnified about four times." This description is taken from the "Journal of the Royal Microscopical Society," Vol. II., p. 56, to the Editor of which we are indebted for the loan of the illustration.

METEOROLOGY OF THE MIDLANDS.

THE WEATHER OF FEBRUARY, 1879.

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

February proved a cold and wet month, fully maintaining the severe character of the winter of 1878-9. Rainfall was above the average, but was, perhaps, not so remarkable for its amount as for its persistency, there being only some five days on which no rain was measured. Snow fell on ten or twelve days, to the depth of from three to six inches on the 1st and 24th. Opening with some days of frost, a thaw set in on the 6th which continued to the 16th. A thaw also marked the last day of the month. The sky was mostly overcast, and there were several foggy days. The barometer ruled low, with variable winds. At Oxford lightning was seen on the 17th, a solar halo on the 20th, and lunar halo on the 7th. The absence of small birds was noticeable; at Orleton "very few blackbirds, and no thrushes, fieldfares, or redwings have been seen;" at Shifnal "all the starlings (of which we had flocks) deserted us, a few only returning at the end of this month; the same with regard to throstles. Blackbirds remained, and were saved, with robins, chaffinches, tits, and hedge-fauvets, by coming to be fed with the sparrows;" at Coundon "no fieldfares or redwings seen in this neighbourhood since December 10th, when three were picked up dead or dying in this garden." Vegetation was very backward. At Burton-on-Trent, hazel and willow flowered on the 22nd. At Coston Rectory the aconite flowered about the middle of the month. At Stroud, "only three plants in blossom, viz., the butter-bur, hazel, and daisy."

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.									
Cainscross, Stroud	W. B. Baker, Esq.	4·11	·74	8	18	54·0	9	20·0	23
Cheltenham	R. Tyrer, Esq.	2·70	·38	13	23	54·8	9	12·4	25
Stroud	T. J. Coley, Esq.	3·88	·70	9	22	56·0	10	19·0	23
SHROPSHIRE.									
Haughton Hall, Shifnal	Rev. J. Brooke	2·26	·35	8	17	50·0	9	21·0	20
Woolstaston	Rev. E. D. Carr	2·83	·47	15	22	52·0	27	20·0	25
Leaton Vicarage, Shrewsbury	Rev. E. V. Pigott	2·76	1·15	8	20	54·2	27	21·0	25
More Rectory, Bishop's Castle	Rev. A. Male	3·22	·47	1	23	52·0	9 & 11	22·0	23, 24,25
Bishop's Castle	E. Griffiths, Esq.	2·85	·31	15	20	53·0	9	21·0	25
Cardington	Rev. Wm. Elliott	2·24	·22	1	17				
Adderley Rectory	Rev. A. Corbet	3·14	·45	8 & 17	19				
Stokesay	Rev. J. D. La Touche	2·51	·47	8	16	54·4	27	22·5	25
HEREFORDSHIRE.									
Whitfield	W. Wheatley, Esq.	4·05	·52	8	24			14·0	23
Stoke Bliss	Rev. G. E Alexander	3·34	·36	15	21	54·0	9	20·0	24
WORCESTERSHIRE.									
Orleton, Tenbury	T. H. Davis, Esq	3·35	·45	8	22	54·8	9	15·0	25
West Malvern	A. H. Hartland, Esq.	3·14	·41	13	22	50·0	9	21·5	24
Pedmore	E. B. Marten, Esq.	2·99	·41	8	21	54·0	9	22·0	24
Longlands, Stourbridge	J. Jeffries Esq.	3·01	·40	8	19	54·0	9	14·0	24
Dennis, Stourbridge	Mr. C. Webb	3·03	s)·40	19	21	52·0	9	14·5	24
STAFFORDSHIRE.									
Thorganby Villa, Wolverhmtn	G. J. C. Broom, Esq.	2·54	·43	1	21				
Amblecote	Mr. J. Robins	2·57	·40	8	21				
Dudley	Mr. J. Fisher	2·50	·33	8 & 19	21	54·0	9	22·0	24
Sedgley	Mr. C. Beale	2·49	s)·45	19	19	50·0	9	24·0	24
Kinver	Rev. W. H. Bolton	2·63	42	8	19	51·0	9	18·0	24
Walsall	Mr. N. E. Best	2·80	·34	1 & 8	19	50·0	9	26·0	1
Grammar School, Burton	C. U. Tripp, Esq.	3·55	·53	17	21	54·0	9	21·0	24
Weston-under-Lyziard R'tory	Hon. and Rev. J. Bridgeman	2·50	·39	8	23	53·0	9	20·0	25
Wrottesley	E. Simpson, Esq.	2·40	·47	8	19	52·6	10	19·8	25
Heath House, Cheadle	J. C. Philips, Esq.	4·09	·72	8	20	53·0	9	22·0	24
Alstonfield Vicarage	Rev. W. H. Purchas	4·75	·82	13	18	49·5	9	12·0	23
WARWICKSHIRE.									
Coundon, Coventry	Lieut.-Col. R. Caldicott	3·33	·51	8	22	51·0	9	20·0	24
Coventry	J. Gulson, Esq.	3·25	·51	8	20	53·0	10	21·0	24
Bickenhill Vicarage	J. Ward, Esq.	3·03	·48	8	18	46·0		19·0	
Oscott College	Rev. S. J Whitty	2·64	·37	1	22	54·0	9	20·9	25
Henley-in-Arden	T. H. G. Newton, Esq.	3·24	·40	8 & 13	21	53·0	9	20·0	25
Rugby School	Rev T. N. Hutchinson	2·88	·45	8	22	53·8	9	23·0	23 & 24
DERBYSHIRE.									
Buxton	E. J. Sykes, Esq.	4·72	·73	7	20	66·1	9	10·9	23
Stoney Middleton	Rev. U. Smith	2·97	·51	8	14	50·0	9	11·0	13 & 23
Brampton St. Thomas	Rev. J. M. Mello	4·18	·70	7	19	52·0	9	16·0	24
Fernslope, Belper	J. G Jackson, Esq.	3·69	·64	8	22	52·0	9	23·0	24
Linacre Reservoir	C. E. Jones, Esq.	3·78	·69	8	17				
Willersley Gardens	J. Tissington, Esq.	4·14	·78	14	11				
Spondon	J. T. Barber, Esq.	2·72	·56	8	21	52·8	9	21·2	24
Duffield	Wm. Bland, Esq.	3·07	·40	4	22				
Trent College	Rev. T. F. Fenn, B.A.	2·88	·60	2	17	55·0	9	18·0	23
NOTTINGHAMSHIRE.									
Tuxford	J. N. Dufty, Esq.	2·44				51·0	9	24·0	2,3,23,24
Hodsock Priory, Worksop	H. Mellish, Esq.	2·76	·49	8	20	60·2	8	17·7	24
Park Hill, Nottingham	H. F. Johnson, Esq.	3·03	·67	8	17	52·5	9	25·0	23
Hesley Hall	B. J. Whitaker, Esq.	2·48	·41	9	19	55·0	10	22·0	24
LEICESTERSHIRE.									
Loughborough	W. Berridge, Esq.	2·45	·43	8	19	55·4	9	18·7	24
Ashby Magna	Rev. E. Willes	2·70	·33	18	20	54·0	9	18·0	25
Market Harborough	S. W. Cox, Esq.	2·84	·35	8	17	52·0	9	21·0	24
Kibworth	T Macaulay, Esq.	2·50	·47	8	18				
Town Museum, Leicester	W. J. Harrison, Esq.	1·96	·30	9	22	54·8	9	23·6	24
Belmont Villas, Leicester	H. Billson, Esq.	2·09	·45	24	18	55·0	9	24·2	24
Syston	J. Hames, jun., Esq.	2·71	·50	25	19	51·0	10	23·0	24
Waltham-le-Wold	E. Ball, Esq.	2·49	·41	8	19	52·0	9	22·0	23
Little Dalby Hall	G. Jones, Esq.	2·17	·35	13	18	52·0	9	20·0	23
Foxton Locks	Union Canal Company	2·26	·35	8	17				
Coston Rectory, Melton	Rev. A. M. Rendell	1·87	·34	8	22	55·5	9	18·5	23
Belvoir Castle	W. Ingram, Esq.	2·22	.42	9	20	55·0	10	16·0	24
NORTHAMPTONSHIRE.									
Towcester Brewery	J. Webb, Esq.	2·98	·38	28	19				
Castle Ashby	R. G. Scriven, Esq.	3·21	·44	10	22	53·0	9	20·0	23
Kettering	J. Wallis, Esq.	2·74	·24	8 & 15	20	54·0	10	21·0	24
Althorpe	G. S. Groom, Esq.	2·57	·37	8	20	53·0	9	18·0	23
Pitsford	C. A. Markham, Esq.	2·69	·44	7	18				
RUTLAND.									
West Deyne, Uppingham	Rev. G. H. Mullins	2·16	·52	15	19	54·0	9	19·0	24
Radcliffe Observatory, Oxford	Mr. H. E. Bellamy	3·31	·39	8	22	53·7	9	23·8	23
Spital Cemetery, Carlisle	T. Bell, Esq.	1·20	·26	9	14	47·8	7	18·0	24
Ventnor Hospital	H. Sagar, Esq.	3·86	·68	9	24	50·3	8	26·1	24
Altarnun Vicarage	Rev. G. Tripp	9·02	1·06	11	23	53·0	15	13·0	25

Correspondence.

Midland Entomology.—I am pleased to find that the subject of "Midland Entomology" is being ventilated in the pages of the "Midland Naturalist." It is now many years since Mr. F. Plant and myself worked this county for Coleoptera. My own reason for abandoning the local for a wider field was the persistent impediments placed in the way of our working all the best hunting grounds, the rich and extensive woodlands owned by the present Earl of Stamford. Previous to my own and Mr. Plant's career, the county had been assiduously worked by my brother, (H. W. Bates,) and in happier times, before the decease of the late earl, when free access to all the best localities was unimpeded. The collections then formed are now all scattered. The neat and handsome little collection of Mr. Plant was offered at a cheap rate to our Museum, but was not taken; the committee I suppose not being able to discern any value in "beetles," even although they were a part of our *local fauna*, the obtaining of which *ought* to be one of the prime considerations in the formation and management of a *local museum*. [This was five-and-twenty years ago. They would know better now.—Eds. M. N.] Fortunately, before this dissemination of our local collections took place, a catalogue of all the known Leicestershire species of Coleoptera was compiled by myself for publication in Mr. Potter's "History of Leicestershire." From some unexplained cause this history never came to anything, there not being, I believe, sufficient subscribers obtained to defray the mere cost of its production. A reference to that catalogue, incomplete as it is, will show that our county is quite up to the average in the production of rare, curious, and interesting species. [By the kindness of Mr. Bates the MSS. of this catalogue has been placed for reference in the Library of the Leicester Museum.—Eds. M. N.] The occurrence of a local variety of the grandest of all British beetles, the *Calosoma inquisitor*, is of itself sufficient to tempt investigators to court instead of "to shun as they would the plague" our local hunting grounds. *Tropideres sepicola* and *Trachodes hispidus* also occur to me, the former being new to the British fauna at the time of its capture; and the latter amounting to a re-discovery. I am glad to find amongst us a Coleopterist of the evident calibre of Mr. Robson, whose acquaintance I shall be happy to make.—Fredk. Bates, Leicester.

Double-headed Salmon.—Among some embryo salmon I have lately watched hatching from the spawn, several have shown abnormal development, and I have just found one with two heads, attached together by the neck, so that it has four eyes, but only two sets of gills, and one heart. In fact all the posterior parts are of the usual normal form of a single fish.—Thos. Bolton.

Aquaria.—My experience is that H. M. need not trouble himself as to what he shall feed his fish with in the winter season, for they do not need feeding during the cold weather. Roach, Dace, and Minnows thrive the best with me. Perch soon die. In the summer small red worms thrown in are soon disposed of, and either in summer or on mild days in winter, when the fish are extra active, bread pressed between the finger and thumb and dropped in after making into very small pellets is readily taken. A piece of raw meat suspended by a string from a little bit of wood will afford amusement, and should H. M. be blessed with bloodthirsty beetles he will probably find that it will be a source of great satisfaction to them.—C. L.

Thistles.—Two years ago a fox covert near here (Ravenstone) was cleared of its underwood, to allow fresh to grow up, and the greater part of the timber was felled. The next year enormous quantities of the common Buck thistle made an appearance, growing to six feet high and so thickly together as to be nearly impenetrable. This is the species of thistle so obnoxious to farmers. I never remember seeing one in the wood before, although they were of not uncommon occurrence in the adjoining fields. What could have been the cause of their sudden appearance?—L. F.

Ornithology.—The break-up of the frost revealed the evidence of a sad mortality amongst the poor birds. Great numbers were picked up dead, especially beneath ivy and hedge bottoms, where they had sought shelter. Mr. Arthur Startin writes me that the few days of intense frost ending on Christmas Day were very fatal. Mr. Startin says: "Since the heavy fall of snow the birds have been able to pick up a little food in the hedge bottoms, as I have noticed that the dead leaves under my fences have been carefully scratched over; during those few severe days land unprotected by snow was hard and impervious everywhere. The Starlings, being insect feeders, have especially suffered here. I picked up myself during those days no less than six of these birds which had fallen dead from the ivy on my house. My workmen found several more, and also Robins. The breast bones of the poor things too plainly showed the cause of death. I had hoped that feeding with the sheep and poultry, and also on crumbs, &c., from the house, the birds would have been safe, but when I found the true state of the case, too late, I at once gave them a little animal food also, and the Rooks discovering this became so confident as to come quite close to the kitchen door. I managed to save the life of one poor robin—which I found nearly dead—by placing it in the greenhouse, where it revived and took food, and afterwards, although allowed to go out whenever the ventilator was open, it always returned, and has now become so tame that it will frequently perch upon my finger and take food from my hand. It has even sat upon my beard and picked bread from my lips. It is a male bird, and now makes the house ring with its song."—John Gulson, Coventry, March 5th.

Ornithological Notes from Derby.—On January 11th a friend of mine, who knows the bird perfectly well, saw a Waxwing at Chellaston, near here. It was pecking out of a wagon on the railway, but he could not see what it was eating.—All winter, up to March 3rd, I had seen very few Chaffinches about my garden, but on that day I saw and heard a great many, all cocks so far as I could observe. Nearly every tree and hedge had its "Pied Finch," as they call them about here, singing away with all its might, as if to welcome returning spring.—On the night of March 7th, at half-past eleven, I was much surprised to hear a Thrush singing, in a small plantation at a short distance from the house; I listened to him for about twenty minutes, and during the whole of that time he was singing as loudly and clearly as if it were daytime, perhaps rather more in snatches than is usual, but not so much as a Missel Thrush. It was a bright moonlight night, with a slight mist, and rather cold, in fact the next morning the ground was white with frost, though it had been a beautiful day. I have occasionally heard thrushes singing on the warm light nights of early summer, but never before so early in the year, and I think the circumstance is worthy of record.—Merlin, Derby, March 16th.

Ornithological Notes.—I lately procured a female Great Spotted Woodpecker, which was killed near here last spring; it is a very rare bird now in this district, and not common anywhere in England. A pure white Swallow was shot here about Michaelmas; it had been seen for some months. Several peculiar Blackbirds have come under my notice lately:—(1) a cream coloured one, shot in the summer; (2) one with white on the sides of the head, picked up dead early in January; (3) a very beautiful specimen with several of the quills in the wings and tail pure white, it had been seen about for some time, and presented a curious appearance when flying; it was shot in October, and I had it preserved; all three were cocks. On December 6th I was shown a Tufted Duck and a Razorbill, which had been received here that morning by a bird stuffer, while they were yet warm; they were probably killed on one of the canal reservoirs. This is the first time I have heard of the latter bird being obtained in this neighbourhood. During December I saw several Water Rails and killed two of them; they are seldom seen except in very hard weather. On the 7th of that month I observed some Wild Geese flying over but could not make out the species, and on the 14th February two were seen on some floods; several more were observed at different times, but I did not hear of any being shot. Greylags are sometimes seen here on the stubbles, and Brents and Canada Geese have also occurred. Snipe have been very plentiful this season, and Bramblings more so than I ever remember. I killed a large specimen of the former early in December; it weighed a trifle over five ounces, the average weight being about 3½. I heard Larks and Yellow Ammers singing for the first time this year on the 8th and 10th of February respectively. Wild fowl were still plentiful with us at the beginning of this month. On the 1st I saw hundreds of Wigeon and Wild Duck, also a few Teal and Snipe. They were still here on the 8th, but in less numbers. Rooks began building on the 5th inst., in one rookery; they are a little late this year owing, I suppose, to their sufferings during the winter. On the 6th I noticed our first summer migrant, the Wryneck; I also saw a pair of Stock Doves investigating a hollow tree where they generally breed. — O. V. A., Bodicote, Oxon., March 11th.

Brown Owls.—The following occurrence may be of interest to some readers. At the commencement of the late winter the natives of a certain village near Ashby-de-la-Zouch were alarmed by hearing what sounded to them unearthly cries, disturbing the silence of the night, and sallied out with lanterns to investigate the cause. The noises suddenly ceased, and the village resumed its quiet, but a month afterwards a fine specimen of a brown owl *(Strix stridula)* was unearthed from the sooty recesses of a chimney. It was a fine bird, measuring 35in. across the wings, and it appears that when it had entered the chimney it had been unable to escape. The screech of the white owl *(Strix flammea)* is a familiar sound about here, but the noise which caused the alarm was a decided hoot. Some writers aver that both brown and white owls hoot, others that only the white does, but I think this is an instance in favour of the latter assertion.—L. F.

Abnormal Hen's Eggs.—About ten years ago, a very large Dorking hen's egg was given my father by the keeper of Allington Lock, about 1¾ miles from here. It was larger even than a turkey's egg. On accidentally dropping it, I was astonished to discover that it contained two yolks and another perfect egg, of the usual size, with a shell of the average thickness. It is now preserved in Maidstone Museum, with the outer shell partly removed, so as to show the smaller egg inside. There are, I believe, similar instances on record of one egg inside another. Small fowls' eggs, too, are not unusual. I have two in my collection not larger than magpie's eggs, and another though of the usual length is not larger round than a blackbird's, and terminates in almost a sharp point, a most singular looking thing. These are not the results of domestication, for I have a jackdaw's egg not so large as a thrush's.—Fred F. Grensted, Maidstone.

[A double hen's egg is reported in "Science Gossip" for 1868, p. 117. In same Vol., at p. 151, is an interesting article on monstrosities in eggs in general, in which the writer says, speaking of the extremes of size in hens' eggs, that he has one little above the size of that of a wren's, and another 4½oz. in weight.—Eds. M. N.]

Gleanings.

THE MIDLAND UNION.—We have pleasure in stating that the Nottingham High School Natural History Society has joined the Union.

PRE-CAMBRIAN ROCKS.—The sum of £50 from the Government Fund for the Endowment of Scientific Research has been granted, on the recommendation of the Royal Society, to Dr. C. Callaway, M.A., F.G.S., of Wellington, Salop, in aid of his researches into the relations of the pre-Cambrian rocks.

AMERICAN QUARTERLY MICROSCOPICAL JOURNAL.—We have received Nos. 1 and 2 of this excellent periodical, which publishes the transactions of the New York Microscopical Society. The articles are varied, many of them being of great value; the illustrations are truly excellent, and the paper and printing as good as can be desired. All the societies in our Midland Union interested in microscopy should subscribe for this journal. It is published by Messrs. Hitchcock and Wall, 150, Nassau Street, New York, and the subscription, post free, is 13s. 6d. per annum.

FREDERICK SMITH, F.L.S., Assistant-keeper of the Zoological Department of the British Museum, died on the 16th February last, aged 73. He was not better known than appreciated by every entomologist engaged in the study of the British Hymenoptera. His loss will be most deeply felt, and a wide gap has been made in the ranks of true entomologists which it will be almost impossible to fill up. All who have been in the habit of submitting their captures of Bees and Wasps to Mr. Smith for identification will feel their loss more and more as their collections increase, for his valuable services in the arduous work of naming specimens were always most willingly rendered, and he did in a few hours what to most others would have been an endless if not impossible task. His work on the British Apidæ is full of original observations. All who attended the late Entomological Exhibition at the Royal Aquarium will remember how willingly he worked to ensure a successful meeting, and how he lent his magnificent and unique collection of British Bees and Wasps, "the work of forty years' patient collecting and study." Though we shall never meet him again, either in our rambles at Hampstead Heath, or in his place at the Museum, (where he had been twenty-seven years,) his name and works, and his prompt willingness to help the young entomologist will never be forgotten by "one who loves to hear the music of the Wild Bee."—F.E.

THICKNESS OF THE ANTARCTIC ICE.—Dr. Croll has sent us a reprint of his paper on this subject, which appeared in the "Journal of Science" for January last. The Southern Pole is enveloped by an ice-cap, which reaches to lat. 70°, and has an average diameter of 2,800 miles, the edge of the ice-cap at any point being thus about 1,400 miles from the South Pole. Its thickness at the edge, where it enters the sea, may be taken at not less than 1,400ft., for icebergs, whose total thickness would several times exceed this amount, have frequently been seen floating from it northwards. From the edge the thickness must gradually increase to the South Pole. A slope of half a degree would give a thickness of twelve miles of ice at the Pole, which is probably a very low estimate. Dr. Croll then applies these facts to the consideration of the last glacial epoch in the northern hemisphere, insisting that the magnitude of the ice-sheet which then enveloped Scandinavia and the British Isles has been much underrated. In an appended note he states that two of the officers of the Scotch Geological Survey, Messrs. B. N. Peach and J. Horne have lately found unmistakable proofs that the Shetland Isles were glaciated by land-ice from Scandinavia.

New Geological Formations.—Dr. Henry Hicks now recognises three formations in Wales of earlier date than the Cambrian rocks. The beds which form them were mapped by the Geological Survey, either as igneous, or as altered Cambrian or Silurian rocks. In Pembrokeshire he distinguishes beneath the Harlech (Cambrian) group a mass of volcanic breccias and ashy schists and slates, perhaps 8,000ft. thick, on which the Cambrian beds repose unconformably. For this series Dr. Hicks proposes the name *Pebidian* from Pebidiauc, the name of the division or hundred in which these rocks are mainly exposed. They in their turn rest unconformably on compact quartz schists, chloritic schists, and indurated shales with beds of dolomitic limestone. The base of these beds is not seen, but they have a very high dip, and the thickness exposed is estimated at 15,000ft. Dr. Hicks has named them *Dimetian* from Dimetia, the ancient name for a kingdom which included this part of Wales. In 1877 the presence of both these series of rocks was proved in Caernarvonshire, in North Wales, and at the last meeting of the Geological Society, (Feb. 5th, 1879,) Dr. Hicks stated that he had ascertained the presence of a third new group of pre-Cambrian rocks, which forms ridges of quartz-felsite in the neighbourhood of Haverfordwest. They lie between the Dimetian and the Pebidian rocks, and he proposed to name them *Arvonian*. Of course these names are only proposed provisionally, and as a matter of convenience; but there can be little doubt that the great advances made in late years in the study of igneous and metamorphic rocks, together with the introduction of the use of the microscope, will greatly alter our ideas of the nature of many of these old rocks, and will render their thorough re-examination a matter of necessity.

MIDLAND UNION OF NATURAL HISTORY SOCIETIES.

The Second Annual Meeting of Members will be held at Leicester, on Tuesday and Wednesday, May 20th and 21st. A circular will shortly be issued to all members of Societies in connection with the Union, containing the full programme of this Re-union of Midland Scientists and their friends. The members of the Leicester Literary and Philosophical Society are working hard to make the meeting a success, and the Mayor of Leicester has kindly granted the use of the new Municipal Buildings. The Excursion to Charnwood Forest on the second day, (May 21st,) it is proposed to divide into two parties, one mainly Geological, and the other mainly Botanical, so as to avoid the inconvenience arising from the presence of such a large number in a single party as would render it unwieldy and unmanageable. Full particulars of the proceedings proposed for both days will be published in the May number of the "Midland Naturalist."—Edward W. Badger, W. Jerome Harrison, Hon. Secs. to the Council.—Birmingham, March 24th, 1879.

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—February 25th.—Geological Section.—Mr. W. Southall was elected President of the Section.—Mr. T. H. Waller read some notes on "Fluid Cavities, and other Inclosures in Crystals," giving a short sketch of their general characteristics, and of the method in which they have been produced, with some of the deductions which have been drawn from observations made on them. Specimens illustrating various points in the paper were exhibited, and a section of obsidian from Mexico, showing a polarising structure produced by the straining of the glass round some of the included felspar crystals. March 4th.—General Meeting.—Mr. Thos. Bolton exhibited embryos of trout and salmon, and young *Plumatella repens* and *Fredericella sultana*, emerging from the statoblasts.—Mr. J. E. Bagnall exhibited three mosses—*Fissidens exilis*, from Knowle, rare in Warwickshire; *Andræa homomalla*, recently added to our British flora; and *Buxbaumia indusiata* from Ballater.—Mr. Lawson Tait read a long and elaborate paper on the gland structures of digesting plants, referring chiefly to the Nepenthes or Pitcher plants, describing the different zones of cells, glandular or otherwise, which line the interior of the pitchers, and the functions which each zone performs in capturing, retaining, or digesting insects. March 11th.—BIOLOGICAL SECTION.—Mr. J. E. Bagnall exhibited *Aulacomnion turgidum*, a moss new to the British flora, and microscopical preparations of other species. Also curious specimens of prolification in leaves of *Cardamine pratensis*.—Mr. T. Bolton exhibited a large collection of organisms from Kinver, including *Melicerta ringens*, *Limnias ceratophylli*, and other rotifers, several species of Infusoria, Radiolaria, &c.—Mr. Cotton exhibited a collection of Foraminifera from Barmouth, and from the winter quarters of the Alert.—Mr. A. W. Wills gave some notes on some of the Unicellular Algæ, dwelling especially on the value of a study of these plants as giving a clear insight into the laws of cell structure and growth, and prefacing an account of the family Palmellaceæ, from which his illustrations were chiefly drawn, by a summary of the views now generally accepted by botanists on the subject of the morphology of the vegetable cell. These remarks were illustrated by a number of specimens, living and mounted, belonging to the genera Protococcus, Chlorococcum, Palmella, Tetraspora, Glœocapsa, Urococcus, Apiocystis, &c. March 18th.—MICROSCOPICAL GENERAL MEETING.—Mr. E. W. Badger exhibited mounted specimen of the larva of Tortoiseshell butterfly, showing the spiracles and tracheal system; also, on behalf of Mr. Fredk. Enock, six beautifully prepared entomological slides, presented to the Society by Mr. Enock.—A cordial vote of thanks was passed to the donor.—Mr. W. G. Blatch, after some remarks on the above, exhibited a minute beetle, *Bryaxis Waterhousei*, found only at the sea-side in a very few localities.—Mr. T. Bolton exhibited living edible frogs (*Rana esculenta.*)—Mr. W. R. Hughes exhibited skin of the common sole (polariscope) and *Artemia salina*, the brine shrimp, an Entomostracan found in the salt-pans at Lymington, Hants, mounted by Mr. Enock.

BIRMINGHAM AND MIDLAND INSTITUTE SCIENTIFIC SOCIETY. —February 26th.—Mr. W. Russell exhibited and described some Electrotasimeters constructed by himself. Their sensitiveness was shown by their indicating the expansion of a strip of ebonite when breathed upon. March 12th. —Dr. Wm. Hinds read an interesting paper on "Hyphal or Basal Fungoid Tissue." The subject was illustrated by drawings and microscopical preparations.

BIRMINGHAM SCHOOL NATURAL HISTORY SOCIETY.—February 28th.—GENERAL MEETING.—A paper was read by F. Pearson, entitled "Birds and their Nests." Microscopical objects were exhibited by A. B. Badger. Twenty-two new members were elected. March 14th.—GENERAL MEETING.—A paper was read by H. F. Devis, entitled "A Walk round Dolgelly;" mounted specimens of plants were exhibited by him, including the following:—*Impatiens Noli-me-tangere*, *Campanula* (*Wahlenbergia*) *hederacea*, *Asplenium viride*, *Linaria repens*. Five new members were elected, who completed the Society's numbers, namely, fifty.

BURTON-UPON-TRENT NATURAL HISTORY AND ARCHÆOLOGICAL SOCIETY.—March 11th.—Mr. J. Charles Cox, author of "The Churches of Derbyshire," read a paper on "The Recent Excavations at Dale Abbey." After giving an outline of the history of the abbey, he gave an account of the excavations. About six months ago there was nothing to be seen but a lofty arch standing in the middle of a large grass field. Mr. St. John Hope happened just before then to meet with a plan of Dale Abbey drawn by Dr. Stukeley in 1730, and he laid the matter before the Derbyshire Archæological Society. It was resolved that the ground should be excavated, and after the preliminary arrangements had been made the work was commenced. After removing about five feet of earth they came to the foundations of the abbey, the walls of which were from two to between four and five feet above the level of the floors. They had now excavated to the boundary of the field, and had discovered the choir, (eighty feet long by thirty-five feet wide,) a double aisle on the south, the foundations of the central tower, north and south transepts, a square chapel, and other buildings on the south side, but the western part had not yet been excavated owing to the fact that cottages had been built on the site. Four-fifths of the buildings found were of the decorated style of architecture. Mr. Cox then gave a list of the "finds," pointing out particularly the large number of encaustic tiles—some of which were unique, and were found in their original positions—the high altar *in situ* at the east end of the choir, a number of tombs and monuments, the beautiful mouldings, and one large block of Purbeck marble. He described a number of other articles which had been found, and, as he had photographs of some of them and a large map of the excavations, he was able to make the address interesting and explicit. In concluding, he cited several legends attached to the abbey, and appealed to the members of the Burton Society to make the abbey the destination of one of their excursions.

CARADOC FIELD CLUB.—At a recent meeting the following were elected officers for 1879:—President, Rev. J. D. La Touche; Vice-Presidents: Rev. W. Jellicorse, Rev. J. J. Lambert, Mr. Wm. Phillips; Honorary Secretary and Treasurer, Rev. William Elliot. The following Field Meetings were decided on:—Wednesday, June 25th, Coalbrookdale; Wednesday, July 30th, Welshpool; Wednesday, August 27th, The Stiperstones; Wednesday, September 24th, (Special for Cryptogamic Botany,) The Wrekin.

DUDLEY AND MIDLAND GEOLOGICAL AND SCIENTIFIC SOCIETY AND FIELD CLUB.—March 13th.—At a committee meeting, held this day, the following Field Meetings were arranged for, and several new members elected:—April 22nd, Froghall, Cauldon Low, and Cornsall Wood, with the North Staffordshire Field Club; May 20th and 21st, Leicester, with the Midland Union; June 18th, Annual Meeting at Dudley and Frankley; July 24th, Shatterford and Arley Castle; August 22nd, Cheltenham; September 23rd, Sutton Park; October 20th, Bushbury, and Evening Meeting at Wolverhampton.

EVESHAM FIELD NATURALISTS' CLUB.—January 22nd.—The Rev. Canon A. H. Winnington Ingram, F.G.S., read a paper on "The Glacial Deposits of the Vale of Evesham." He divided them into four groups. The oldest, capping the Craycombe and Lench Hills, had been deposited by a marine current from the north, was destitute of animal remains, and composed chiefly of quartzose pebbles, many of which were halves of rounded fragments of transition rocks. The pebbles had been cloven in two probably by the action of intense frost. The next series of drift was also a marine accumulation after an elevation of the land, and was found on subjacent eminences, rising from seventy to 120 feet above the level of the Avon. This gravel is composed of waterworn fragments of older rocks, and includes on Green Hill some very large perfect flints with marks of Glacial Striation, transported, no doubt, on ice from a south east direction. The beds of gravel and sand at Harvington, Norton, and Lenchwick were laid down by the sea after it had retired from the higher ground, and left a wider area for animal life. Bones of the mammoth and other mammalia appear in this drift, and there are signs of a large river from the north having debouched into the marine waters. The gravel terraces occurring on both banks of the Avon were formed by the river when it flowed in a stream more than half a mile broad. The fluviatile origin of these terraces of sand and pebbles is indicated by the occurrence of river shells at their base. The presence of antlers of reindeer, and bones and teeth of the long-haired elephant and woolly rhinoceros, bespeaks a cold climate at the time of their deposition. The association of the teeth and tusks of the *Hippopotamus major*, a congener of which is at present a native of South and Central Africa, with the relics of northern animals, may be explained by the supposition that the bones of the latter were floated on river ice, from a colder territory, or by the hypothesis of intervals of a genial climate occurring in the ice age, more suited to the condition of life of the river-horse, which could not have existed when the watery element in which it delights was frozen over during a great part of the year, and the adjoining land supported only stunted birches and mosses and lichens, the food of the reindeer. Fresh-water shells in a layer of fine sand at the bottom of those highly interesting gravel deposits, near the New Inn at Cropthorne and Little Comberton, testify that they owe their origin to the neighbouring rivulets which formerly flowed in a much larger volume of water, and so seem to afford a corroboration of Mr. Tyler's theory of the existence of a time of more abundant rainfall, which he styles the pluvial period. The Beckford sand and local gravel beds are proved by the presence of sea shells of boreal type to be of marine formation and the abundance of mammalian remains in them, including *Bos primigenius*, *Bos longifrons*, and *Bison priscus*, and the bones of horses, red-deer and bears in the Cropthorne and Little Comberton drift help to give a picture of the fauna of the period when they were accumulated. No implements used by Palæolithic man had as yet been discovered in the drift of our district, but a very fine polished flint axe turned up from the soil of Harvington, probably by the deeper penetration of the steam plough, testified to the existence of Neolithic man, who after a long interval of time succeeded his Palæolithic predecessor. A slate bracer in Mr. Ingram's cabinet and described by Mr. Evans in his work on stone implements, may have protected the wrist of some Neolithic savage when he directed his arrow against the carnivorous creatures with which he disputed the dominion over the beasts of the field. Mr. Ingram agreed with Mr. James Geikie in considering the existence of the ice age of which our gravels afford indisputable evidence as due to the winters of our hemisphere occurring when the earth was in aphelion, or at its farthest distance from the sun, and not as they do now, when the earth is in perihelion, or nearest to the sun. A contemporary occurrence of a maximum ellipticity of the earth's orbit increasing the distance of our planet from the centre of heat by 8½ millions of miles would necessarily intensify the cold. This astronomical phenomenon happening vast ages ago, and the slow dripping of stalagmite on cave deposits contemporary with a portion of our gravels all agree in corroborating the opinion warranted by the investigation of our drifts, that a period of long duration must have elapsed during their accumulation, disturbance, and redistribution. In fact, if astronomy affords us an insight into the immensity of space, geology offers to our contemplation an infinity of time.—March 5th, Mr. J. S. Slater read a paper on "The Reproduction of Ferns," illustrated by specimens under the microscope.

NOTTINGHAM LITERARY AND PHILOSOPHICAL SOCIETY.—Natural Science Section.—February 28th.—Mr. Henry Hartnell read a paper on "The Mechanical Equivalent of Heat, and How it has been Determined." The terms "work" and "energy," as used by scientists, were explained. "Work" was defined as the production of motion against resistance. "Energy" denotes simply the power of doing work. The principle of the conservation of energy was explained, and examples given of the different forms of energy. The conversion of work into heat, and the experimental methods by which the numerical relation between the quantity of heat and the quantity of work has been determined, were dealt with. In establishing the convertibility of work into heat, Joule showed that to raise a pound of water 1°F. in temperature required the expenditure of as much energy as would raise a weight of one pound to a height of 772ft. Joule made experiments in the friction of solids and fluids, in magneto-electricity, and in the condensation of gases. In these experiments the mechanical energy of a suspended weight was transformed, by the friction of a paddle rotating in water, into heat, and the temperature of the water raised. Iron discs were rotated in contact with mercury. Mechanical energy was expended in generating electric currents by induction, which, in turn, were converted into heat, and by comparing the work expended with the heat produced the mechanical equivalent was deduced. The experiments in the condensation of gases gave approximate results. March 7th.—Mrs. Cowen read a paper on "A Ramble in the Inner Hebrides." Starting from Glasgow, steamer was taken at Greenock, through the Kyles of Bute, along the lower part of Loch Fyne, through Crinan Canal, past the Slate Islands, to Oban and the Isle of Mull. At the latter place Loch na Keal and Craig Craiggen were visited. The geology of the Island of Mull was described. The following botanical specimens were gathered:—Bog Myrtle, Drosera, Cotton Grass, and Bog Asphodel. The Island of Eigg was next visited, and the geology of the Scuir described. and illustrated by a photograph taken by one of the party. Specimens of the fossil conifer *Pinites Eggensis* were obtained in the conglomeratic beds beneath the pitchstone of the Scuir. From Eigg the ramble led through the Sound of Sleat, to Raasay, Portree, and Gairloch, and the geology and scenery of the route were described. Mr. J. J. Harris Teall, M.A., F.G.S., gave a description of the microscopic structure of the pitchstone from the Scuir of Eigg, of which the following is an abstract:—The matrix is of true pitchstone, with crystals of glassy felspar, (sanidine ;) some of the specimens have a felsitic matrix. Under a 1in. the matrix is brown and granular, and a banded structure may be seen, probably produced by the movement of the mass when in a viscous condition. The interbedded crystals are of two kinds, 1st, of glassy felspar, which are transparent, 2nd, opaque crystals. The glassy felspar crystals are of irregular forms, triangular, oblong, &c. In some cases the characteristic faces of orthoclase may be recognised. They are traversed by irregular cracks along which, as also along the edges, decomposition in certain cases has set in. The glassy felspar contains the opaque crystals, and also well marked gas cavities. The opaque crystals are more regular in form, and belong to the hexagonal system. I have never seen biotite so opaque, but I am disposed to call them by that name. The whole specimen is traversed by irregular cracks, along which decomposition has taken place. The cracks are filled with a yellowish deposit. When viewed with polarised light and crossed prisms the matrix produces a slight action, showing that it might be more appropriately termed felsite. This action is no doubt due to the great number of exceedingly fine crystals which can be detected under a higher power. The matrix in which these crystals are imbedded may be truly glassy. The felspar shows fine colouration, the prevailing colours being blue, red, and yellow. In several instances the edges of the crystals are surrounded by iris coloured rings, which mark the progress of decomposition. In some cases the glassy crystals contain a number of very fine acicular crystals, probably apatite. This phenomenon is by no means common. The fine acicular crystals are only found as endomorphs along with the opaque crystals. The section of Pinites from the Scuir of Eigg shows all the characters of a transverse section of an ordinary pine. The annual rings are well marked, and turpentine vessels exceedingly rare. The autumn cells are smaller than those formed earlier in the year. The decomposed portions show a rude pentagonal or hexagonal structure, and in the centre is a small portion of tissue still showing the characteristic structure, and from this part radial lines are prolonged.

NOTTINGHAM NATURALISTS' SOCIETY.—February 5th.—The Hon. Sec. (Mr. L. Lee) delivered an address on "Marine Aquaria," in the course of which he described the methods to be pursued for the successful management of aquaria generally. The address was illustrated by diagrams. February 19th.—General Meeting, to receive a report from the committee appointed at the last Annual Meeting to consider the rules of the society. March 5th.—Mr. C. Thornton read a paper on Animalculæ, and exhibited specimens of Hydra. The paper gave interesting particulars of pond-life. It was illustrated by diagrams. Localities were mentioned where animalculæ may be found.

SEVERN VALLEY NATURALISTS' FIELD CLUB.—March 7th.—The Annual Meeting was held at Bridgnorth, when the following were elected officers for the year:—President, Mr. T. Martin Southwell; Vice-presidents: Mr. J. G. P. Smith, Mr. A. Mathias, Rev. A. T. Pelham, and Mr. S. T. Nicholls; Secretary, Mr. Rowland W. Ralph, Honnington Grange, Newport, Salop. Field Meetings as under were arranged:—May 20th, Bewdley, for Habberley Valley and the Severn; June 10th, 11th, and 12th, Barmouth; July 17th, Ludlow.

EXCHANGE.

Coleoptera.—*Anchomenus puellus*, for other local species.—Address, W. G. Blatch, Green Lane, near Birmingham.

Microscopic Slides for Exchange.—Synapta skin; diatoms from New Nottingham, South Jarras, Oran, Kristianstad, Franzensbad, &c.; Helispeltas, Arachnoidiscus, Isthmia, Melosira, &c.; parasites of black rat, mouse, pigeon, &c.; Polar: Naphthaline, sulphate of magnesia and copper, citric acid, stearic acid, &c.; Polycystina, Foraminifera, and anatomical sections stained; also insect slides.—William J. Fuller, Broad Plain Soap Works, Bristol.

RAMBLES WITH A HAMMER.

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

In writing an account of some geological walks in the midland counties, we wish at the outset to state briefly the purpose of our remarks. Selecting, as far as possible, districts which exhibit typically certain rocks, we propose to point out how these may be best reached and studied in the course of one or more day's walking, describing the sections to be visited, and giving such a general idea of the route as will enable the visitor to have a knowledge of any remarkable objects to be met with on the way.

We shall estimate an ordinary summer day's walk of this kind at from twelve to fifteen miles, a distance which will be found well within the powers of an ordinary individual of either sex. Only those who have tried it can form an idea of the pleasant and thorough way in which a country can be seen in this manner, or of the improvement in health, as well as knowledge, which result from it.

In clothing we advise stout lace-up boots, a light felt hat, and flannel next the skin. A good square-headed hammer is indispensable, as also a small compass and the Ordnance or Geological Survey Map of the district if possible. A good bag, satchel, or knapsack in which to carry provisions, &c., will also be needed; a clinometer, trimming hammer, chisel, pocket lens, and tape measure are of course useful, but may be taken or left according to the special object of the trip; a good plan is to go twice over the ground, on the first visit getting a good idea of the nature and lie of the rocks and the salient features generally; whilst on the second occasion rocks and fossils may be collected, and the sections studied in detail. A note-book and pencil should always be carried.

RAMBLE NO. I.—OVER CHARNWOOD FOREST.

In selecting a region for a first ramble, our thoughts naturally fell upon Charnwood Forest, partly because of the age of the rocks and the accessibility of the district, but more especially because we trust that many of our readers will during this month avail themselves of the annual meeting of the "Midland Union" at Leicester to pay a visit to this remarkable outcrop of palæozoic rocks in the very centre of England. Charnwood lies within the triangle formed by the towns of Ashby-de-la-Zouch, Loughborough, and Leicester. Its shape is an oval formed of hilly ridges trending north-west to south-east, the distance from Gracedieu to Groby being about eight miles, while the width at right angles to this from Bardon Hill to Forest Gate is about five miles. Mountsorrel is an outlying mass on the edge of the Soar Valley, two miles to the north-east, whilst syenitic bosses crop up as far southwards as Sapcote, nine miles from Groby.

The forest area is formed by crystalline and metamorphic rocks, which are, however, at many points covered over by Triassic red marls, the latter running up the valleys in long tongues. The metamorphic rocks are a great series of volcanic ashes, grits, breccias, and slates, destitute of fossils so far as yet known, and of which the precise age (except that they are certainly pre-carboniferous) cannot be decisively ascertained. These are pierced and disturbed by syenitic masses of later date, and the whole region appears to owe its existence at the surface to an extension of the same upheaving forces which elevated the Pennine chain. An anticlinal line traverses the forest from north-west to south-east, which is also a line of fault. East of this line the strata dip (on the whole) at a pretty high angle to the north-east, and on the other (western) side we find them inclining in the same way to the south-west.

The Midland main line from Leicester to Nottingham affords a fair view of the eastern ridge, while the branch line from the former town to Burton passes along the western side. The line from Ashby to Derby, *via* Melbourne, is of little service to the visitor, as the trains are few and fit in badly.

At least two days are required to "do" the Charnwood rocks properly, of which one should be devoted to the south and east, and the other to the centre and north of the chain. One or other of these may be taken first, according to the direction from which any person arrives; and, of course, either may be begun at the end which is most convenient.

First Day's Walk, from Sileby, by Mountsorrel, Brazil Wood, Swithland, Old John Hill, Bradgate Park, Newtown Linford, and Groby, to Leicester, (thirteen miles.) Getting out at Sileby, (on the Midland main line, seven miles north of Leicester,) we walk westwards through the village, stopping to take a brief look at the fine church (Decorated Gothic, Henry VI.) and the ancient elm tree 30ft. in circumference, which grows in the churchyard. Starting from the church we may either take the north road and first inspect the extensive limestone quarries in the Lower Lias, which lie about halfway between Sileby and Barrow-on-Soar, or, avoiding this detour, which will be about a mile out of our way, take the west road, which leads straight to Mountsorrel. A pleasant half hour's walk across the alluvium of the Soar ends in the main street of the long, narrow village. Turning to the right, we seek the Granite Company's Offices, and obtain leave to inspect the quarry, a request ever kindly granted by the courteous manager, (C. H. B. Hambly, Esq.,) himself a good geologist, and one of the earliest students of the Royal School of Mines. Then, walking up a narrow passage opposite to the offices, we find ourselves in the midst of a scene of great animation. In front rises a grand wall of rock, nearly half a mile long, and about 100ft. in height. On the floor lie enormous blocks of the rock, and in long lines of wooden huts some 600 men and boys are engaged in breaking these up into setts, kerbs, &c. Tiny steam engines, the "Fairy," "Pixy," &c., are puffing up and down, conveying heavy loads to the powerful steam stone-crushers, and carrying finished material by a branch line to the company's siding near Barrow. The rock is a hornblendic granite, consisting of felspar, quartz, hornblende, and a very little mica. There are two principal varieties, grey and pink, the difference being caused by the variation in tint of the felspar. Embedded in the stone are many darker more finely crystalline lumps, which may, perhaps, be included fragments not quite melted down. A basaltic dyke, known as the "Great Fault," runs obliquely across the face of the quarry from north-west to south-east; it is of a bluish tint, and is overlaid by breccia and "mush," as the workmen style any soft, decomposed rock. Crystals of iron pyrites are common in the granite, and a rather rare mineral, *molybdenite* (called "lead" by the men,) is not uncommon. At the entrance of the quarry the triassic red marls may be seen resting on the granite; they are much ripple-marked, and contain large blocks of stone at their base. Climbing the ridge which bounds the quarry on the right hand or northern extremity, we look over into a hollow containing some fine examples of glaciated rock-surfaces. Ascending the hill we reach the spot once occupied by a windmill, a well-known landmark, removed in consequence of the advance of the quarry "face." Here is a very typical felstone dyke, only about eight inches thick, of a compact texture, and pinkish colour. Several other dykes or veins of similar material occur in the quarry, and are called "salmon" by the workmen. From this point there is a fine view across the Soar Valley to the marlstone ridges of East Leicestershire. The rounded hill to the south-east is Billesdon Coplow, the promontory due east Borough Hill. On the north-west, the great expanse of Buddon Wood lies close at hand, where the lily of the valley still flowers, and where enormous ant-nests excite our curiosity, and send us with renewed pleasure to the perusal of Sir John Lubbock's papers on their habits; beetles, too, are many, and include some rare species. But we must turn to the west and then south-west, leaving this inviting spot on our right, until after walking a mile we reach some cottages, standing on another granitic tor, called Kinchley Hill. Going still south-west we cross a brook by means of a great slab of Swithland slate which forms a capital bridge, and walk along the side of Brazil Wood, until an outcrop of rock in the middle of a field on our right induces us to walk up and examine it. This little knoll is formed of *diorite* (felspar and hornblende.) It is a coarse, dark rock, and excessively tough, as the rock collector will find when he attempts to secure a good specimen. Next we enter the wood on our left by a gate, and stand in front of a small quarry of gneissic rock, while within a few yards there is a final outcrop of Mountsorrel granite. The gneiss and diorite occur at this point only, and to discover their relationship to each other and to the granite it will be necessary to make a small excavation to lay bare the line of junction. Returning to the field path we walk on, noticing Swithland Hall (Lord Lanesborough's seat) on the south-east (left hand,) and in ten minutes enter the village of Swithland, where, if needful, we can recruit at "The Griffin." Continuing our walk westwards we reach the cross-roads, where large deserted slate quarries afford us our first glimpse of the metamorphic series. Standing on the edge of the pit we can discern the bedding and dip (30° E.N.-E.) by means of the *stripe*, or variation in tint of the beds owing to difference of texture and weathering. West of the road are the lovely grounds and house of The Brande, where the late Mr. Alfred Ellis loved to encourage the residence of every wild animal and bird native to the district (see his letters to the *Times* on the habits of the badgers who made their home here.) Turning to the left hand and going southwards we enter a bye-road which leads through Swithland Wood. Here is a quarry of great depth, (about 250 feet,) worked by Messrs. John Ellis and Sons. The slates are of a dull blue tint, not cleaving so well as the Welsh slates, but producing a roofing material which is practically everlasting. The dip is E. 30°. No fossils, we have already remarked, are known to occur in any Charnwood rocks, yet every student would do well to search these Swithland slates. Prof. Morris once told us that long ago he devoted three days to the task, and felt some chagrin at his want of success; but "never despair" must be the watchword, and it is our firm conviction that these Charnwood strata will yet at some point or other yield us evidence of life. How all-important such a discovery would be it needs no words to point out. Other attractions of Swithland wood are the many rare mosses, and the snakes and blind-worms which may be found by turning over a few of the large stones. Going south, and clambering, if necessary, over one or two stone walls, we strike the straight piece of road which runs up Ling Dale, and which, with its northern continuation to Sheepshed, runs so nearly along the line which separates the eastern and western dips, that it deserves the name of the "Anticlinal Road." Turning to the left (south-east) and walking down this road we reach Holgate (Hall-gates) Lodge, and enter Bradgate Park on the right. The path runs right through this famous demesne, leaving Holgate Hill on the right, and with a large reservoir (140 acres) on the left. Soon we pass the ruins of Bradgate House, once the home of Lady Jane Grey. A little quarry on the left hand (across the brook) shows quartz-grit, and fine slates. Old John Hill, capped by a tower, (a modern erection,) rises on the right hand to a height of about 720ft., its sides and top show well the banded slates so characteristic of Charnwood; they dip 60° south. Close at hand (south-west) is the village of Newtown Linford, where artists flock in summer to sketch the fine "bits" of scenery in the neighbourhood, and where, at the "Bradgate Arms," (Beck's,) every want can be supplied.

Taking the south road, (nearly opposite the little old church,) a mile's walk brings us to Groby Pool, a fine sheet of water, forty acres. Further on is a large syenite quarry (left-hand side of road) where the Triassic marls are very finely exposed, dipping away from the igneous rock. Now we near Groby Village, and observe a mound on the right, the only vestige of the old castle; close by is part of an old manor-house, the residence of Elizabeth Woodville, afterwards the queen of Edward IV. Then turning to the left (east-south-east) we have a four miles' walk over the Trias to Leicester.

Second Walk, from Bardon Hill to Green Hill, High Towers, Charley, Nanpantan, Forest Gate, and Loughborough.

Bardon Station is on the Leicester and Burton branch of the Midland Railway. As many trains do not stop there, it may in some cases be more convenient to get out at Coalville (the next station towards Burton) and join the route here given at the Forest Rock Inn.

The north-east road from Bardon Station leads to the Birch Tree Inn, at the back of which is an exposure of pinkish slates and grits (dip 80° south-west.) Then, making for the tall chimney of the crushing mill, a wood on the right contains a knoll of rock, composed of volcanic breccia, irregular masses of slate, &c., embedded in an ashy matrix. At the entrance of the lower quarry is a bed of finer breccia, and further in a remarkable shale-bed (called a "fault" by the workmen,) and thirty yards further a remarkable rock, (on the left hand,) containing large quartz and felspar crystals. The main mass of the quarry, (which the men call "good rock,") is apparently a highly altered slate. The floor of the upper quarry is sixty feet above the one below, and a path leads thence to the top of the hill, (902 feet,) the highest point in Leicestershire. This is an important trigonometrical centre, and here we see the cairn built by the Ordnance Survey. The view is most extensive, extending to Black Tor in Yorkshire, (fifty miles north-west,) Lincoln Minster, (48½ miles north-east,) Stow-on-the-Wold, (fifty-nine miles south,) the Wrekin, (fifty-two miles west,) the Longmynds, (sixty-six miles west,) &c., and embracing an area of over 9,000 square miles. Facing north-east, the forest region lies spread out at our feet like a map. Markfield Knowl on the right shows its cone eaten half away by the remorseless quarrying to which it has been subjected. We recognise Old John with its tower, whilst right in front rises Beacon Hill. Near the northern foot of Bardon is Green Hill, on which is a conspicuous house having a turret and cupola, (Thos. Nevinson, Esq.) The ridge running to the left forms High Towers, Peldar Tor, &c., and just at its south-west foot runs the great Coleorton fault which bounds the Leicestershire coal-field, the coal seams rising as they approach it till they become vertical. Prof. Hull estimates the "throw" of this fault at 2,200 feet.

Descending the north-west side of the hill through brushwood and fern we quickly reach Green Hill, a porphyritic rock, the embedded crystals of quartz and felspar having probably been ejected from a volcanic vent, a theory which their broken condition goes far to prove. This bed is probably identical with the one already described in Bardon Quarry, and shows that that hill has been thrown forward by a cross fault; the same bed is again seen further north-west at Peldar Tor. Gaining the high road we turn to the left, and then cross a field on the right ascending the High Towers ridge. Here a bed of breccia, containing immense masses of slate, is well exposed; some of these are six feet long, and strangely contorted. A little reservoir is close at hand, Timberwood Hill lies next on the right, and Ives Head is the bold prominence in the north-east.

Walking along the ridge it is just possible that a call at the Forest Rock Inn may be deemed desirable, which will involve a slight detour to the left, (south,) where the inn stands at the cross roads. Returning along the north-east road, we leave on the left the Roman Catholic Reformatory and the well-known Monastery of St. Bernard, (founded in 1835, Cistercian order, buildings designed by Pugin,) and enter a private road on the right, leading to Charnwood Lodge. Here is a wonderful mass of agglomerate, standing like a wall, and full of fragments of all sizes, the ruins in all probability of some long-vanished volcanic cone. Continuing north-east across the moorland we reach the Hanging Stone, an immense block of breccia, poised on a lower mass; this was once a logan or rocking-stone. The Oaks Church now lies close to on the north; the rocks near it are grey grits and pale slates, (dip south-west.) Keeping to the right we cross Blackbrook, and walk south-east for 1½ miles to the cross roads at Bawdon Lodge, and then turn north (to the left.) Now we cross the anticlinal line, leaving the grassy outline of Charley Knowl on the left; half-a-mile on, and to the right is Whittle Hill, famous for its little quarry in a bed of compact siliceous slate, which yields whet-stones of the first quality, known to workmen all over England as "Charley Forest Hones," (dip east 35°.) Here we are close to Beacon Hill, (south-east,) and can admire its fine outline; its height by aneroid is 850 feet. Regaining the Loughborough road, we walk still northwards, crossing the ridge, and noticing the grand rhododendrons of Longcliff on the left hand; half-a-mile further on we ascend Nanpantan, the little hill on the right, where banded slates are splendidly exposed. Walking on to Loughborough, a deserted quarry on the right-hand shows a volcanic breccia, in which the imbedded fragments of slate, &c., stand out with remarkable clearness from the ashy glistening matrix. From this point it is 2½ miles to the station.

The metamorphic rocks of Charnwood, the ashy slates, grits, breccias, agglomerates, &c., would seem to have been ejected from a series of low cones in the neighbourhood of a tranquil shallow sea, or large lakes. Their total thickness is not much under 10,000 feet. They much resemble the Borrowdale series of the lake district and so may be of Lower Silurian age, but Dr. Hicks has lately found volcanic rocks in his pre-Cambrian (Pebidian) beds. As no fossils have yet been found, and as the oldest rock in the neighbourhood is the carboniferous limestone, which at Gracedieu, on the north end of the forest, is known to rest unconformably on the slates, the age of the latter must remain for the present an open question. The syenitic masses are plainly intrusive, and are therefore of later date. For detailed information the reader should consult an admirable paper by Prof. Bonney and the Rev. E. Hill, "Quarterly Journal Geological Society," Vol. xxxi. p. 754, and Vol. xxxii. p. 199, 1877-78, or my book on the "Geology of Leicestershire and Rutland."

NOTES ON THE HAWFINCH.

The Hawfinch about Derby.—It seems to be the general opinion of ornithologists that the Hawfinch has of late years both extended its range in this country and become more plentiful; see the account of the bird by the late Mr. Henry Doubleday, in the "Magazine of Zoology and Botany," (Vol. I., p. 148,) which is epitomized in Yarrell's "British Birds" (4th ed., Vol. II., p. 99 *et seq.*); and see also the remarks of Professor A. Newton, the editor of that edition, (Vol. II., p. 100,) where he says "Even while compiling the present account of it, the editor has received overwhelming proofs, in addition to the evidence to the same effect published since Doubleday's paper appeared, of the constant spreading and ever increasing abundance of the Hawfinch." Mr. Stevenson indeed suggests in his most interesting book, " The Birds of Norfolk, " (Vol. I., p. 214,) that the frequent discovery of its nests of late years may be due to " The more careful researches of modern Naturalists," but if this were really the true explanation, I think we should hardly find such a careful observer as Gilbert White writing, " Birds of this sort are rarely seen in England and only in winter."

The species is said in Yarrell (4th ed., Vol. II., p. 100) to be still a local one, there being " Yet wide districts in which it is absolutely unknown." Such being the case, I thought a short record of its occurrences in the immediate neighbourhood of Derby might not be uninteresting to the readers of the " Midland Naturalist." I think it may be said correctly that, although the Hawfinch is not a very common bird here, it is a resident all the year round and regularly breeds; it has occurred very frequently this winter.

1.—In the spring of 1874 a nest was found at Littleover, at the top of a small larch about 12ft. high. The nest was composed of dried grass upon a foundation of twigs, the whole was very loosely put together; the eggs were of a dull green, streaked and spotted with a light brownish olive green, and indistinctly with a light purplish colour.

2.—End of April, 1877, a pair nested in the churchyard at Darley Abbey. One of the old birds was shot.

3.—In August 1878 four were shot in Mill Hill Lane, almost in the town, they were male, female, and two young ones. Most likely the old ones had bred in the neighbourhood.

4.—December 12th, 1878, one shot and another seen in Littleover Lane.

5.—1st week in January, 1879, another seen at Littleover.

6.—January 13th, 1879, one caught by a cat at Quarndon.

7.—Several specimens were also seen during the late severe frost, about Belper and one at Spondon Hall, " Journal of Derbyshire Achæological and Natural History Society, " (Vol. I., p. 128).

8.—One at St. James' Parsonage Derby, on February 25th, 1879, which, overcoming its usual shyness, fed with the sparrows within two feet of a sitting room window. — *Derby Mercury*, February 26th, 1879.

I may add, in conclusion, it is a thousand pities that this handsome species should be so ruthlessly shot as is generally the case, since, if only a little mercy were shown it, it would probably soon become much commoner than it is at present.—Merlin, Derby, March 16th.

The Hawfinch at Malvern.—The Hawfinch *(Coccothraustes vulgaris)* has been more numerous about Malvern this season than usual. I have heard of it and seen it in small flocks of six to eight in number and have received several fine specimens. This interesting bird was formerly considered scarce in this neighbourhood, but, probably owing to there being more observant eyes than formerly, it is now known to be anything but uncommon; partly too, perhaps, from its natural shyness it has often escaped the eye of the tyro ornithologist. Being naturally a shy bird, it avoids the neighbouroood of man, and hides itself in woods or other secluded spots. Its favorite resort here is a small fir plantation, where it may be detected by its sharp, shrill note at the approach of danger, similar to *click, click, click.* To get within gunshot of it requires much caution. I have invariably noticed, when I have seen the bird in small flocks, one of them will perch itself on the extreme top of the highest tree, and there act as sentry, keeping a sharp look out. If the flock be once disturbed it is a chance if you get near it again.

I am under the impression the Hawfinch remains here all the year. I have upon two occasions found its nest upon the Malvern Hills, in the fork of hawthorn bushes, about six to eight feet from the ground, and on another occasion at Malvern Wells, in an old apple tree, where, not being disturbed, it reared four young birds, which I saw a few days after flitting about the trees in the orchard. In each case the nest was very carelessly built, and extremely shallow; it seemed scarcely deep enough to contain the bird. It is some years since, while living in Essex, near Bishop Stortford, on the borders of Takeley Forest, that my attention was first drawn to the Hawfinch. It used to visit a fir plantation regularly every year in the month of February. I have seen there from twenty to thirty in a flock. It never seemed to stay longer than a week or so. I once, to my great delight, it being my first year of collecting bird's eggs, found in the forest a nest containing four eggs. On one or two occasions I have dissected the stomach of these birds. In one killed in December, 1878, I found remains of hollyberries, apple, and arbutus; in another, in February last, there were apple and seeds of, I think, the Scotch fir, with four hawthorn seeds. I hope other correspondents interested in this beautiful bird will communicate their observations.—W. Edwards, Malvern.

METEOROLOGY OF THE MIDLANDS.

THE WEATHER OF MARCH, 1879.

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

March commenced pleasantly, with dry weather, a rather high barometer, and south-westerly winds. This state of things continued till the 14th, when a radical change took place, the barometer falling half-an-inch in twenty-four hours, and wind shifting to the east. Snow fell to the depth of one or two inches. A rapid recovery, however, took place, and there were a few glimpses of sunshine between the 18th and 20th. From the 22nd to the 28th there were strong north-east winds, extremely cold and dry, very bitter and trying, bearing out the old adage that east winds are "neither good for man nor beast." Snow fell at intervals from the 25th to the 28th. The last three days of the month were warmer with westerly winds.

March was decidedly a dry month. At the majority of stations the total fall did not amount to one inch. The temperature was about 1¼ degrees below the average. There was a thunderstorm near Ludlow on the 14th; lunar halos were seen at Orleton on the 5th and 30th; at Loughborough, 4th and 30th; Stokesay, 31st; Leicester, 30th. The ploughed fields were in good condition for sowing, the frost having reduced the clods to powder; but all gardening operations were very backward. The grass looked brown, and no buds had burst in the hedgerows at the end of the month. At More Rectory blackbirds commenced whistling on the 9th, and wood-pigeons to coo on the 11th, stone-curlews returned very early in the month; at Shifnal rooks began to build on 6th, and ringdoves' coo heard on 17th; snowdrops full out on 4th, crocuses 12th, apricot blossoms 29th, celandine on 30th. At Coventry the note of the little chiff-chaff was heard on the 30th. At Cheltenham bats were seen flying on evening of 19th.

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.									
Cainscross, Stroud	W. B Baker, Esq.	·72	·30	28	6	70·0	19	26·0	14
Cheltenham	R. Tyr r, Esq.	·[illegible]8	·22	30	14	59·8	19	23·0	2
Stroud	T. J. Coley, Esq.	1·02	·32	29	11	59·0	20	24·0	21
SHROPSHIRE.									
Haughton Hall, Shifnal	Rev. J. Brooke	·89	·17	16	15	51·0	5, 12, 18, (19	23·0	2
Woolstaston	Rev. E. D. Carr	1·55	·50	17	17	61·5	31	22·0	26
Leaton Vicarage, Shrewsbury	Rev E. V. Pigott	1·01	·39	17	16	57·3	12	21·8	2
More Rectory, Bishop's Castle	Rev. A. Male	1·48	·38	17	18	53.0	18	23·0	13
Larden Hall, Much Wenlock	Miss F. R. Boughton	1·07	·17	15	16				
Bishop's Castle	E. Griffiths, Esq.	1·55	·40	17	15	57·0	7	23·0	13
Cardington	Rev. Wm. Elliott	1·11	·32	17	13				
Adderley Rectory	Rev. A. Corbet	·94	·21	5	14				
Stokesay	Rev. J. D. La Touche	1·21	·31	17	14	57·0	7	23·4	13
HEREFORDSHIRE.									
Stoke Bliss	Rev. G. E. Alexander	·79	·13	28	16	55·0	9	28·0	25
WORCESTERSHIRE.									
Orleton, Tenbury	T. H. Davis, Esq	·81	·10	28	15	60·2	9	22·3	2
West Malvern	A. H. Hartland, Esq.	·87	·21	14	11	60·0	9	25·0	23, 24, 25
Pedmore	E. B. Marten, Esq.	·67	·12	16	14	58·0	9	28·0	12
Longlands, Stourbridge	J. Jeffries Esq.	·62	·10	28	11	58·0	29	24·0	1 & 13
Dennis, Stourbridge	Mr. C. Webb	·59	·17	16	11	58·5	9	25·5	12
STAFFORDSHIRE.									
Thorganby Villa, Wolverhmtn	G. J. C. Broom, Esq.	·55	·10	15	14				
Dudley	Mr. J. Fisher	·70	·25	16	14	58·0	9, 19, 29, (30	26·0	1 & 13
Sedgley	Mr. C. Beale	·55	·11	16	15	54·0	19	[illegible]9·0	23, 24, 25
Kinver	Rev. W. H. Bolton	·63	·13	28	14	55·0	19	25·0	1 & 12
Walsall	Mr. N. E. Best	·64	·09	28	17	52·0	12, 29, 30	28·0	12, 23, 24
Grammar School, Burton	C. U. Tripp, Esq.	·[illegible]6	·17	16	17	60·0	29	26·0	8 & 13
Weston-under-Lyziard R'tory	Hon. and Rev. J. Bridgeman	·96	·34	16	15	58·0	5 & 16	24·0	2 & 13
Wrottesley	E. Simpson, Esq.	·59	·17	16	11	55·5	20	22·5	13
Heath House, Cheadle	J. C. Philips. Esq.	1·10	·30	16	15	57·0	19	25·0	13
Alstonfield Vicarage	Rev. W. H. Purchas	1·57	·33	16	14	55·0	9	20·4	26
WARWICKSHIRE.									
Coventry	J. Gulson, Esq.	·90	·15	29 & 30	15	57·0	20	26·0	2
Coundon, Coventry	Lieut.-Col. R. Caldicott	·79	·16	28	15	57·0	19	27·0	1 & 12
Bickenhill Vicarage	J. Ward, Esq.	·96	·18	28	8	53·0		27·0	
Oscott College	Rev. S. J Whitty	·78	·24	16	13	59·0	19	25·6	13
Henley-in-Arden	T. H. C. Newton, Esq.	·90	·12	16	13	59·0	9	25·0	13
Rugby School	Rev. T. N. Hutchinson	·68	·12	28	12	64·0	19	26·2	13
DERBYSHIRE.									
Buxton	E. J. Sykes, Esq.	2·69	·68	16	15	56·4	9	22·3	13
Stoney Middleton	Rev. U. Smith	1·69	·44	16	13	54·0	19	19·0	7 & 24
Brampton S. Thomas	Rev. J. M. Mello	·78	·21	16	9	61·0	9	21·0	8
Fernslope, Belper	J. G Jackson, Esq.	1·36	·34	16	16	56·0	19	26·0	13
Willersley Gardens	J. Tissington, Esq.	1·[illegible]9			8				
Spondon	J. T. Barber, Esq.	·94	.31	16	13	56·0	29	24·4	12
NOTTINGHAMSHIRE.									
Tuxford	J. N. Dufty, Esq.	68				54·0	19	25·0	12
Hodsock Priory, Worksop	H. Mellish, Esq.	·88	·14	16	15	59·1	29	26·4	14
Park Hill, Nottingham	H. F. Johnson, Esq.	1·14	·27	16	13	56·9	19	29·3	12
Hesley Hall	B. J. Whitaker, Esq.	·93	·21	17	12	61·0	12	27·0	14
LEICESTERSHIRE.									
Loughborough	W. Berridge, Esq.	·[illegible]0	·14	16	16	61·2	19	26·7	13
Ashby Magna	Rev. E. Willes	·79	·21	29	13	61·0	19	20·0	13
Market Harborough	S. W. Cox, Esq.	·83	·15	28	13	57·0	19	[illegible]3·0	13
Kibworth	T Macaulay, Esq.	·81	·16	28	13				
Town Museum, Leicester	W. J. Harrison, Esq.	·68	·1[illegible]	28	14	61·0	19	26·6	8
Belmont Villas, Leicester	H. Billson, Esq.	·70	·13	28	14	64·0	19	27·8	13
Syston	J. Hames, jun., Esq.	·65	·16	28 & 30	8	65·0	20	27·0	13
Waltham-le-Wold	E. Ball, Esq.	98	·13	16	14	56·0	19	24·0	12
Little Dalby Hall	G. Jones, Esq.	·63	·13	30	14	63·0	19	22·0	13
Coston Rectory, Melton	Rev. A. M. Rendell	·68	·11	30	14	60·0	19	21·5	2
Belvoir Castle	W. Ingram, Esq.	1·09	·26	31	16	60·0	20	25·0	13
NORTHAMPTONSHIRE.									
Towcester Brewery	J. Webb, Esq.	·89	·19	30	13				
Castle Ashby	R. G. Scriven, Esq.	·99	·18	29	12	58·0	7	28·0	12
Kettering	J. Wallis, Esq.	·92	·12	29	11	57·0	20	27·0	13
Althorpe	C. S. Groom. Esq.	·63	·10	31	14	57·0	19	25·0	2, 8, 9
Pitsford	C. A. Markham, Esq.	·83	·11	30	18	62·0	19	25·0	12
Northfields, Stamford	W. Hayes, Esq.	·97	·40	18	10	60·0	29	26·0	2
Ventnor Hospital	H. Sagar, Esq.	·73	·20	18	12	57·6	9	31·6	25
Altarnun Vicarage	Rev. G. Tripp	1·87	·35	19	18	64·0	20	25·0	2 & 14

METEOROLOGY.—I should be much obliged if some one would tell me the name of a good and comprehensive text book on general Meteorology, tolerably up to date. It must be in either French or English.—H. M.

SPRING FLOWERS.—In March I noticed Whitlow Grass in flower on 8th, Coltsfoot 10th, Chickweed 12th, *Cardamine hirsuta* 17th, Lesser Celandine 27th, and *Saxifraga oppositifolia* on 30th.—Stroud: S. J. C. Chickweed flowered on 8th, apricot on 30th.—Burton-on-Trent: C. U. T.

Microscopy.

Mr. Sharpus's Method of Mounting.—Mr. Sharpus, an amateur microscopist, of London, and an esteemed corresponding member of the Birmingham Natural History and Microscopical Society, has lately presented to that Society specimens of his microscopical preparations of Echinoderms and other objects.

All these objects are so remarkable for their exquisite beauty as microscopical preparations, that they are valued by the Society as perfect models of what such objects should be. Mr. Sharpus has, therefore, been asked to give, for the benefit of our readers, an account of the means by which such admirable results were obtained, and he has kindly acceded to the request. Perhaps the most noticeable for beauty are the minute star-fishes, *Ophiocoma rosula*, *O. neglecta*, and *Asterina gibbosa.* About these Mr. Sharpus writes:—"It is imperative that they be prepared immediately they are taken from the sea. They must be killed by being plunged into *cold* fresh water, and then placed in weak liquor potassæ. The time for remaining in this varies so much with different specimens that it is impossible to say anything more definite than that care must be taken to remove them before they show signs of breaking up; then wash repeatedly in distilled water, and dry on blotting paper, in sunshine if possible. No pressure must be used. Mount either as dry opaque objects, or in balsam."

As to the Pedicellariæ of *Uraster rubens*, and *U. glacialis*, the directions are:—"Remove a ray and macerate it in liquor potassæ till the 'pedes' leave the skin upon the liquor being agitated; wash in distilled water, and select the most perfect specimens for mounting. They can be fixed to the slide with gum tragacanth, to which has been added a little gum acacia. The pedicellariæ and ambulacral discs of Echinus may be obtained from a specimen that is dried. Treat with liquor potassæ, but with extreme care, lest the segments of the calcareous disc separate." Amongst the objects presented were heads of Vanessa, Bombyx, &c., which were singularly clear and perfect. Of these Mr. Sharpus says:—"They were boiled in weak liquor potassæ until the pigment in the eyes, and all else that could be dissolved, had disappeared; they were then washed, and boiled in distilled water for five minutes. They are mounted in glycerine."

"Palate of Buccinum was placed in liquor potassæ for a day, or a little more, then washed in distilled water, stroking it with a sable brush, in the direction of the teeth, to clean it."

Mr. Sharpus assures us that extreme care, great patience, and some little experience are the essentials of his success in the mounting of these objects, and that with these essentials, and perseverance, equal success may be attained by any one.

It will interest our readers to know that, so long ago as 1875, Mr. Sharpus exhibited to the Birmingham Natural History and Microscopical Society preparations of *Ophiocoma neglecta*, which he believed proved that that star-fish certainly was viviparous. Mr. Hughes, F.L.S., read before the Society, on the 16th February in that year, a paper upon these preparations, describing their peculiarities, and pointing out the extraordinary nature of the fact which these specimens seemed to prove. So startling, however, was the assertion that a star-fish could be viviparous, that the Society dared not accept it fully from the evidence then laid before them. The observations of Sir Wyville Thomson, which have since been published, prove that Mr. Sharpus was right in his conclusions, and that certainly he was one of the discoverers of this astonishing fact in the life-history of Ophiocoma. Joseph Bragg.

Freshwater Life.—Mr. Bolton's little "tubes" only need to be known to be more generally subscribed for. The other evening we had the contents of four different tubes under observation, and we could not help wishing that all our readers who own microscopes would put themselves in communication with Mr. Bolton, (17, Ann Street, Birmingham,) and get a supply of the good things he is continually distributing over the country. One tube contained a colony of *Plumatella repens*, most of them emerged, others just in the act of emerging from the statoblasts. Who that has seen the lovely lophophore of this beautiful polyzoon needs any description to recall it, and what words would give an adequate idea of it to those who have not? In another tube there was a supply of *Nitella translucens*, (in which the circulation of the sap was visible,) to which were attached innumerable bunches of *Carchesium polypinum*, so well described in our last number by Mr. Forrest. A third tube contained another kind of Carchesium, much like an Epistylis, which, so far as we know, has not yet been described. There were also specimens of *Paludicella Ehrenbergi*, *Limnias ceratophylli*, *Hydatina senta*, *Euglena viridis*, and numerous other interesting objects. We warmly advise all microscopists to subscribe to Mr. Bolton for a regular supply of living freshwater objects, which he distributes in a manner rendering their examination as easy as it is possible to be, for he usually forwards with each tube illustrations and descriptions of the objects, which are invaluable to those who are unacquainted with the objects sent.

Correspondence.

Snow Flakes.—Whilst walking home on the 26th of March, about one in the morning, snow began to fall very gently, but instead of the usual powdery or feathery appearance, each flake consisted of a distinct plate, in some cases perfect six-pointed crystals. I measured some of the plates, and the largest were as much as $\frac{3}{8}$in. across. On taking up a handful the appearance was most peculiar. Instead of the white opaque body one usually sees, the mass was pearly, and although very familiar with Boracic acid, I should have found some difficulty in deciding between a handful of that body and the snow. The effect near the lamps was very beautiful, more especially as the road became covered, the ground appearing covered with luminous points, which scintillated like stars as one walked along, whilst the falling crystals reflected iridescent hues. The effect in the country, on igniting some magnesium wire, was very brilliant. It was a cold dull night, barometer falling.—F. E. L., Burton-upon-Trent.

Black Band in the Drift.—I have recently noticed a curious bed in the drift, near Birmingham, of which a short account may be interesting. It occurs in a new railway cutting at Washwood Heath, on the Birmingham and Coleshill Road, and consists of a black band of about four to six inches in thickness. It appears to resemble peat, for it dries brown, and contains sufficient vegetable matter to make it burn in the fire. Traces of vegetable structure can be seen with a lens, but it is not very distinct. Above this bed lie about twelve feet of sand, and it rests upon a thin bed of white, tenacious clay. Below this is a thick bed of sand and pebbles, of which the thickness cannot be seen, but which evidently reposes on the red marl of the Triassic system. The black band terminates rather abruptly towards the north, but the excavation has not been carried far enough, as yet, to show how far it extends in other directions. I have never met with a similar formation in the drift, but should like to know if it is a common occurrence.—A. H. Atkins, Birmingham.

Pollen of the Hazel.—Examining the pollen from the cultivated hazel in my nuttery (the Fill-basket variety) with a magnifying power of about 400 diameters, I find that although when dry the grains look nearly all alike, when moistened with water they vary greatly. Three distinct forms are distinguishable, two of which (I will call them A and B) are triangular in shape and show three projections of the *intine*; but while A is of equal transparency throughout, B has only the projections transparent. The third form (C) is slightly larger than the others, the triangular shape of A and B is but faintly indicated, the projections of the *intine* are not developed, but there is a distinct granular opaque nucleus in a transparent sac. I conclude that these variations are due to differences of ripeness in the pollen-grains; that in C, the growth of the *intine* being less advanced, the absorption of water has swelled the *extine* and caused a separation between the two tissues, leaving the *intine* as a central nucleus; while in A and B, the *extine* being already broken through at the three angles, it is the *intine* which has absorbed the water and so increased the prominence of the projections. The difference between A and B consists probably in this, that A being a little riper the *intine* has burst at the three projections and discharged the granular *fovilla*, leaving only the transparent sac. On close examination a slight raggedness may be seen at the apex of each projection in A.—F. T. Mott, Birstal Hill, Leicester.

Notes on Ornithology.—During the past severe winter our usual winter visitors disappeared in a very marked way. At the commencement of the frost, on the 7th December, Fieldfares and Redwings were unusually abundant, Starlings also were as numerous as usual. After the frost had lasted a fortnight, all three disappeared entirely and were no more seen until the frost fairly broke up. This did not take place until the 2nd February, so that during eight weeks I did not see a single specimen of either genus. As soon as the frost broke up, and they could hunt for their food on the grass, the starlings returned at once, but the fieldfares were not seen again till the 15th February, and since that time have only been occasionally observed, and in very small flocks. The same may be remarked of the redwings. There is no one of our migrants which remains with us so long as the fieldfare; arriving about the third week in October, I have observed it passing on its return journey as late as May 10th, (1877,) a period of nearly seven months. On 29th March I heard the welcome voice of our first arrival, the Chiff-chaff. This was followed on the 4th April by the Blackcap. On the same date (4th April) I saw a Wheatear, and on the 7th I heard the Wryneck. I see in the last number of the "Midland Naturalist" a report of the Wryneck being heard in Oxfordshire on the *6th March*. Without for one moment suggesting a doubt of the accuracy of the observation, it would be interesting to know whether the bird was *seen* as well as heard, as the date is at least three weeks earlier than usual. In this county it never appears earlier than the first week in April, and generally later, preceding the Cuckoo, whose "mate" it is, only by a few days. In the "Birds of Oxfordshire," published about thirty years ago by the Brothers Matthews, in the "Zoologist," they give the date of the arrival of the Wryneck in that county as from the last week in March to the third week in April. If the bird were not seen, but only heard, I might suggest the possibility of mistaking the call-note of the Kestrel during the pairing time, (which would correspond to the date mentioned,) for the note of the Wryneck, from which it would be very difficult indeed to distinguish it. On the 29th March I observed three Dotterel on a newly-turned fallow near Kibworth. These birds are rarely seen here.—T. Macaulay, M.R.C.S.L., Kibworth.

Buzzard in North Notts.—It may interest some of your readers to know that a common Buzzard *(Buteo vulgaris)* was killed near here on

April 3rd. The bird had been constantly seen in the neighbourhood since Christmas; it frequently took rabbits from the keepers' traps. The only spring migrant which I have noticed as yet was a Willow Wren *(Phylloscopus trochilus)*, or Chiff-chaff *(P. collybita)*, I am not quite certain which, on April 5th. Very few signs yet of birds beginning to build.—H. MELLISH, April 8th.

ABNORMAL HEN'S EGGS.—Noting a paragraph on the above subject in your last number, I was led to hunt up a note concerning an egg laid by a Brahma fowl last September. The egg was 3⅜in. long by 2½in. diameter. On breaking it was found to contain another egg in a perfectly sound shell, measuring 2¼in. long by 2in. diameter, the intermediate space containing only white albumen. The inner egg was complete and in no way differing apparently from an ordinary egg. The same fowl has laid many very large eggs, mostly double-yolked, both this season and last.—F. E. L., Burton-upon-Trent.

CORRECTION.—In my notes in the April number, page 102, I made some remarks on geese, which it would be better for readers to erase altogether, as some confusion has arisen as to species.—O. V. A., (Bodicote, Oxon,) April, 1879.

Gleanings.

THE HISTORY OF COAL.—This is the title of an excellent lecture by the Rev. Thos. Wiltshire, M.A., F.G.S., published by Spon, (price one shilling.) It gives in a thorough, yet concise and readable manner, an account of this important mineral, as known to the ancients, and also all that is known as to its use and development in Great Britain.

LICHENS.—Mr. Charles Larbalestier, B.A., proposes to issue during the ensuing summer and autumn fasciculi of the Lichens of the Channel Islands, England, and Ireland. Many of the species will be new to science or extremely rare. For particulars apply to the Author, Roche Vue, St. Aubin's, Jersey.

POLLEN.—A comprehensive and valuable paper on the subject of "Pollen" was recently read at Natal, before the Natal Microscopical Society, by Mr. Maurice S. Evans. A copy of this paper has been sent to us by the Secretary. We congratulate our distant microscopical friends on having among their members such good original workers in science as the author of this paper.

DURATION OF LIFE.—We quote the following from the Proceedings of the Geologists' Association (Vol. V., p. 336.) At a meeting at the British Museum the keeper of the botanical department, Mr. Carruthers, "informed the members that he had revived Bauer's specimens of the minute annelid, *Vibrio*, known as the 'paste eel,' after it had been 'pectously dead' for sixty years." This is the finest instance of "revivification" which we have yet come across, and one might incline to feel sceptical were it not that the high scientific reputation of Mr. Carruthers forbids such an idea.

THE YORKSHIRE NATURALISTS' UNION commenced the season of 1879 by a visit to Ingleton, on the 14th of April last. A special train from Leeds and Bradford conveyed about sixty members. Ingleton is situated at the confluence of two mountain streams which drain the slope of Greygreth, (2,250ft.,) Whernside, (2,414ft.,) and Ingleborough, (2,373ft.,) three of the loftiest mountains of the West Riding. The party broke up into sections and explored in different directions, under the guidance of qualified leaders, some devoting themselves to geology, others to botany, and others again to ornithology. The sections reassembled for tea, at the Ingleborough Hotel; afterwards sectional meetings were held, and then a general meeting, at which the Rev. W. Fowler, M.A., vice president, occupied the chair. The sectional reports were then presented.

Gall-making Plant Lice. — The life-history, and the agamic multiplication of the aphididæ have always excited the interest of entomologists, and have even attracted the attention of some of the most eminent of our naturalists. Vol. V. (1879) of the "Bulletin of the United States Geological Survey" contains some biological notes by Dr. Riley, in which he recounts the following remarkable history:—*Schizeneura Americana* is a species of aphis which infests the leaves of the American elm, sometimes in such numbers as to cause all the leaves to fall. If during the winter the cracks in the bark of one of these trees that was badly infested with this leaf-curling species the previous summer be examined, there will pretty surely be found here and there a small dull yellow-coloured egg, about ·5mm. long, probably still covered with the remains of the female's body, quite dried up. Out from this egg, in the early spring, will be hatched the little crawling creature which constitutes the first generation in a very remarkable series. This "stem-mother" begins to feed, and causes the leaf to swell up and pucker until it at last curls over the tiny form. After three moults, and the temperature being warm, it commences to people the leaf with young at the rate of about one every six or seven hours. The second generation, though they never grow to be at all as large as the stem-mother, are like her in many respects. They accumulate in vast numbers, some of which, scattering, form new colonies. Their issue forms the third generation which are destined to become winged. These winged forms are short-lived, but they lay twelve or more pseudova at average intervals of about half an hour. The young plant-lice from these form the fourth generation, the members of which are very active, running swiftly. They are of a brown colour, and are somewhat like in general appearance to those of the second generation. In this stage they swarm over every portion of the tree, and their necessities cause them to migrate, in which effort masses of them get destroyed. The fifth generation is very similar to the fourth. It gives rise to forms like the fourth, but without wings. These give origin to the sixth generation. All of these acquire wings. These abound in the latter end of June and early part of July. They congregate on the bark, seeking out sheltered cracks or crevices, in which they deposit their young. These form the seventh generation, and are sluggish, of the colour of the bark, the females a little larger than the males. They have no mouth. They live for several days without motion. The female seems to increase in size by the enlargement of her one single egg. Both sexes soon perish, leaving among their shrivelled bodies the shining, brownish, winter egg, with which we started; so, after a long series of vegetative reproductions, at last the time comes for the renewing of the race by this zygospore-like body. Surely in this lies a hint to our plant-growers. It would be easier to destroy a single egg than stop a stream of agamic-produced forms extending to six generations.

Roman Glass.—The Leicester Town Museum contains many specimens of Roman glass vessels, but probably none exceed in interest a small fragment of a circular vessel, perhaps a drinking cup, which was found in East Bond Street, Leicester, in 1874, and presented to the museum by T. Fielding Johnson, Esq. The fragment is 3 inches in diameter, and 2½ inches in height. It represents rather less than one-half of the upper portion of the entire vessel. On a panel, 1⅜-inch in depth, are seen the figures of two gladiators, armed with helmet, shield, and short sword, apparently wearing greaves on their legs, and clothed in short tunics. One lies prostrate on his back, and the other stands near him, in a threatening attitude. The figures are about 1¼ inches in height, and the scene was evidently repeated, perhaps all round the bowl, as a portion of the erect figure can be seen again near the broken edge. On the upper margin of the vessel, above the figures, is the following inscription:—"SPICVLVS COLVMBVS CALM.....VS." The two last letters appear on the left hand side of the fragment, and appear to be the termination of the whole inscription, which probably ran round the entire vessel. In this vessel we probably have the record of some famous gladiatorial contest, the names of the combatants being very likely those recorded on the margin of the vessel. The glass itself is of a greenish blue tint, and is now beautifully iridescent. It must have been blown in a mould, as the figures are in relief on the exterior, with corresponding hollows within. A description of this interesting fragment, together with an excellent drawing by A. H. Paget, Esq., appears in the number lately issued (Vol. IV., Part 4) of "The Transactions of the Leicestershire Architectural and Archæological Society."

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—Geological Section.—March 25th.—Mr. T. Bolton exhibited embryo salmon covered with embryo swan mussel. Mr. Crick exhibited pollen of mistletoe. Mr. Lawson Tait presented to the Society a photograph of the birthplace of Dr. Charles Darwin, for which the best thanks of the Society were tendered to him. Mr. Atkins exhibited a specimen of apparently vegetable matter from a depth of 20ft. in the drift sand, just above a bed of clay, in a cutting on a new line of railway near Birmingham. Mr. C. J. Watson exhibited a series of rocks from Charnwood Forest, sent by Mr. W. J. Harrison, of Leicester, as a typical collection for comparison in boulder examination. General Meeting.—April 1st.—Mr. T. Bolton exhibited *Paludicella Ehrenbergi*, showing the hybernaculum or winter-bud; *Cristatella mucedo* emerging from the statoblast; *Anuræa squamula*, a free-swimming Rotifer; and Stentors, Epistylis, Ophrydia, &c., from Barnt Green. Mr. C. E. Crick exhibited the mistletoe, showing male and female flowers; *Daphne laureola;* and a fasciated stem of Dogwood. Mr. J. E. Bagnall exhibited *Plagiochila asplenioides* from Wylde Green, *Grimmia apocarpa* from near Wolverhampton, and *Chiloscyphus polyanthus* from Sutton Park; also, on behalf of Dr. Braithwaite, *Blasia pusilla*, collected by Jensen in Jutland, showing the gemma-like bodies *in situ*. Mr. C. Pumphrey exhibited *Glyciphagus plumiger*, and some foraminifera from a marsh near Cambridge. The Rev. H. W. Crosskey read a very interesting paper on "The Glacial Phenomena of the Vosges Mountains." Biological Section.—April 8th.—Mr. J. Levick exhibited a Stentor of a pink colour, which he believed to be of an undescribed species. Mr. E. W. Badger exhibited a beautiful series of hybrid Primroses (*Primula altaica* and *P. auriculiflora*) and a number of duplex cowslips from Mr. R. Dean, Ealing, and read some notes from that gentleman on the specimens. Mr. J. E. Bagnall exhibited a moss, *Physcomitrium fasciculare*, from Marston Green; also sections of the capsules, shewing columella and band of primary mother-cells, and another section in a more advanced stage, showing the spore mother-cells *in situ*. Mr. T. Bolton exhibited some zoospores of an alga in early stages of development. Mr. W. G. Blatch exhibited several beetles belonging to the Pselaphidæ. Mr. J. E. Bagnall exhibited *Hierochloe borealis*, and gave some notes on its geographical distribution; he also exhibited a number of wild flowers sent from Algiers to Mr. Derrington. Microscopical General Meeting.—April 15th.—Mr. J. Levick exhibited *Hydatina senta*, and Mr. Bolton *Batrachospermum moniliforme*. Mr. H. E. Forrest exhibited a specimen of the common snake, *(Natrix torquata,)* and pointed out the differences in size, colour, and form of the tail between this species and the viper. Mr. W. R. Hughes read the ninth and last of a series of papers on the "Parasites of Man," contributed by Dr. Cobbold. At the conclusion of the paper a cordial vote of thanks was passed to Dr. Cobbold for his valuable series of papers, and for the many specimens which he had sent to illustrate them. A vote of thanks was also passed to Mr. Hughes for his kindness in reading the papers.

BIRMINGHAM AND MIDLAND INSTITUTE SCIENTIFIC SOCIETY. —March 26th.—Mons. Z. Camelinat read a paper on "Scientific and Industrial Education in France." He described the various abortive attempts which had been made since the first revolution to impart scientific training to the working classes, and proceeded to describe the two technical schools now actually at work in Paris. The one of these, that of the Boulevard de la Villette, is intended for a model for large industrial towns. The pupils are received at thirteen years, and their average cost to the town is £10 per annum. The other school, that of the Rue Tournefort, will serve as a model for the smaller towns and agricultural districts. Here the pupils are received at eleven years, and cost annually £4. In both the pupils stay three years. The studies consist of general subjects, together with instruction in the use of all kinds of tools. At the end of the second year the student selects his favourite trade, and then devotes the greater part of his time to it, so that when he leaves the school he is able to earn the full wages of a practised workman. It is proposed to make these schools compulsory all over France. April 8th.—A party of the members visited the tar-distilling works of Mr. J. C. Major, Monmore Green. The processes of obtaining naphtha, naphthalene, benzole, carbolic acid, anthracene, creosote, pitch, and other substances were inspected with much interest. April 9th.—Mr. C. E. Crick read a paper on "Plant Life," which was illustrated by numerous microscopical specimens. Good Friday, April 11th.—There was an excursion to the Severn Valley. The party proceeded by rail to Droitwich, and walked thence through Westwood Park to Ombersley. Just outside the park a very interesting quarry in the Keuper sandstone was visited. The rock abounds with carbonised stems of trees, and contains considerable quantities of copper ore. The path through Lord Sandys' park to Holtfleet was then taken, and the valley kept to Hampstall, where tea was provided. After visiting several woods in the vicinity, where some good botanical finds were made, the party recrossed the river and walked to Hartlebury station, having spent a most pleasant day.

CHELTENHAM NATURAL SCIENCE SOCIETY.—April 17th.—At the usual monthly meeting a paper on "The Ideas of Harmony and Symmetry, and the part they have played in Astronomical Discovery," was read by C. H. Hinton, Esq., B.A. The next meeting will be the last of the Session, which has been a successful one.

DUDLEY GEOLOGICAL SOCIETY.—The first field meeting of the year was held on Tuesday, April 22nd, jointly with the North Staffordshire Naturalists' Field Club, at Froghall, under the leadership of Mr. Rigby, of Leek. Between sixty and seventy members of the two clubs, including many ladies, assembled at Froghall, special through carriages being provided by the courtesy of the London and North-Western Railway and the North Staffordshire Railway Companies. Proceeding about half a mile to the foot of the tramway to the Caldon Quarries, the whole party were drawn up the incline. On arrival at the quarry there was, by the kind arrangement of Mr. Fraser, the manager, a tremendous blast of rock, in which 9cwt. of powder was used and about 6,000 tons of stone dislodged, which came crumbling down from the face of an escarpment about 200 feet high. After examination of the fragments the rest of the fine quarry was visited, and at intervals numerous smaller blasts to split the larger fragments took place. The top of Caldon Low was then ascended to see the extensive view. Some specimens were secured of the characteristic fossils and of the various ores, spars, and crystals found in the limestone, which contains crystals of silica, some perfect microscopic specimens of which, about enough to fill a small thimble, were shown as having been obtained from 3lbs. of the rock dissolved. The descent was then made in the wagons as before, each going independently by its own gravity controlled by a brake. After a meat tea, the club separated, with mutual congratulations on a successful and interesting excursion.

NORTHAMPTON NATURAL HISTORY SOCIETY.—The annual business meeting was held on the 20th March, J. B. Hensman, Esq., in the chair.—Mr. Thomas Bailey, Treasurer, read the balance sheet, from which it appeared that after paying all expenses, including rent, binding of books, periodicals, mounting of photographs, and repaying balance due to treasurer, there was a balance in hand of £8.—The President, (Lord Lilford,) was re-elected, and the Vice-presidents, (Rev. S. J. W. Sanders, F.G.S., Rev. G. Nicholson, and William Hull, Esq.,) were re-elected, the Rev. William Thornton, F.G.S., being added to the number. The committee was re-elected, as were also the sectional officers, the only change being Sir Herewald Wake, president, and Mr. W. S. Godfrey, secretary of the entomological section. The secretaries of excursions are Mr. T. Cordeux and Mr. William Barton. The Secretary was re-elected, and then read a digest of the society's work during the year:—"The progress of the Northampton Natural History Society during its third year's existence has been fairly successful. I purpose, with your permission, to give a short *résumé* of its work. In April, after the publication of our last report, the Rev. H. W. Crosskey delivered a lecture on 'The Glacial Epoch,' dealing in a vigorous manner with the difficulties of the subject, placing clearly before the members the conditions and causes of the glacial drift. Owing to the miserably wet weather of May, but one excursion, an evening walk from Brampton Station, was made, the pleasure of this being marred by the rain coming on, and preventing any work being done. In June, on the first fine day, a wagonette full of members proceeded to Cransley and Broughton, the first halt being at Rushden, where, by permission of W. Clark Thornhill, Esq., the gardens and grounds of Rushden Hall were visited. These are interesting to botanists as being the first locality discovered in England for truffles, and in Morton's history the wilderness is stated to be the habitat of the fly orchis, but on this visit neither of the previously-mentioned plants were seen. The triangular lodge and other objects of interest having been seen, the company proceeded to Rothwell, where the church and bone-crypt were inspected. At Foxhall, the botanists were delighted with exploring a piece of bog land, in which many plants, new records to Topographical Botany, were found. Lamport was made a resting place for tea, after which, by Sir Charles Isham's permission, the party strolled about the gardens of Lamport Hall, the rockery, with its many interesting flowers and ferns, being much admired. The photographical section obtained views of Rushton Hall, Rothwell Church, &c., which were inserted in the album. Evening walks to Hunsbury Hill, Clifford Hill, and Harleston Plain Woods took place during June and July. In August a numerously-attended excursion was made to Fotheringhay, where the castle and moat were inspected, Mr. Holding reading a paper on 'The History of the Collegiate Church of Fotheringhay' in the existing building. A pleasant drive was then enjoyed by Wansford to Burghley, the botanists walking from Wittering to Southorpe, and through Burghley Park to the mansion. After the art treasures had been inspected, the party visited Stamford, from whence, after tea, the company made the home journey. Specimens of *Asperula cynanchica*, *Gentiana Amarella*, *Menyanthes trifoliata*, *Epipactis palustris*, *Schœnus nigricans*, and many other rare plants were obtained. In September, by the kind invitation of our President, a visit was paid to Lilford Hall, and a most enjoyable day was spent in seeing the splendid collection of birds, and examining the beauties of the neighbourhood. Some of the party visited Barnwell Wold, where the wild pear was gathered, and others went to Barnwell Castle and the picturesque village. In the photographic album are views of Barnwell Castle, Lilford Hall, and Lilford Bridge. Besides these excursions, the photographic section made a few special excursions. The opening meeting of the winter session was held in the Guildhall, Lord Lilford presiding, being supported by Sir H. Wake, Rev. William Thornton, and the vice-presidents. Lord Lilford gave an address, but confined his attention principally to the occurrence of the *diurnal raptores*, enumerating, among other species found in Northants, the golden eagle, the peregrine falcon, &c. Mr. Scriven gave the report of the photographic section, and mentioned their intention to photograph the remarkable trees of Northants. Mr. A. Perry said that out of the sixty-five British butterflies, there was good authority for thirty-eight having been captured in Northants; but his list of moths was but poor, numbering only 130. In botany twenty-three new species and twenty varieties had been found, including *Lythrum flexuosum*, a casual not before reported to occur in Britain, and the roses were also many of them local and rare. The geological report was principally on the magnificent present of the Marquis of Northampton to the town museum. In November, Mr. Beeby Thompson gave a lecture on 'The Lower Forms of Animal Life, and their Physiological Relation to the Higher.' In December, the Rev. W. Thornton, F.G.S., read a most interesting paper on 'The Occurrences of the Northampton Liassic Strata among the Volcanic Rocks of the West Highlands.' In January, Mr. C. Jecks read a paper on 'Darwinism.' In March, Mr. A. J. Richardson read a paper on 'The Age of the Earth.' The microscopical and botanical sections had also had a meeting. The library has been increased by Lord Lilford's handsome gift of twenty volumes of 'The Ibis' and the 'Birds of the West Highlands.' The periodicals, &c., of the society had also been bound into thirteen or fourteen volumes; these can be seen at any time by applying to Mr. Jeffery. The photographs have been mounted and bound in two handsome volumes. An herbarium has been commenced, and includes about 200 specimens. The list of members now contains 105 names, exclusive of some few removed or seceded. It is trusted that the circulation of the 'Midland Naturalist' among the members may increase not only the number of members, but also the love for, and interest in, all branches of natural history. The working up of the various branches of natural history is peculiarly our own subject, and for this object many observers are wanted. The balance sheet compares favourably with that of last year."

NOTTINGHAM NATURALISTS' SOCIETY.—March 19th.—Mr. C. T. Musson read an interesting paper on "The Curiosities of Natural History." March 20th.—Annual soiree at the Mechanics Large Hall. It was a decided success, and gave general satisfaction. April 2nd.—Mr. Musson continued his paper on "The Curiosities of Natural History." April 16th.—An address by Mr. L. Lee (hon. sec.) on "Corals, Living and Fossil," illustrated by diagrams and specimens.

NOTTINGHAM LITERARY AND PHILOSOPHICAL SOCIETY.—NATURAL SCIENCE SECTION.—March 28th.—A lecture was delivered by A. H. Scott White, B.Sc., B.A., F.G.S., &c., on "The Geological History of the Animals of Australia." This was a continuation of the subject lectured on early this session, and after quoting from what was then said, to explain the relation of marsupials to other mammals, the lecturer proceeded to explain that geological history is compiled in nearly the same way as any other history, for although we have no documents to search, yet we have the fossil remains of the animals; and these give us facts more certain than any obtained from writings. The geologist was compared in his task with Dr. Schliemann, who, working on the supposed site of Troy, found traces of five cities which had arisen one after another, and one on the ruins of the other. From each stratum of *débris*, Dr. Schliemann could tell much of the people who had lived in the corresponding city, and when he came to the last stratum he could tell the relative—although not the actual—age of that city. The lecturer proceeded to explain and illustrate the nature of fossils; and inasmuch as in the case of marsupials all the remains consist of bones, the difficulty of the geologist's work was pointed out, and reference was made to Cuvier, the founder of the science of palæontology; of this distinguished man a fine likeness was exhibited. On a "Table of Strata" the positions where marsupial remains have been discovered were pointed out and the localities given *seriatim*, as each set of bones was exhibited by means of slides. The following were the principal examples referred to:—Keuper, *Microlestes* and *Dromatherium;* Stonesfield Slate, *Amphilestes*, *Amphitherium*, *Phascolotherium*, and *Stereognathus;* Purbeck Beds, *Triconodon*, *Plagiaulax*, *Spalacotherium*, and *Galestes;* Gypseous series of Montmartre, *Didelphys*. The lecturer pointed out the similarity not only of the fauna but also of the flora of the Mesozoic period to that which is now peculiar to Australia, and brought his subject to a close by referring to and exhibiting photographs of the remains of the giant pachydermatous marsupials, *Diprotodon* and *Thylacoleo*, which have been discovered in the bone caves of Australia. April 4th.—Mr. E. Smith, M.A., read a paper on

"The Classification of Insects," illustrated by photographic and other lantern slides. Many of the slides were photographed from mounted specimens by Mr. J. Burton, Portland Road, Nottingham, and were much admired by the members. April 14th.—An excursion was made to Stanton-on-the-Wolds, Grimston, and Wartnaby. This was the first excursion of the season, and, owing to the unfavourable state of the weather, a number of members were prevented from joining. Mr. E. Parry, the engineer of the new line of railway now in course of construction between Nottingham and Melton Mowbray, kindly made arrangements for a special train to be placed at the disposal of the party, by means of which the journey was quickly and conveniently made. Starting from Nottingham at ten A.M., Stanton tunnel was soon reached; here the party alighted to examine the deposits of boulder clay in the cutting, and a section prepared by Mr. Parry was exhibited, which showed that in the tunnel (a thousand yards long) and its approaches the whole mass of the hill, to a height of 80ft. above the line, was composed of glacial drift. At the north end of the tunnel is a low outcrop of Rhætic shales, and Lower Lias limestone (10ft. exposed) at a little further south. At the south entrance of the tunnel the drift was well shown in a vertical section of 50ft. to 60ft. in height. The boulder clay is a stiff clay of a purplish brown colour, and, with the exception of an isolated pocket of earthy grit, did not appear to contain any interstratifications of sand or gravel, although, at the north end of the tunnel, a bed of clean, coarse, gritty sand, having a thickness of 14ft., was observed. The majority of rock fragments contained in the clay are more or less perfectly smoothed or polished, and are often beautifully striated. The formation most abundantly represented is the Lower Lias limestone, the rounded blocks being often of large size. Less commonly nodules of fine-grained limestone, from the Rhætics, are found, and these, along with fragments of marlstone, Upper Keuper marl, and fibrous gypsum, may have come from no great distance. Boulders of millstone grit (one of which measured 3ft. in height by 11ft. 9in. in circumference), of encrinital carboniferous limestone, coal measure sandstone, and quartzites, probably from the Bunter pebble beds,—which also occur—must have come from a greater distance, as also must the pebbles of chalk and chalk flints, occasionally met with. This vast deposit appears to have been the result of the action of icebergs or floes, which, drifting along from the east and north became stranded in shallow water, and impinging on the shales of the Rhætic and Lias crumpled and kneaded their soft materials like so much dough, while tearing up, polishing, and striating the blocks of the harder limestone bands which those rocks contain. The engineer states that the surface of the Lower Lias limestone met with in the tunnel beneath the boulder clay was striated *in situ*, the striæ trending in an approximately north-east and south-west direction. Regaining the train the party proceeded to Dalby. Here some time was spent in hunting for Lower Lias fossils in the waste heaps of the Grimston tunnel, and amongst others the following were obtained:—*Gryphæa arcuata*, *Unicardium cardioides*, *Cardinia Listeri*, *C. gigantea*, *Plicatula spinosa*, *Pholadomya ambigua*, *Lima gigantea*, *Ostrea Liassica*, *Crenatula ventricosa*, *Modiola scalprum*, *Pecten*, *Rhynchonella variabilis*, *Terebratula*, *Cerithium*, *Pleurotomaria*, *Serpula*, *Pentacrinus*, *Ammonites*, *Belemnites*, *Montlivaltia Hamiei*, &c. After a visit to a quarry in the marlstone at Wartnaby, the party soon after sought out the "special," and after a rapid run of ten miles reached Nottingham by six o'clock.

STROUD NATURAL HISTORY AND PHILOSOPHICAL SOCIETY.—The annual meeting was held on April 24th. After the transaction of formal business, the President delivered an address. There was a most interesting conversazione and exhibition of a wonderful collection of scientific apparatus, experiments, natural history specimens, &c.

WOOLHOPE NATURALISTS' FIELD CLUB.—The annual meeting was held at Hereford, on April 15th. The general financial statement of the Club was read, and the dates and places of field meetings for the year fixed. The report of the Pomona Committee, with the Treasurer's statement, were also read. After the members had dined together, the President, the Rev. H. W. Phillott, M.A., delivered his retiring address.

MIDLAND UNION OF NATURAL HISTORY SOCIETIES.

SECOND ANNUAL MEETING AT LEICESTER,
ON TUESDAY & WEDNESDAY, MAY 20TH & 21ST, 1879.

Annual Meeting.

The Annual Meeting will be held in the Council Chamber of the Town Hall, Leicester, on Tuesday, May 20th, at half-past Three o'clock, the President of the Union (George Stevenson, Esq.) in the chair. The business of the Meeting will be to receive the report of the Council and the Treasurer's accounts; to fix the place of the next Annual Meeting in 1880; to appoint the Officers; to consider any suggestions that members may offer; to discuss the work of the Union during the coming year; and to transact all necessary business. The President will open the meeting with an Address.

Conversazione.

A Conversazione will be held in the Leicester Town Museum, (entrance in Hastings Street,) on Tuesday Evening, May 20th, the arrangements for which are under the direction of the Leicester Literary and Philosophical Society. There will be an exhibition of objects of general Scientific interest, Microscopy, the various departments of Natural History, Archæology, and Art. Members of Societies in the Union willing to contribute specimens, or to exhibit or to lend microscopes, will oblige by at once communicating with Mr. W. Jerome Harrison, Town Museum, Leicester. At intervals, a selection of Instrumental Music will be performed, under the direction of Mr. H. Nicholson.

The charge for admission to the Conversazione will be 2s. 6d. Doors open at half-past Seven. Morning dress. Tickets are now ready, and can be obtained by members for themselves and for friends not members of the Union, through any of the Secretaries of the Societies in the Union; or direct from Mr. W. J. Harrison, Town Museum, Leicester. Tickets can be obtained up to Eight P.M., on Saturday, May 17th, at the Leicester Town Museum.

Excursion.

On Wednesday, May 21st, there will be an excursion to Charnwood Forest. This will be divided into two parties, one of which will be devoted chiefly to Geology, under the guidance of Mr. W. J. Harrison, F.G.S.; the other to Botany, under the guidance of Mr. F. T. Mott, F.R.G.S. The two divisions will leave the Museum together at nine o'clock A.M., in carriages, and will continue together as far as Woodhouse Eaves. They will then separate, the Geological party taking a somewhat wider circuit, and arriving at Newtown Linford an hour later. Both will return together at 6 30, arriving in Leicester at 7 30. A detailed account of the district (together with a map of the route) will be provided for all those intimating their intention of joining the Excursion. See also "Rambles with a Hammer," by W. J. Harrison, F.G.S., at page 117 of this number.

Tickets for either party 7s. 6d. each, including meat tea. Tickets must be applied for not later than Saturday, May 17th, and may be procured from Mr. W. Jerome Harrison, Town Museum, Leicester. Applicants will please to state distinctly whether they intend to join the Geological or the Botanical party.

MIDLAND UNION OF NATURAL HISTORY SOCIETIES.

SECOND ANNUAL MEETING AT LEICESTER, MAY 20TH, 1879.

ADDRESS BY GEORGE STEVENSON, ESQ., PRESIDENT OF THE UNION.

If my predecessor regretted that his attainments in science did not sufficiently qualify him to preside over your first annual meeting, pray believe me when I assure you that by an unfortunate coincidence the same cause of regret oppresses me in a double degree. For not only am I rushing into a region where even he fears to tread, but, after reading his address, I know too certainly how much less I am able to direct your inquiries. It is, however, a consolation to me that the success of these meetings and of your organisation depends so much less upon the President for the year, whom chance has given you, than upon the spirit which impels us to unite for local research, and, if possible, to advance the interests of science. It is the more earnest and united cultivation of this spirit in the prosecution of our work that I would respectfully urge upon your consideration. We have an organisation comprising representatives from the active centres of scientific life in the midland districts of England. We have a medium for discussion and correspondence in the "Midland Naturalist," conducted by gentlemen who are not only excellent editors, but themselves able explorers and lecturers. We have, or may have, a fund adequate to such enterprises as the scope of the Union may justify us in undertaking. Our Council has problems of local and scientific interest numerous and important enough to invite and reward co-operation; and all we require is that hearty union and concentrated exertion for selected and specific objects which will, by the convergence of so much power upon them, ensure their attainment. I venture to urge this policy with the more earnestness because it is practical, and may be fruitful; and because little systematic effort in this direction has, I believe, as yet been made. I observe in the "Midland Naturalist" that transactions and reports of some of the Natural History and other Scientific and Literary Societies are collected, but not with much tendency, as to any one subject, to a definite result. Your late President suggested various topics, few of which have left their traces in the pages of our periodical recorder; that of Dr. Spencer Cobbold being an exception, but which had been previously commenced. Now, most of the Societies to which I have referred, if constituted like our own in Leicester, address themselves mainly to supply such general and popular expositions of science as fall within the scope of the average mind and education of the people. But the prosecution of special topics of inquiry or research is relegated in our Society to the section that is organised with reference to the specific subject. In large towns, as in Birmingham, separate societies exist for prosecuting the definite objects in question. But, either through a section of the Society, or the Society itself, a connected series of observations and researches might be undertaken and collected from the Midland district; and, at the next annual meeting, the subject may be exhausted. The result may be an important contribution to the established facts of science. In any case it can hardly fail to create a larger and more intelligent area for the consideration of those higher problems and ultimate facts on which the world respects the judgment of British scientists. If no such result rewards our ambition, the useful effect may be to make us more thoroughly conversant with the natural history of our own immediate district, to create a body of trained observers, and to revive the love of such pursuits in our elementary schools. The secrets of nature lie scattered in such rich profusion about and beneath our feet, that some scientific treasure-trove is sure to reward our patient research. The microscope and the test-tube have converted the ground we tread, the rocks we climb, and the rivers and seas we fathom, into new worlds of life—" Old and yet ever new"—no longer to be assailed merely with the hammer or sounded by the plumb-line, but to be gently questioned by our finest and most sensitive instruments in order that their delicate tongues may tell in wondrous words "the story of their birth." The exuberance of the minute forms of animal and vegetable life, shown by the highest powers of our instruments, as Professor Huxley graphically states, to defy arithmetic to reckon, affords a fresh and inexhaustible range of inquiry. Indeed, the pleasures of imagination constitute a new stimulus to the pursuit of science, and reward some of its noblest achievements, by suggesting new worlds for conquest.

Let me then give point to these words by urging that during the coming year this Union should undertake the investigation, and, if possible, the solution of a definite subject. Some of my learned and scientific friends, more capable than myself of suggesting problems for useful work, think that you might select subjects for observation with the distinct understanding that at the next meeting the Council shall present a report founded upon such communications as they have received. It has been thought desirable that quarterly meetings of the Societies, or of the sections of the Societies, should be held for the purpose of keeping up and recording the work of the Union. From these, reports should go to the "Naturalist" to be collated by the Secretaries for the Council, who should meet half-yearly, if practicable. In the "Midland Naturalist," (Vol. I., p. 242,) Mr. Harrison has proposed a scheme for exhaustively examining the Glacial Deposits of the Midland district; and the *modus operandi* is very fully shown. The Birmingham Society has already joined in this quest; I trust that by extensive and systematic co-operation the subject may be successfully prosecuted and reported upon at your next meeting.

It has been suggested that as in Meteorology the Union now possesses a band of eighty observers, provided with excellent instruments, regularly reporting the weather, notes of rainfall, and, if practicable, of temperature also, should be taken at the loftiest points of the district. Changes commence in the upper regions of the atmosphere, and are often detected days before they are visible in the lowlands. Rain-gauges should be established on three or four of the Charnwood hills, the Wrekin, the

Malverns, Cotswolds, and other elevations, and our local registrar of the weather would gladly give practical hints as to the character of the instruments most likely to give useful results. Entomology is another subject far from exhausted as to the field for observation in the Midlands. Mr. Frederick Thompson Mott, to whose ability and talent for organisation our Leicester Society and the Union owe so much, advises the investigation of the life-history of some one species of plant or animal, until it is fairly "run down," and he instances the earth-worm, the common Brake Fern, or the migratory Thrushes, as affording ample scope for such an exhaustive treatment to be undertaken by each Society, or the Natural History section of each Society. He also commends to the acuteness of the collective Union the attractive topic of "Vegetable Odours," their chemistry, the conditions under which they are given off, and the functions of them, if any. That such functions exist we no more doubt than that

"Nothing walks with aimless feet."

The question of the causes of colour in plants deserves elaborating, and the dates of the flowering of common plants, and of the appearance of insects and migratory birds generally, would involve small but very useful labour, if accurately observed. It is interesting to find how regularly some people note these things with apparently no idea of connecting their notes with any scientific purpose. It would be a gain to science could we prevail on the multitudes who will tell you of these things to jot them down. Then, when "found and noted," our new facts should be deposited in the "Midland Naturalist" for the ensuing month. The habits of animals present a wide field. The ant-nests of Buddon Wood have an economy and mode of life well worth our study. Sir John Lubbock has only opened a region which is replete with problems of highest interest. So closely do these little beings, and some of our domestic animals, approach, in their marvellous institutions, sagacity, and subordination, the proud confines of human intellect that we may note their habits and capabilities without fear of not growing wiser.

I cannot leave this subject, nor could the Union meet in Leicestershire, without paying a tribute of respect to the memory of a gentleman who has been so distinguished by his pursuits in Natural History as Mr. Alfred Ellis, who has so recently passed from our midst. Belonging to a family highly esteemed amongst us for their support of education and social improvement, Mr. Alfred Ellis added to his other qualities a remarkable interest in the habits and instincts of wild animals, and by a vigilant provision for their wants, succeeded, like his friend, the late Charles Waterton, in surrounding his home at the Brand, in Charnwood Forest, with safe retreats for all manner of persecuted birds and animals. They seemed to appreciate the sympathetic thoughtfulness of their guardian; and the various nooks, rocks, and waters about his lovely forest residence contain many creatures whose prolonged and happy existence rewarded his care. Letters to the *Times* occasionally gave to the public interesting details of their habits, as he observed them, and his active intervention with gamekeepers and others for their protection may be worthily imitated by members of this Union whose influence extends over so wide an area. His memory deserves to be held in honour by all Midland

Naturalists, in whose hands he placed a powerful help when he taught us that there was scarcely one of the so-called inferior natures too wild and refractory to be conciliated by kindness.

As a practical step, it is thought that a model of the district, as worked by each society, would help each section or field-club, and should be constructed on the scale of the largest Ordnance map, (six inches to a mile,) so that the contour of the district and every special spot can be clearly marked.

For Geological members, Leicestershire, in its Charnwood Rocks, offers special attractions. Professor Judd lately told us he had rarely visited a district that comprised, in so small a space, so many illustrations or so much material for study. The points for observation and inquiry set down in the notes for the excursion will furnish topics for comparison with similar formations in other parts of the district. In following the course of the Rhætic beds from the Severn to the Humber, Mr. Harrison has described them as forming part of the strata disclosed in some clay pits on the east side of the town. Striking illustrations of the glacial drift, and of the erratic boulders of the Midlands, are also to be seen near Leicester.

In the name of my fellow townsmen, I beg to give you a hearty welcome to Leicester. In the town you will find that, having built on the earliest foundations of our national life, the ground beneath us is a series of strata, which have been laid successively by ancient Britons, Romans, Saxons, Danes, and Normans. Our Museum has vestiges of each and all of them, and by slow degrees each layer and each race received and shows "its form and pressure." The various convulsions of the social fabric are seen here and there in a rock of one condition or formation of life, protruding through and marking the general crust of the other. So the past in our old town ties itself in with the new. This cannot be altered any more than in the face of nature; and we do not regret it, because it contributes an element of individuality and variety to the scenery of our social life. Perhaps we are not so rapidly overrun with modern ideas as other and newer districts, but we may not part so readily with what is good in older notions. So much for our people. In the town we shall show you, if not the very habits in which our ancestors lived before and during and after the Roman rule, yet the ornaments they wore, the pavements they trod, parts of the fanes in which they worshipped, and the urns to which their ashes were consigned. Mr. Kelly, our eminent local archæologist, will, with Mr. Reeve and Mr. Nevinson, describe them. In the county we shall show you Charnwood Forest, with its microcosm of Geology, and under the guidance of your able secretary you will enjoy a clinical demonstration which the previous researches and speculations of Whewell and Sedgwick, of Jukes, Ansted and Judd have invested with special interest.

Mr. Mott will take such as prefer the Flora of our county through its selected haunts, and tell you all that is as yet ascertained upon a subject he has made his own.

Once more, let me respectfully remind you that it will afford our Society much gratification if the result of your visit to Leicestershire may be such a united and exhaustive treatment of some subject of scientific pursuit as shall make it memorable—if not for some fresh conquest, yet for the increase of that steady habit of local observation and the cultivation of that scientific spirit which must tend to make our information more accurate, and our views more philosophical.

The Leicester meeting of the Midland Union, held on Tuesday and Wednesday, May 20th and 21st, under the presidency of G. Stevenson, Esq., whose address is given above in full, was a most successful and enjoyable one. It attracted a goodly muster of members from nearly all the Societies, who were entertained with unbounded hospitality by their Leicester friends. A full report of the proceedings will be given in our next number. How the visit of the Union was regarded by the local press will be gathered from the following extract from the *Leicester Chronicle* of May 24th:—"The second annual meeting of the Midland Union of Natural History Societies, which took place in Leicester this week, was in every respect a marked success. The attendance at the conference, conversazione, and excursion must have exceeded the sanguine expectations of the promoters; the arrangements fully sustained the strain to which they were thus subjected; the atmospheric influences were propitious and genial—in short, everything combined to render the event as enjoyable as it was fortunate. The Presidential address was a model of what all inaugural discourses should be. Though creditably brief, it gracefully and admirably summed up the *raison d'être of* the Union, and pointed the way to new discoveries and conquests amid the open secrets of field, rock, and wood. The great desideratum in this branch of investigation at the present day is painstaking, persevering, and above all, organized and systematic research. To spread the available fund of talent and energy over the whole of the vast field of enquiry is simply to fritter away inestimable possibilities of usefulness, and court failure. If, therefore, the Union does no more than gather up and concentrate upon a few important problems, the hitherto desultory and discursive labours of our naturalists, it will thoroughly justify its claim to the thanks and support of the community. Research without organization, comprehensive co-operation, and method, must necessarily be alike inefficient and uncertain. But let the Union adopt the admirable plan of concerted action in specified fields of study, with periodic meetings, reports, and comparison, and the investigations will be redeemed from the double evil of confusion and barrenness. The Leicester students of natural history are peculiarly fortunate in possessing within easy reach a storehouse of treasures like Charnwood Forest. It is much to be regretted that the taste for the study is still imperfectly developed, and that only the comparative few of our vast population ever realise the inexhaustible mine of health and wealth which has been placed almost at their very doors. We hope the Midland Union may either directly or indirectly create a popular taste for the sweetest influences of Nature's loveliness. The naturalist, by his pensive rambles amid field, forest, and wild, derives a pleasure of the purest and highest order. To him a day of communion among the beauties of Charnwood is a source of unalloyed enjoyment and inestimable profit. Such a well-spent holiday expands the mind, invigorates the body, and refines and elevates the heart. The worshipper of Nature returns home in every respect happier, better, wiser, with a rich store of joyous memories to lighten the burden of labour and care amid the struggles and conflict of every-day life."

NOTES ON COLEOPTERA.—II.

BY THE REV. W. W. FOWLER, M.A.

[*Continued from page 94.*]

In my last paper I endeavoured to give a few hints as to collecting and preserving Coleoptera. I now propose to speak of the chief localities in which they may be found.

Beetles are truly ubiquitous. The woods, the fields, the ponds, the streams, all possess their particular species, and even the interior of our houses is not free. The death watch, which has caused so much groundless alarm to superstitious minds, and given rise to so many ghost stories, is nothing more than a tiny beetle of the genus Anobium that burrows in old furniture, and makes the little round holes with which we are all so well acquainted. The clicking noise is produced by the action of its mandibles upon the hard wood, the sound not being audible by day, but plainly heard in the silence of the night.

There is, however, one great exception to the ubiquity of beetles, an exception which makes one hesitate to apply the term to them at all—none have hitherto been found in the sea. In brackish ponds a few yards from the sea (*e. g.* Lymington Salterns) they abound, but in the sea itself there are none. This is the more strange as vegetable life (certainly entirely cryptogamous) is plentiful in the sea. Crustaceans, too, are found in both fresh and salt water, and mollusca also abound in both. It seems strange that although many of the forms of animal life above them as well as below them are found in both salt and fresh water, the Insecta proper seem so carefully to avoid the sea; the explanation is probably to be found in their transformations.

To give any idea of the localities in which the various species of beetles are found would require a volume, and it is impossible in a short article to do more that point out likely places, not for particular genera or species, but for Coleoptera generally.

In doing this it is as well perhaps to classify them roughly under the particular methods and instruments of capture recommended in my last paper.

The Beating Net (an old umbrella serves the purpose thoroughly well.)—The best time for using this is in May and June, though in the early autumn many good things may be obtained. The best trees are hazels, aspens, oaks, and hawthorns—the latter when in bloom yield a very large number of species. The beating net may be also used to very great advantage in osier beds. Many species of Telephoridæ, (soldier beetles,) Chrysomelidæ, (golden-apple beetles,) and Curculionidæ, (weevils,) always occur in these in abundance.

The Sweeping Net.—This is of use on any warm day from spring to late autumn; but a sunny day, with a warm south wind after rain, will produce a hundred-fold greater result than a very dry day, with the wind even a point or two to the north or east. It is often astonishing what the beetles do with themselves—they are swarming, perhaps, one day, (or even one hour,) and entirely gone the next. If one finds a good thing in plenty it is no good to leave taking more of it until the next day, for the chances are there will not be a specimen to be found. The same rule applies to beating; moreover, during the heat of the day, from eleven or twelve to about four, beetles seem to take a siesta, for trees and plants on which they are abundant morning and evening will be found during this time to have not a single insect upon them, as the writer of this article has found by unpleasant experience. It is very annoying when one has only a few hours, perhaps, in a good place, and has to rush to catch an evening train, to leave a very likely spot just as the good things are coming out.

Damp places are far more productive for sweeping than dry ones. The strips of grass on the edges of cliffs, especially if the field they form a border to happens to be a corn or vetch field and has just been cut, are exceedingly productive. Corners of fields and woods generally abound in species, but a great majority of these species have their peculiar plants, and so a knowledge of Botany, to a certain extent at least, is absolutely necessary for the student of Coleoptera.

The Water Net.—Stagnant pools and running streams alike produce beetles in multitudes, and a little use of the water net will soon give experience in their localities; a tiny puddle in summer will often yield more in a few minutes than a large pond in some hours' work. The Palpicornia are often found in the mud or weeds just at the margin, and should be carefully looked for there; and certain species of Curculionidæ, *e.g.* Phytobius, are semi-aquatic, and are only to be obtained by searching the water weeds. The moss on the edge of waterfalls must also be mentioned, as many beautiful species, not found elsewhere, are found underneath it.

The fern trowel is a very useful implement all through the year, for digging beetles out of sandy banks, (where many of the Geodephaga, especially Bembidia, abound,) for searching at the roots of trees, and also as a bark ripper. Many species are found in old wood and under bark, and it is often inconvenient to carry a large implement; but if one really wants to work wood-feeding beetles, a small strong hatchet is absolutely necessary. A tack extractor also makes a very useful bark-ripper. Old trees on the ground often contain a great quantity of species, and are of course easy to examine; but many of the best wood-feeding beetles are obtained by sugaring old trees, and so attracting them at night out of their burrows. In winter, sifting old leaves over paper will often produce many rare things, especially Pselaphidæ and Scydmœnidæ. Moss, too, is very productive, and the taller tufts of grass, either in winter or summer, if dug up carefully (here our fern trowel again comes into play) and shaken over paper, will never fail to put something into our bottles if all else fail. The damp bottom layer of a haystack in the coldest weather (as we might naturally expect) will be found, as a rule, full of Coleoptera and Hemiptera.

The grass cut from our lawns and stored in the sun is a very good trap for several rare species—a single hot bed will almost produce work enough for a whole season, and its effect is heightened by putting a little moss in one corner;—the latter is an excellent trap for Euplecti; many people find these hard to get a series of, but I have seen them in numbers by adopting this plan. Dead birds and animals contain Necrophaga in abundance; heaps of decaying sea weed on the sea shore should always be examined, as many species, never found elsewhere, occur in such places, and ordinary species are found in profusion.

When a tree has been cut down in the autumn it should always be carefully watched in the spring when the sap rises, as many species (Epuræa,Ips,Longicornes,&c.,) come to feed on the juice. Old granaries and meal boxes, old houses and old cupboards, old vessels and old sea piles all possess their beetle inhabitants; the small weevils known as granary beetles are amongst the most destructive of our Coleoptera, and often do incalculable harm to stored grain.

There is only one other locality that I would here speak of, and that is ants' nests. Various beetles live in ants' nests and in ants' nests only. The relations that they bear to their hosts are not yet discovered, but they are on the most friendly terms; in fact, on a nest being disturbed, one of the first cares of the ants seems to be for their *protégés*, and they may be seen carrying off beetles larger than themselves to a place of safety.

Midland Naturalists have a very good opportunity of working this group, for the ants' nests abound in Bewdley Forest and elsewhere, and contain many good species.

As a rule there is no doubt that the Midlands have not been so productive of Coleoptera or Hemiptera as the Southern districts and the coasts. This is in a great measure owing to the general character of the soil—for chalk and sand always produce more species,—but there is many a spot and many a district in the Midlands, hitherto unworked, that would prove well worth the labour expended upon it. More workers are wanted, and if they come forward the Midlands will soon be able to bear a very fair comparison, to say the least of it, with the so-called more favoured districts.

AN INTRODUCTION TO THE STUDY OF FUNGI.*

BY THE REV. J. E. VIZE, M.A.

There are very few people who study the interesting plants called Fungi. Hence a leading object in preparing a paper on the subject will necessarily be to try to allure some one onwards to their study, or at all events, if their study would occupy too much labour and research, to unfold a fragment of their importance in the vegetable world, and so to get for them a little more consideration than has been granted them up to the present time.

The wonder is that fungi have been so much neglected, because they would, if studied, fill up many a period of time which now is probably not so well employed. If a man be fond of his microscope, he will detect in them shapes as various as the most ardent lover of change can desire; he will find tints, among the colours of black, brown, and yellow, as gradual and progressive as anywhere; he will notice symmetrical forms as exquisite as gracefulness can be; he will be able to make many a valuable addition to his own knowledge, and confirm the opinions of others, or confute them, by noticing what he sees; he will get a steady progression from one form to another, from one order to another, until he finds how the works of God ramify in every direction, and are all in themselves perfect. There is a rich fund of science coupled with pleasure among the fungi to the man who merely takes his microscope and examines slides under it; but the microscope need not be used merely as a means of looking at a pretty thing; the adjunct of a camera will prove of great service, drawings should be made and always to one uniform scale of considerable magnitude. After making the sketch, the draughtsman may use his talent with the brush, and drive care and idleness away by colouring the magnified drawings on paper from the object still visible under the instrument.

But suppose there be no microscope, and that the privileges just named be not easily attainable, if such a thing be possible in these days, when first-rate instruments are to be purchased at so low a price. Well, of course, a great loss is sustained; but even then there are in fungi forms so large that, at a rough estimate, one-third of the British fungi need no more than the unassisted eye for their examination. Nor should it be forgotten that the present extensive use of the microscope is of recent date, that the pioneers of mycology had not the advantages we have; yet, to the honour of some of them be it said, they often surprise us who try to aspire to their knowledge. Hence none need despair. There is such a vast field of work before us all that the fungi may be worked with or without the microscope; the whole range may be studied at once, or it may be divided and sub-divided, and there will still be work for a lifetime.

See too the advantages attaching to the study of fungi from their being within reach of everyone. If you have a garden attached to your

* Read before the Chester Natural Science Society, February 22nd, 1877.

house, there you are certain to find specimens. Is your house damp? The wall-paper will supply you with an object to examine, possibly three, four, or more, from the same strip of paper. The linen hanging up in your cupboard will supply you, if not moved occasionally. Keep your cheese until it becomes decayed, there will be something to admire in it. Put your hazel nuts away, then see in course of time the beautiful pink that grows upon them. Look at your apples, in those wart-like spots you have fungi again. The diseased house-fly on the windows will furnish specimens, and the cellar is a most prolific spot. But leave home, and go for a walk: the leaves of the trees, the bark, the branches stripped of their bark, will all yield supplies. Go to the lanes, the hedges, the ditches, the inside of a wood, still better the edge of it. Look at the gate-posts, the stiles, the grass under your feet, the corn-field, the decaying sticks, the utterly rotten wood; all these positively invite us at some period or other to study the fungi.

But all is not so smooth as you may perhaps suppose from what you have hitherto heard; there are difficulties to be overcome, *severe difficulties*, and it is only fair that both sides of the question should be placed before you. Let us see then some of the troubles connected with mycology. Pre-eminently stands the want of books with plates of any excellence. There are so few men who study this special department of botany that the inclination to publish dwindles away from want of support. Anyone who attempts it may feel pretty sure that he will not be repaid for his trouble. Also, since few copies of any work that may be published are produced, their value in a number of years becomes proportioned to their rarity. Corda's "Icones Fungorum," by no means costly at first, is now worth £28. Sowerby's "English Fungi" seems to be almost unobtainable. Still, if any one really cares to examine the fungi, the want of books need not deter him; he can make his own drawings, and he can obtain a copy of Dr. Cooke's "Handbook of Fungi," a work which embraces the information contained in Mr. Berkeley's "Outlines of Fungology," and in those valuable papers of Messrs. Berkeley and Broome scattered here and there in the "Ann. and Mag. of Natural History." He can also cope with the times, and the most recent ones too, by subscribing to that record of cryptogamic botany issued every quarter called "Grevillea."

Another difficulty is that of assigning the correct name to a plant. Some fungi are in outward appearance very much like others, the orthodox place of which is very remote from theirs. In fact so difficult is it to say decidedly what a plant is without microscopic help that the higher authorities rarely venture to name anything off at once, or, if they do, it is with the understanding that a critical examination shall be made of it when opportunity offers. Of this we may be sure, that study will unfold the name and place of many a plant which perhaps is unknown for a long time, and of another thing we may be more certain still, that, when it is known that a man really does his best to ascertain his plants, there is such a feeling among the lovers of mycology that every one is ready to help his friend, and give all the assistance in his power.

Now about fungi themselves. What is their place in the vegetable kingdom? How are they especially to be distinguished from their allies? Acknowledging that all lines of demarcation are optional and therefore not necessarily rigid, there are certain means by which fungi are separated from their close companions, Algæ and Lichens. An Alga draws its nourishment through the whole of its surface from the water in which it grows, or the excessively moist place of its existence, which is the same to it as water. Besides this, it is propagated by means of zoospores, tetraspores, &c. Lichens are propagated by means of sporidia contained in asci, also by green bodies, which occur in their frond or thallus, called gonidia. Fungi are propagated by spores or sporidia, and they are nourished from the substance on which they grow through their mycelium. They never have gonidia like lichens. "Their fructification consists either of cells attached externally to threads, which either arise immediately from their mycelium or from a special fructificative tissue, and which are then called spores, or of similar bodies produced in little sacs or tubes, and then called sporidia." A singular fact is observable about fungi, so singular indeed that it has been proposed to assign them a special locality between the animal and vegetable kingdoms; they absorb oxygen and give out carbonic acid; hence in this respect their office seems to be like that of an animal, in confirmation of which you will never find a fungus with the beautiful green colour of vegetables; but, if there be green at all, it is invariably of a metallic tint.

Let us now examine some of the uses of fungi. Amongst other things they assist in destroying vegetable matter which would otherwise be most offensive and pestilential; decaying plants, unless fungi attacked them, would be simply intolerable. M. Roumeguère, in a work published in 1870, called "Cryptogamie Illustrée," gives a list of 220 fungi which grow on the different parts of the *Fagus sylvatica*, and yet the beech is one of the mildest examples we could select, inasmuch as the leaves are anything but fleshy, and their decay would cause less smell than many others when decomposition sets in. How beautifully God has arranged for this decay without injury to our health. The spores and sporidia—in familiar language, the *seeds*—of fungi are wafted through the air in myriads, they are infinitely small, but of such specific gravity that in due course of time they fall and settle on some object. Multitudes of course perish from lack of the exact spot and accompaniments necessary to cause growth. Many begin to vegetate, but their requirements are not there in full, they die in their very cradle. But supposing a spore or sporidium finds everything adapted for it, how does it grow? It does so by means of its mycelium. Moisture, which is essential to the life of fungi, causes a process to start from the spore, which elongates, branches out in all directions, and penetrates even into the hardest woods; and, as it feeds upon the parts that it touches, consumes the matter around it, and so rapidly hastens decay. By this beautiful arrangement, the very substances which are poisons to us form its food. If there were no fungi there would be far more illness.

It is very singular how different forms of fructification proceed from the same mycelium. If a mycelium produced only one form of fruit, some of the species might be lost, but there is less prospect of such an event now, because from the same low form of fungus will arise one, two, three, four, or more different kinds of fruit, all of which are capable of becoming again the starting points of their species. For instance, there are the dust-like productions called conidia, then the macroconidia, the pycnidia, the stylospores, the ascospores. Many an interesting research has shewn this to be the case, and proof after proof is furnished by those who investigate these things, that the moulds are the forerunners of higher forms of fungoid life. These furnish interesting materials for those who take up the study of fungi. The ease of the study is not increased thereby, but the pleasure and the profit are.

How useful is the vinegar plant. And what is it but a vegetable production, caused by the growth of the mycelium of a fungus *(Penicillium crustaceum)* in saccharine liquor, when not in a state of fructification? The fermentation of the dough of bread is due to the growing of a fungus, by which the bread is made light and wholesome. It is a species of Torula, which forms the yeast; this feeds upon the sugar of the flour and sets free carbonic acid gas all through the dough, and, when it is placed in the oven, the gas is driven off entirely, the fungus is baked, its vitality utterly destroyed, and its remains, which of course do not come out with the gas, are eaten as part of the bread. Thus every day of our lives we are fungus-eaters.

Whilst we have spoken of the uses of fungi, it cannot be denied that there are many instances in which they do great injury. Smut is very often found in fields of corn, although it has now by artificial means been rendered less common than formerly. It destroys the good qualities of the ear at any early period of its growth. Bunt does the same, differing however from smut, inasmuch as its presence is not so easily ascertained. Human beings suffer occasionally from the attacks of fungi. There is a disease from which the natives of India sometimes suffer, called the fungus-foot of India; strange to say, the disease never ascends higher than the base of the leg-bone, just above the ankle. Mr. Berkeley has given an excellent paper on this malady in the "Intellectual Observer" of 1862. The first case he mentions is one in which the bones were "perforated in every direction with roundish cavities varying in size from that of a pea to that of a nut or pistol bullet, the cavities being filled up with a dense fungous mass of a sienna red within, but externally black, and resembling a small dark truffle. From these cavities canals lead to the surface, from which a purulent fœtid discharge is poured out, often accompanied by little pieces of the fungus." Two other kinds of foot fungus are recorded by Mr. Berkeley in the same paper.

In our own country there is a disease to which we are liable, which causes a good deal of unpleasantness rather than pain. I mean ringworm. Ringworm is a fungus, it has its mycelium, and bears its spores, which are very minute and easily conveyed through space. Whether the spores would develop if the skin were perfectly healthy, or whether some weakening cause be needful, is not for me to examine. Insects also are liable to be attacked with fungoid parasites. The silk-worms in France have suffered severely. Wasps have been seen alive infested with a growth which would eventually deprive them of life. Between twenty and thirty species of ascigerous fungi have been recorded as parasitic on insects. One of our British specimens is very beautiful. It grows in autumn on the pupæ of moths buried in the ground, and is of a splendid orange-red colour, scarcely two inches high, its clavate head being covered with tubercles. The contrast between the scarlet head of the fungus and the green grass in which it grows is very gladdening to the sight of a mycologist who has never before seen it.

The potato disease also is a fungoid growth. A popular idea prevails that the potato disease comes down with the warm rains of summer, and this notion originates in the fact that the leaves are seen to be diseased after the showers of July. When there is a dry season, the leaves are free from the brown spots which indicate the disease. But the rain by no means has the disease in itself; it only causes the spores to grow. Moreover, the spots on the leaves are not the first startings of the disease, they are only proofs that it is at work elsewhere. The first part affected is the tuber; the resting-spore, (oospore,) which has lain dormant nearly the whole year, is ready to mature in June and July, and if it gets sufficient moisture sends out mycelium, which penetrates any tuber it touches, extends up the haulm, and goes to the leaves, there showing its presence by a brown spot. It protrudes through the stomata, forming a grey tint or bloom upon the leaf. This bloom consists of a branched growth upon which are borne two kinds of spores, both of which are capable of growth during the moist summer weather, but neither of which will exist through the winter. One kind of spore we call conidia, or dust spores; these are wafted to another leaf or stem, where they will grow, if they can find a stomate to enter. They will even start into existence on any damp spot, but die quickly unless they can meet with a potato or some closely related species. The other kind of spore is called a zoospore. Its structure is very different; it is capable of division into a number —say eight—of atoms. These have two lash-like tails, with which they can propel themselves for hours or even days together. They are more able to propagate the disease than the others, because of their wonderful power of locomotion; hence a warm wet day or night is very favourable to the spread of the disease.

But the question arises, if these two kinds of spores do their destructive work only in the summer and die, how is the disease propagated through the winter? This is the puzzle which has harassed the minds of the ablest men of the day, and the solution of it has gained for my friend Mr. Worthington G. Smith a gold medal. Mr. Smith collected a great number of the brown-spotted leaves, and kept them moist during the whole of the winter at the cost of a good deal of labour and trouble. The consequence was that these moist leaves produced a quantity of mycelium threads, including the long-looked-for missing link, which is called the resting-spore. If it could be destroyed we should be free from the potato disease. Every diseased potato you leave to be buried in the ground deposits vast numbers of these resting-spores, the haulm you put to the manure heap to rot for future use only increases the disease. This spore, unlike the others, requires to be fertilised, an office which is performed by a smaller body which grows near it on the mycelium. After their union the oospore is capable of withstanding the cold, and awaits its time to grow; it may, for all we know, live for years, until it finds suitable conditions for growth. As yet there has not appeared anything to destroy it, and certainly the difficulty of its destruction must be enormous. Wet seasons and wet places promote its growth more than dry ones. The same ground should not be used for successive years for the growth of the potato. The haulm and every root and rootlet should be burned. Those varieties of potato which are least affected by the disease, such as the very earliest sorts, should be encouraged, so should the red kinds of winter potato rather than the white. It is not as though the common kind of potato only were attacked. Eleven of the Solanaceæ, the family to which the potato belongs, are recorded as having developed the disease, so has *Arthoceris viscosa.*

In conclusion, let me now give you some idea as to the division of the fungi. The fungi are arranged under two divisions: 1st, the Sporifera, in which the spores are naked; 2nd, the Sporidiifera, in which the spores are in sacs or asci. The first division is subdivided into four families, the second into two. In all these families the name is derived from the predominance of some feature in each.

Hymenomycetes, from Gr. *humēn*, a membrane, and *mukēs*, a mushroom; the fruit being formed on a membrane, which is either naked from the first or soon becomes so, if originally enclosed in a volva.

Gasteromycetes, from *gaster*, a belly, where the fruit is produced in a closed receptacle.

Coniomycetes, from *konis*, dust; the dust-like spores forming the chief character.

Hyphomycetes, from *huphē*, a woven mass of threads.

Physomycetes, from *phusa*, a vesicle or bladder, where the fruit arises from the tip of a thread, penetrating into the vesicle which forms a covering for the fruit.

Ascomycetes, from *ascos*, a sac, where the fruit is formed within asci.

The families are subdivided into thirty-one orders, the orders into 368 genera up to the publication of Dr. Cooke's "Handbook of British Fungi," and the species up to that time (1871) amounted to 2,809. But within the the last few years a great number of species has been recorded as new to Great Britain, and this number does not now represent by hundreds the fungi that are known as British.

In concluding my paper, it must not be thought that I have exhausted the subject. Not a word has been said about the luminosity of fungi, their ubiquity, and the advantage gained in studying them from the fact that they are to be found every day in the year, as compared with flowering plants which can only be obtained during a limited season. Not a word has been said about their geographical distribution, and very little about their hybernation, and their various modes of fructification. These points may be left for a future time.

ARTIFICIAL SEA-WATER.

BY R. M. LLOYD.

Having had occasion to make some artificial sea-water, and not feeling satisfied with Mr. Gosse's formula, I calculated one as below from Dr. Schweitzer's analysis of sea-water at Brighton. I found Mr. Gosse in error with regard to the amount of sulphate of magnesia, his quantities are also very confusing, being partly given in "ounces avoirdupois" and partly in "grains troy." It is, however, unnecessary to be very exact in the respective quantities of the different substances. Plants and animals will thrive in water compounded according to Mr. Gosse's direction. The composition of the sea, moreover, varies not only in different places but in the same place at different times. The most important point, is to have the water of the right specific gravity, which may be told by some form of hydrometer, preferably a hollow glass ball so weighted that it will just float when the water is of the right density.

DR. SCHWEITZER'S ANALYSIS.

Parts in 1,000.

Water	964·74	100 lbs.	=	10 gallons.
Chloride of Sodium	27·06	44·92 oz.	=	44 oz. 15 drs.
Chloride of Potassium	·77	1·28 oz.	=	1 oz. 4 drs.
Chloride of Magnesium	3·67	6·09 oz.	=	6 oz. 2 drs.
Bromide of Magnesium	·03	·05 oz.	=	1 dr.
Sulphate of Magnesia	2·30	3·81 oz.	=	3 oz. 13 drs.
Sulphate of Lime	1·40	2·32 oz.	=	2 oz. 5 drs.
Carbonate of Lime	·03	·05 oz.	=	1 dr.
Iodine and Ammonia	traces			
	1000·			

It is quite unnecessary to use distilled water. Clear stream water, or that from a deep well, is to be preferred. Ordinary pump water must be avoided.

As chloride of sodium (common table salt) usually contains chloride of potassium, it will be sufficient if the weights of the two are added together, and that quantity of common salt used. The salt should be well dried before it is weighed.

Chloride of magnesium must be kept in a closely stoppered bottle until required, as it rapidly absorbs water from the air.

Bromide of magnesium. This being in such a small proportion, may be entirely disregarded if thought well.

Sulphate of magnesia. This, as ordinarily sold under the name of Epsom salts, consists of rather more than half water of crystallisation, (63 parts in 123.) It is, therefore, necessary to make allowance for this, and instead of sulphate of magnesia 3·81 oz. = 3 oz. 13 drams, read Epsom salts 7·82 oz. = 7 oz. 13 drams.

Sulphate of lime is only soluble to the extent of one part in about 400, and, as sea water contains about one part in 700, if a saturated solution of rather more than half the quantity proposed to be made be formed, and then the clear supernatant solution poured off, filtered, if necessary, and added to the other portion, the whole will contain about the proper proportion.

Carbonate of lime. As this occurs in the water proposed to be used, and only in a very small proportion in the sea, it is quite unnecessary to take any further notice of it.

CALENDAR OF NATURE, 1878.

KEPT BY MEMBERS OF THE BURTON-ON-TRENT NATURAL HISTORY SOCIETY.

Explanations: lf., *in leaf;* fl., *in flower.*

			OBSERVER.
Jan.		The winter months of 1878 were mostly very wet and mild	C. U. T.
,,	27.—	Heavy fall of snow and rain, causing high flood in the Trent	C. U. T.
,,	31.—	First skating since March 1st, 1877	C. U. T.
Feb.	2.—	Woodbine, lf., Dunstall	W. M. H.
		Small White Butterfly (Pieris rapæ) taken	C. F. T.
,,	17.—	Wasp seen at Bretby	S. J.
		Bee seen at Grammar School. A remarkably warm day (therm. 60°.)	C. U. T.
		Bee seen at Walton-upon-Trent.	
,,	23.—	Currant, lf., at Grammar School.	
		Gooseberry, lf., at Grammar School.	
		Thrush's Nest, three eggs, locality Byrkley	E. B.
,,	24.—	Hybernia leucophearia taken	C. F. T.
,,	25.—	Rhubarb, lf., Grammar School.	C. U. T.
Mar.	3.—	Tortoiseshell Butterfly (Vanessa urticæ) seen	C. F. T.
,,	4.—	Hybernia progemmaria and H. rupicapraria taken.	C. F. T.
,,	6.—	Robin's Nest, with five eggs, Stapenhill	F. E.
		Pink Ribes, fl.	
		Tæniocampa instabilis came out of pupa	C. F. T.
,,	9.—	Celandine, fl., locality Tatenhill	G. F. U.
		Coltsfoot, fl., Tatenhill	G. F. U.
		Primrose, fl., ,,	G. F. U.
		Violet, fl., ,,	G. F. U.
		Wood Anemone, fl., ,,	G. F. U.
		Daisy, fl., ,,	G. F. U.
		Cuckoo-flower, fl., ,,	G. F. U.
		Gorse, fl., ,,	G. F. U.
		Thorn, lf., ,,	G. F. U.
		Briar, lf., ,,	G. F. U.
		Honeysuckle, lf., ,,	G. F. U.
		Dog's Mercury, fl., ,,	G. F. U.
		Elder, lf., ,,	G. F. U.
		Currant, lf., ,,	G. F. U.
		Gooseberry, lf., ,,	G. F. U.
		Raspberry, lf., ,,	G. F. U.
,,	16.—	Ground Ivy, fl., ,,	G. F. U.
		Speedwell, fl., ,,	G. F. U.
		Wild Strawberry, fl., ,,	G. F. U.
		Hazel, fl., ,,	G. F. U.
,,	20.—	Palm Willow, fl., ,,	G. F. U.
,,	20.—	Thrush's Nest, with young birds, Rangemore	J. M.
,,	22.—	Crow's Nest, with eggs, Egginton	H. B.
,,	23.—	Dandelion, fl., Needwood Forest	W. M. H.
		Wood Anemone, fl., Bretby	T. G.
		Cowslip, fl., Bretby	T. G.
		Hedge Sparrow's Nest, three eggs, Branstone	F. G.
		Wild Duck's Nest, three eggs, Branstone	F. G.
		Robin's Nest, three eggs, Egginton	H. B.
,,	24.—	The Eurydice gale; thick snow at Burton, 12 30 to 1 30 P.M.	C. U. T.

Mar. 26.—Hard frost (thermometer on grass fell to 12°) .. C. U. T.
April 10.—Swallows seen, Burton-upon-Trent .. .. .. C. F. T.
„ 11.—White Butterfly, Branstone .. .. T. G.
„ 14.—Horse Chestnut, lf., Grammar School .. .. C. U. T.
Cherry Tree in blossom, Branstone .. .. .. F. G.
Forget-me-not, fl., Tatenhill .. .. F. U.
Bluebells, fl., Tatenhill.. .. .. G. F. U.
„ 22.—Adder's Tongue, fl., Tatenhill .. .. J. G.
Candock, Stitchwort, Branstone .. .. .. J. G.
Broom, fl., Barton .. .. J. G.
May, fl., Catton .. .. J. G.
„ 27.—Water Daisy, near Sinai Park.. .. .. .. J. G.
„ 29.—Corncrake heard, Yoxall .. .. J. G.
„ 30.—Chaffinch, three eggs, Branstone .. .. .. J. G.
May 1 & 6. Early growth of vegetation much cut by frost. .. C. U. T.
„ 1.—Horse Chestnut, fl., Manor Croft .. .. .. C. U. T.
„ 3.—Wood Pigeon, two eggs, Repton .. .. .. C. F. T.
„ 4.—Magpie, six eggs, Bretby .. .. S. J.
„ 5.—Cuckoo heard, Stapenhill .. .. C. A.
„ 7.—Hawthorn and Laburnum, fl., the former a scanty blossom generally, owing to wet weather .. C. U. T.
„ 9.—Apple blossom falling .. .. C. U. T.
10 to 18.—The Trent at times in high flood; rain more or less every day from 6th to 28th.
„ 11.—Dragon Fly, Stapenhill .. .. J. A.
„ 15.—Limes, lf.
„ 17.—Laburnum, lf., Bagot's Park .. .. C. U. T.
Damson Trees in full bloom, Bagot's Park.. .. C. U. T.
June 2.—Glow Worm, Stapenhill .. .. J. C. P.
„ 4.—Took S. populi .. .. C. F. T.
„ 5.—Took A. cardamines, M. biriviata .. .. .. C. F. T.
„ 6.—Lime, fl. .. .. C. U. T.
„ 7.—Took H. humuli, R. cratægata, I. lactearia, E. alchemillata, E. exiguata, E. vulgata, C. russata .. .. C. F. T.
„ 8.—Took larvæ of C. spartiata .. .. C. F. T.
„ 10.—Wild Rose, fl. .. .. C. U. T.
„ 10.—Took H. velleda, E. dolabraria, T. biundularia, E. heparata, A. luteata, C. pusaria, C. corylata, E. castigata, A. betularia, H. grisealis, H. dentina, H. prasinana, C. propugnata, larvæ of D. cœruleocephala, B. quercus, H. defoliaria .. C. F. T.
„ 12 and 13.—Trent in flood.
„ 12.—Took (Swynnerton Woods, Stafford,) F. piniaria, M. liturata, H. crassalis, N. plecta, X. rurea, R. tenebrosa, H. thalassina, E. lucipara .. C. F. T.
„ 13.—Took (Burntwood, Stafford,) L. marginata, M. hastata, L. pectinitaria, C. exanthemaria, P. lacertula, larvæ of T. quercus, B. perfumaria, C. flavicornis .. .. C. F. T.
„ 17.—Took (Eyam, N. Derbyshire) A. ulmata .. .. C. F. T.
„ 18.— „ „ „ F. atomaria, E. albulata .. .. C. F. T.
„ 19.—Took (Miller's Dale) A. menthastri, A. fuliginosa, M. montanata .. .. C. F. T.
„ 21.—Took (Burton) A. psi .. .. C. F. T.
„ 23 to 28.—Very hot weather: on 26th thermo. 90° at Burton, 95° at Nottingham; on 26th, ·24 inch of rain fell in fifteen minutes during a thunderstorm

June 25.—Took A. incanaria, M. brassicæ .. .. .. C. F. T.
,, 27.—Took S. janira, M. albicillata, L. didymata, A. nebulosa, P. gamma, S. olivalis .. .. .. C. F. T.
,, 28.—Took T. amataria, C. bilineata, P. chrysitis, M. strigilis, H. proboscidalis .. .. .. C. F. T.
July 1.—Took H. oleracea, A. triplasia, A. putris, A. exclamationis, M. typica .. .. C. F. T.
,, 3.—Took (Eyam) B. repandata, E. palumbaria.. .. C. F. T.
,, 4.—Took H. pamphilus, Z. filipendulæ, T. chærophyllata .. .. C. F. T.
,, 6.—Took L. cæsiata, A. rumicis, M. fasciuncula, A. myrtilli .. .. C. F. T.
,, 8.—Took E. nanata, P. forficalis .. .. C. F. T.
,, 9.—Took (Eyam) L. Alexis, N. mundana .. .. C. F. T.
,, 12.—Took H. lupulinus, A. fumata, A. aversata, C. fulvata .. .. C. F. T.
,, 17.—Took (Burton) E. rectangulata, E. sambucalis .. C. F. T.
,, 18.—Limes' leaves falling .. .. C. U. T.
,, 19 & 21.—Therm. 90° in shade, 150° in sun .. .. C. U. T.
,, 19.—Took O. potatoria, P. syringaria, Y. elutata, E. mensuraria, L. impura, P. iota, B. urticalis .. C. F. T.
,, 22.—High wind from N.E., blowing down branches, &c., from trees.
Aug. 3 to 18.—Rain more or less every day, except one .. C. U. T.
,, 16.—Took H. wavaria, T. orbona, larvæ of A. psi, and P. bucephala .. .. C. F. T.
,, 17.—Took larvæ of S. populi, H. oleracea, and D. vinula C. F. T.
,, 24.—Took pupæ of N. typhæ .. .. C. F. T.
,, 29.—Took A. niveus .. .. C. F. T.
Sept. The autumnal tints appeared unusually early.
,, 3.—Took C. testata .. .. C. F. T.
,, 19.—Took C. spartiata .. .. C. F. T.
24 to 26.—Three frosty nights brought on rapidly the fall of leaves, especially from limes and chestnuts .. C. U. T.
,, 24.—Took (Swinnerton) A. rufina, A. saucia, X. ferruginea, P. meticulosa .. .. C. F. T.
,, 26.—Took larvæ of F. piniaria, E. nanata, E. minutata, A. porphyrea, A. myrtilli, imago of T. variata .. C. F. T.
Oct. 5.—Very fine warm day, therm. 73° in shade .. .. C. U. T.
,, 14.—Took O. dilutata .. .. C. F. T.
,, 27.—Deep and early snow in the Peak of Derbyshire .. C. U. T.
,, 30.—Snow at Burton .. .. C. U. T.
Nov. Frequent falls of snow characterised this month.
11 to 13 } 16 to 18 } Trent in flood.
25 & 30.—Dense fogs.
,, 26.—H. aurantiaria emerged from pupa .. .. .. C. F. T.
Dec. Frost occurred every night till the 30th. Skating began about the 6th. Trent at Drakelow bore skating on 14th, and on the 23rd at the Recreation Ground. A rapid thaw occurred on the 30th and 31st.. .. .. C. U. T.
,, 17.—H. defoliaria emerged from pupa .. .. .. C. F. T.

[We are indebted to the courtesy of the Burton-on-Trent Natural History and Archæological Society for permission to insert the foregoing interesting calendar.—Eds. M.N.]

Reviews.

The Study of Rocks. By Frank Rutley, F.G.S. London: Longmans, Green, and Co.

This is a new volume of Messrs. Longmans' well-known cheap series of "Text-Books of Science." Mr. Rutley is petrologist to the Government Geological Survey, and in the book now before us he supplies a want much felt by English geologists, viz., a thorough and correct introduction to the study of rocks. To be able to recognise and correctly describe rocks, at all events any which we shall be likely to meet with in this country, is a power which must be diligently sought after by every student of geology. Such a knowledge, we have no hesitation in saying, can neither be aquired from books alone nor from specimens alone, but any one who will combine the two, who will carefully study Mr. Rutley's work, while at the same time he examines collections of rocks and minerals, such as may be seen in any public museum, or obtained by exchange, or purchased from dealers, cannot fail to lay the foundation of a sound practical knowledge of this subject, which will be of great value to him at every succeeding step in the science of geology. In the introductory chapters of this book Mr. Rutley gives, in a clear and concise manner, an account of the structure and phenomena of rock masses. He then gives very valuable and practical information on the formation of a rock collection, and on the examination of rocks, especially by the aid of the microscope. This part concludes with an account of the principal rock-forming minerals, their megascopic and microscopic characters.

In Part II. the author describes the several species of rocks under two main heads—Eruptive and Sedimentary. This portion of the work is especially interesting, as it contains the latest, and, indeed, new, information on many points of interest and importance. This portion of the book would bear much amplification, so that in future editions (which will certainly be called for) the descriptive petrology might well form a second volume. Altogether, it is certain that all practical workers in geology will hail as a great boon the appearance of this book, for it fills a distinct gap in the (English) literature of the science, whilst we may further hope that it will promote clearness of ideas and uniformity of nomenclature.

W. J. H.

The Post-Tertiary Deposits of Cambridgeshire. By A. J. Jukes-Browne, B.A., F.G.S. Cambridge: Deighton, Bell, and Co.

This work is the Sedgwick Prize Essay for 1876. It constitutes an interesting and important contribution to the study of one of the "burning" geological questions of the day—the origin, nature, and classification of the deposits of the Glacial Period. In the first two chapters Mr. Jukes-Browne furnishes a history of the work already done in this direction, both generally (chap. I.) and in the county of Cambridge, (chap. II.) He next briefly denotes the physical features of the county, and then enters more fully into an account of the *Great Chalky Boulder*

Clay, which he believes to be the lowest glacial deposit present. The gravels and sands which occur sometimes in, sometimes below this great clayey deposit, he regards as local only, and not forming part of the *Middle Glacial Sands* of Mr. Searles V. Wood, jun. As to the mode of its formation, Mr. Jukes-Browne considers that the Chalky Boulder Clay was formed by matter dropped from bergs and coast-ice in a sea open to the north, but with land to the south and west. When this area was again elevated, the coarse hill gravels (with what are called the "Plateaux" and "Flood" gravels) were formed on the highest points as they rose above the sea by the action of currents on the boulder clay. The elevation increasing, rivers would begin to flow over the new land surface, and from their action the several series of river gravels would result. Altogether this essay is a valuable contribution to the geology of the district to which it relates. The author is upon the staff of the Geological Survey, and we shall look forward with interest to further accounts from his pen describing in other districts the deposits of which he has given us so good an account in Cambridgeshire.

W. J. H.

Proceedings of the Chester Society of Natural Science. No. II. Chester: Printed for the Society. Price 2s. 6d.

THIS Society is evidently doing good work, and the pamphlet which has just been issued does the members very great credit. It contains a number of thoughtfully and ably written papers on the geology and the fauna and flora of the Chester district, and is illustrated by an autographic print, taken from a photograph, of a specimen of Stigmaria, from the coal measures of Trefnant, near Ruabon. Mr. A. O. Walker, F.L.S., contributes two very interesting papers, viz., "Observations on Phenomena connected with the Deposition of Sediment at the present day in the Estuary of the Dee, and their bearing upon Older Deposits;" and "Notes on the Lower Coal Measures between Bagillt and Holywell." Mr. George W. Shrubsole, F.G.S., contributes a paper "On the Origin of Rock Salt," in which he contends that "rock salt has been derived from the evaporation of water." Mr. W. Shone, F.G.S., supplies a valuable paper on "The Drift Deposits of West Cheshire," with the lists of the foraminifera, ostracoda, mollusca, polyzoa, cirripedia, annelida, echinoidea, and spongida, found by himself and other members of this society. Dr. H. Stolterfoth, M.A., contributes an excellent "List of the Diatomaceæ found in Chester and district and Cwm Bychan, N.W." In this list are some very rare species. There is a very able paper by Mr. J. D. Siddall "On the Foraminifera of the River Dee," giving descriptions of several species new to the British fauna which have been found in this river; together with extensive lists of the species found by him, many of them very rare. Mr. T. Shepheard gives an excellent account of the "Freshwater Polyzoa found in the neighbourhood of Chester," with descriptions and notes. There is also a lengthy communication by Mr. J. Price, M.A., on "Proliferous Leaves and Notes thereon," being an account of some original investigations made by him on *Cardamine pratensis*. Mr. Price finds that every leaflet of this plant will germinate and give origin to a new plant. This paper is worthy of the attention of all botanists. Mr. E. J. Baillie contributes "The City Flora," and gives a list of over 400 flowering plants and ferns found within the "city of the county of Chester." These proceedings are well printed, and free from typographical errors.

J. E. B.

METEOROLOGY OF THE MIDLANDS.

THE WEATHER OF APRIL, 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 d.	TEMPERATURE. Greatest ht. Deg	Greatest ht. Date.	Great'st cold. Deg	Great'st cold. Date.
GLOUCESTERSHIRE.									
Cainscross, Stroud	W. B. Baker, Esq.	2·55	·72	20	6	65·0	3	26·0	2
Cheltenham	R. Tyrer, Esq.	2·59	·58	6	20	56·2	27	26·5	4
Stroud	T. J. Coley, Esq.	2·36	·59	7	15	59·0	23	29·0	13
SHROPSHIRE.									
Haughton Hall, Shifnal	Rev. J. Brooke	2·49	·40	9	17	56·0	26	23·0	13
Woolstaston	Rev. E. D. Carr	2·82	·43	9	21	63·0	8	20·0	13
Leaton Vicarage, Shrewsbury	Rev. E. V. Pigott	3·01	·61	9	25	56·9	4	19·1	13
More Rectory, Bishop's Castle	Rev. A. Male	2·25	·35	26	24	57·0	26	23·0	13
Larden Hall, Much Wenlock	Miss F. R. Boughton	2·80	·57	9	21				
Bishop's Castle	E. Griffiths, Esq.	2·16	·29	26	21	58·0	4	23·0	13
Cardington	Rev. Wm. Elliott	3·37	·61	9	20				
Stokesay	Rev. J. D. La Touche	2·29	·26	20	21	59·3	27	23·6	13
HEREFORDSHIRE.									
Whitfield	W. Wheatley, Esq.	2·41	·45	6	20			24·0	13
Stoke Bliss	Rev. G. E. Alexander	2·78	·28	11	20	57·0	27	26·0	12
WORCESTERSHIRE.									
Orleton, Tenbury	T. H. Davis, Esq.	2·96	·40	6	20	57·8	27	23·8	13
West Malvern	A. H. Hartland, Esq.	2·95	·44	6	17	55·0	4	24·5	12
Pedmore	E. B. Marten, Esq.	2·54	·34	6	23	60·0	27	28·0	13
Longlands, Stourbridge	J. Jeffries Esq.	2·37	·32	6	21	62·0	26	28·0	3 & 21
Dennis, Stourbridge	Mr. C. Webb	2·40	·28	6	21	57·0	4	27·0	12
STAFFORDSHIRE.									
Thorganby Villa, Wolverhmtn	G. J. C. Broom, Esq.	2·84	42	23	20				
Dudley	Mr. J. Fisher	2·66	s)·40	30	19	62·0	26	28·0	12
Sedgley	Mr. C. Beale	2·84	·35	6	17	54·0	26 & 27	28·0	12
Kinver	Rev. W. H. Bolton	2·32	·33	26	19	57·0	26	26·0	12
Walsall	Mr. N. E. Best	3·10	·56	23	20	54·0	7 & 26	27·0	12
Grammar School, Burton	C. U. Tripp, Esq.	2·68	·49	9	18	58·0	2, 27, 29	25·0	22
Weston-under-Lyziard R'tory	Hon. and Rev. J. Bridgeman	2·91	·55	23	18	59·0	27	13·0	24
Wrottesley	E. Simpson, Esq.	3·37	·67	26	18	55·0	5, 27, 28	24·1	13
Heath House, Cheadle	J. C. Philips, Esq.	2·86	·76	23	16	56·0	7	25·0	13
Alstonfield Vicarage	Rev. W. H. Purchas	3·01	·63	23	16	56·5	10	22·4	14
WARWICKSHIRE.									
Coventry	J. Gulson, Esq.	2·67	·46	6	16	60·0	26		
Coundon, Coventry	Lieut.-Col. R. Caldicott	2·87	·49	6	18	58·0	26	29·0	12 & 18
Bickenhill Vicarage	J. Ward, Esq.	2·98	·53	19	14	47·0		31·0	
Oscott College	Rev. S. J. Whitty	2·78	·61	23	18	56·9	26	26·5	13
Henley-in-Arden	T. H. G. Newton, Esq.	3·09	·54	23	17	59·0	27	27·0	13
Rugby School	Rev. T. N. Hutchinson	2·15	·44	23	18	59·0	26	27·4	22
DERBYSHIRE.									
Buxton	E. J. Sykes, Esq.	3·27	·42	20	19	53·2	26	19·9	13
Stoney Middleton	Rev. U. Smith	3·30	·58	23	15	54·0	8, 25, 26	12·0	12
Brampton S. Thomas	Rev. J. M. Mello	2·73	1·00	10	9	61·0	21	22·0	13
Fernslope, Belper	J. G. Jackson, Esq.	2·60	·48	9	13	57·0	26	26·0	13
Linacre Reservoir	C. E. Jones, Esq.	3·07	·51	9	17				
Spondon	J. T. Barber, Esq.	2·67	·54	9	17	57·0	26	25·7	3
NOTTINGHAMSHIRE.									
Tuxford	J. N. Dufty, Esq.	2·50				60·0	29	25·0	12
Hodsock Priory, Worksop	H. Mellish, Esq.	2·67	·54	9	19	60·0	26	23·6	13
Park Hill, Nottingham	H. F. Johnson, Esq.	3·07	·75	9	14	57·5	7	30·3	12
Hesley Hall	B. J. Whitaker, Esq.	2·51	·43	10	14	63·0	27	29·0	12
LEICESTERSHIRE.									
Loughborough	W. Berridge, Esq.	2·46	·46	9	15	58·3	7	27·7	22
Ashby Magna	Rev. E. Willes	2·41	·61	23	18	61·0	26	24·0	12, 19, 22
Market Harborough	S. W. Cox, Esq.	2·20	·45	12	15	58·0	26	23·0	12
Kibworth	T. Macaulay, Esq.	2·35	s) 44	12	17				
Town Museum, Leicester	W. J. Harrison, Esq.	2·11	s(·49	14	18	57·9	26	28·5	22
Belmont Villas, Leicester	H. Billson, Esq.	2·18	·38	9	18	61·0	7	29·0	12 & 22
Syston	J. Hames, jun., Esq.	1·62	·83	14	15	60·0	5 & 8	28·0	12 & 13
Waltham-le-Wold	E. Ball, Esq.	3·16	·44	9	15	58·0	26	27·0	11
Little Dalby Hall	G. Jones, Esq.	2·63	·36	7	14	60·0	26	23·0	12 & 22
Foxton Locks	Union Canal Company	1·88	·35	13	13				
Coston Rectory, Melton	Rev. A. M. Rendell	2·66	·51	23	18	58·5	7	21·0	22
NORTHAMPTONSHIRE.									
Towcester Brewery	J. Webb, Esq.	2·18	·53	12	13				
Castle Ashby	R. G. Scriven, Esq.	2·78	·59	23	16	61·0	26	28·0	11
Kettering	J. Wallis, Esq.	3·34	·70	23	17	59·0	27 & 28	28·0	13
Althorpe	C. S. Groom, Esq.	1·84	·41	6	13	59·0	26	26·0	11 & 17
Pitsford	C. A. Markham, Esq.	2·07	·53	12	17	62·0	27	26·0	12
RUTLAND.									
West Deyne, Uppingham	Rev. G. H. Mullins	3·08	·60	23	16	57·2	26	26·9	12
Northfields, Stamford	W. Hayes, Esq.	2·54	·45	9	14	60·0	27	25·0	12
Ventnor Hospital	W. T. Ryder, Esq.	3·63	1·20	15	6	57·8	27	28·7	12
Altarnun Vicarage	Rev. G. Tripp	3·27	·60	20 & 21	19	62·0	21	22·0	12

The first few days of the month were fairly warm and fine, but the weather soon relapsed into the cold, sunless, showery character which has characterised the long and dreary winter, which, even now, (May 23rd,) can scarcely be said to have passed away. From the 11th to the 15th snow fell more or less at every station. The fall of the 12th was heavy, and on Easter Sunday (13th) from five to eight inches of snow covered the ground. Easterly winds continued to prevail, and, with almost nightly frosts, so checked vegetation generally that the hedges were black and bare up to the last day. The temperature may be estimated at five or six degrees below the average; rainfall about the average. From the 27th to the 30th thunderstorms were experienced with hail. The Rev. J. Brooke (Shifnal) writes:—"The coldest Easter-day for at least forty-five years, the min. temperature being 23°, and the max. 40°; the next nearest being 1836, (April 3rd,) when min. was 32° and max. 44." Mr. T. H. Davis, (Orleton)—"The coldest month of April that has occurred for more than twenty-four years." We are indebted to our meteorological observers for the accompanying notes of spring birds and flowers.

Dates of Spring Flowers.—*Brampton S. Thomas*—Anemone nemorosa, Mercurialis perennis, fl., 11th; Elder, Hawthorn, l., 29th; Ranunculus Ficaria, fl., 30th. *Stroud*—Fl. on 1st, Wood Sorrel; 5th, Goat Willow (stamens;) 8th, Caltha palustris; 9th, Periwinkle, Wood Anemone, Daffodil; 10th, Red Dead Nettle; 14th, Cinquefoil; 25th, White Dead Nettle, Ground Ivy; 29th, Fragaria vesca, Cowslip, Ranunculus aquatilis, Wood Spurge; 30th, Æthusa cynapium, Cardamine pratensis, Adoxa moschatellina, Chrysosplenium alternifolium.

Migratory Birds, &c., heard or seen.—*Castle Ashby*—Swallows, a few on 20th, main body on 26th; Cuckoo heard on 28th; Nightingale, May 7th. *Woolstaston*—Swallow, 21st; Cuckoo, 23rd. *Coston Rectory*—Cuckoo, 22nd. *Shifnal*—Swallow, 23rd; Cuckoo, 22nd; Sand Martin, 14th; White Butterfly, 29th; Yellow-tip Humble Bee, 4th. *Market Harborough*—Swallow, 19th; Cuckoo, 21st. *Weston-under-Lyziard*—Swallow, 25th. *Bishop's Castle*—Swallow, 24th; Cuckoo, 21st. *More Rectory*—Swallow, 19th; Cuckoo, 21st; Redstart and Garden Warbler, 22nd. *Cheltenham*—Swallow, 20th; Cuckoo, 27th. *Much Wenlock*—(One) Swallow, 25th; Cuckoo, 23rd. *Tenbury*—Swallow, 17th; Cuckoo, 20th; Chiff-chaff seen on 1st. *Handsworth Wood*—Cuckoo, 25th.

Correspondence.

Chrysosplenium alternifolium.—This plant, stated in most works on Botany to be "rare," or "not common," I have found in several parts of this neighbourhood. Will any of the readers of the "Naturalist," who have seen it elsewhere, tell me where it is to be found?—Observer, Stroud.

Two Precambrian Groups in Shropshire.—I have recently obtained clear evidence of a second Precambrian formation, near Wellington. In Primrose Hill, the south-westerly spur of the Wrekin, I have come upon an exposure of hornblendic gneiss, with a high dip to the N.E. Associated with this bedded rock are a red granitoidite and a well-crystallised diorite. The identity of these rocks with some of the common Malvern types in my cabinet is undoubted, and the strike precisely corresponds with that of the Malvernian series. This metamorphic group is unconformably overlaid by the tuffs and rhyolites of the Wrekin. I have just returned from a visit to St. David's, where I was struck with the close resemblance between the lower part of the Pebidian and the ashy slates and hälleflintas of Lilleshall Hill. These Lilleshall rocks I have also detected on the flanks of the Malvern Hills. Thus light begins to dawn upon the obscurity which has hitherto enveloped these ancient and difficult rocks. This is the first announcement of the discovery of a second series in Salop, but I must not do more than state the bare fact at present.—C. Callaway.

Black Band in the Drift.—I hope Mr. Atkins will examine carefully the black band referred to in last month's notes. A similar band was described by the late Dr. Ick, Curator of the Birmingham Philosophical Institution, as occurring at Saltley. Several horns were found in the deposit, and also nuts of the common hazel. It would seem likely that organic remains should be found in the bed Mr. Atkins describes.—C. J. Woodward.

Notes on Ornithology.—Whatever may be the effect of severe weather upon the arrival of our Spring migrants on our shores, it certainly causes them to put in an appearance in the Midland Counties at a later date than usual. Thus, nearly all the dates below mentioned are later, and some of them markedly so than in former years. The Chiffchaff and Blackcap, mentioned in my last notes, were observed later than for three years. The Sand Martin's arrival is the latest record I have by nine days. The Swallow, House Martin, Willow Wren, and Cuckoo were all late, whilst the Nightingale has been heard on an earlier date for seven consecutive years past. At the time I write (May 12th) the Swifts have not yet arrived. I have thirteen arrivals to chronicle, viz. :—

April 11.—Lesser Whitethroat *(Sylvia curruca.)*
,, 17.—Swallow *(Hirundo rustica.)*
,, 21.—Willow Wren *(Sylvia trochilus.)*
,, 25.—Sand Martin *(Hirundo riparia.)*
,, 25.—Nightingale *(Philomela Luscinia.)*
,, 26.—House Martin *(Hirundo urbica.)*
,, 29.—Common Whitethroat *(Sylvia cinerea.)*
,, 30.—Tree Pipit *(Anthus arboreus.)*
,, 30.—Cuckoo *(Cuculus canorus.)*
May 1.—Garden Warbler *(Sylvia hortensis.)*
,, 4.—Wood Wren *(Sylvia sibilatrix.)*
,, 6.—Grasshopper Warbler *(Avicula locustella.)*
,, 8.—Sedge Warbler *(Salicaria Phragmitis.)*

Several others are overdue, and are probably here, but I have failed to observe them. Two small flocks of Fieldfares were seen passing on April 12th, others on 19th, and the last party on 22nd. A nest of Blackbirds was hatched off on April 15th, but the young brood succumbed to the severity of the weather. Rooks were hatched on April 20th. A friend writes me that she heard the Nightingale in Derbyshire on April 17th. In the last number of the "Midland Naturalist," a correspondent in North Notts notes the advent of a doubtful migrant, either *Sylvia rufa* or *S. trochilus.* From the date given, April 5th, it was probably the former, but, as the birds themselves are so easily distinguished, and their notes are so different, there ought to be no doubt as to which it was. I shall be very glad to compare my dates with those of any other observers in the county of Leicester if they will correspond with me.—Thomas Macaulay, M.R.C.S.L., &c., Kibworth.

Ornithological Notes from Derby.—A birdstuffer here, a short time since, showed me a Dipper, *(Cinclus aquaticus,)* which he said had been shot in Christmas week, on a small brook near the Workhouse. That interesting pile is just on the outskirts of the town, and the brook is a small stream running through the red marl, and averaging in width about a yard. The Dipper is common on two of our Peak rivers, the Wye and the Dove, and I have very little doubt on the Derwent also, though I cannot call to mind that I have ever noticed it there. But the place it frequents nearest to the brook above-mentioned is at least fifteen miles away, and the occurrence of a species, like the Dipper, loving rocky limestone streams, on a little lowland clay brook, quite close to a large town, is, I think, remarkable.—The same birdstuffer said he had not had a single Brambling brought to him during the past winter. Usually he has them in abundance.—I have heard of two more Hawfinches being killed near Derby lately, at Mickleover and Quarndon. In my note on the Hawfinch, p. 123, line 21, for "light" read "bright."—Merlin, Derby, 18th May, 1879.

Ornithological Notes.—A few swallows were seen here early. Mr. Bill and Mr. Kirby both saw one on the 8th April, and the Cuckoo was heard at Keresley on the 16th. Mr. Miller, of Combe Gardens, writes me that he saw the first pair of swallows there on the 20th, and on the 25th these birds seemed to have settled down to their work. The Nightingale was heard in High Wood on the 22nd. Mr. Miller writes:—"The late season has made no difference to the rooks, for they commenced the repair and re-building of their nests punctual to a day—in the first week of March. I have ample opportunity of observing them. In a tree within gunshot of my sitting-room window are about twenty-five nests. In this tree, which is a large oak covered with ivy to within three feet of the highest branches, there are breeding at the same time the rook, the ringdove, the stockpigeon, the starling, the sparrow, and, for aught I know, the blackbird and thrush. Later in the season the turtle dove is not an unusual frequenter of this tree. Besides this being my natural history tree I also call it my weathercock, for, as we have east wind prevailing more or less throughout spring, during the time the east wind is blowing the rooks sit on the branches with beaks eastward, tails westward. You can understand it to be a great pleasure, after a long tack of east wind, to come down one fine morning and find the rooks all sitting with beaks westward and tails to the east." Of the summer migrants the chiff-chaff, willow wren, and wryneck seem to be about in their usual number, but I have seen and heard very few of the other small songsters. The blackcap, garden warbler, whitethroat, redstart, and others are all due about the middle of April; but whether their numbers have been thinned by cold in their southern climate, or whether they are late in their arrival, there is certainly an unusual deficiency in the number of these little visitors at present.—John Gulson, Coventry.

Ornithological Notes.—With regard to the Wryneck mentioned in my notes in March, and in the last number of the "Midland Naturalist," I did not see the bird, but only heard it. I heard it again on the 19th March, near the same place, and was quite convinced that it was of that species. I much regret not having gone to the place, so as to have made it a certainty. "Merlin," in the last number, wishes to know if the increase of Hawfinches has been observed elsewhere. For some years I only heard of one specimen having been killed just here, but this season five have been observed; three of them were shot (one being a bird of the year,) the other two, a pair, frequented our garden for some months, and during the frost fed with the other birds. They were last seen about the end of February. A Coot was shot here on March 14th. It is almost a rarity in this district; the absence of large pieces of water may account for this. I saw two Water Rails is different places during that month; this bird seems to have become more common lately. Early in April Chiffchaffs and Willow Wrens arrived, notwithstanding the wintry weather, which, however, does not seen to have affected our migrants in as great a degree as might have been expected. On the 3rd April a pair of Lesser Spotted Woodpeckers were observed on some poplars in this village; although rare, a few of these birds are seen every year. The last large flock of Fieldfares I saw was on April 5th. On the 16th of that month I heard young Rooks calling from the nests. I was rather surprised to hear them so early, as the old birds were rather behind hand in beginning nesting operations. The first Swallow I saw was on the 19th April; they were not, however, plentiful till the 27th. House Martins were not here till the 26th; a very late date. The Cuckoo was first seen on the 27th; but was heard on the 20th. On that day I observed several small birds feeding on the tops of some fir trees, which on examination turned out to be Siskins. This seems late for them to be here. I counted eight. A flock of yellow Wagtails, about twenty, was seen on a fallow on the 21st, strange to say in company with one grey and a pair of the pied species. On the 4th May I put up a Mallard and Duck from off the Cherwell, where they are no doubt going to nest. A Swift was seen on the 10th of that month, and on the same day I saw two male Redstarts.—O. V. Aplin, Bodicote, Oxon, May 14th, 1879.

Seasonable Observations.—I heard the welcome note of the Cuckoo *(Cuculus canorus)* for the first time on April 24th, 1879, April 17th, 1878, April 22nd, 1877. Swallows *(Hirundo rustica)* first seen April 22nd, 1879, April 17th, 1878, April 27th, 1877. Window Martins *(Hirundo urbica)* first seen April 26th, 1879, April 23rd, 1878, April 28th, 1877. Nightingale in full song April 25th, 1878, and May 6th, 1879. I have observed *Potentilla fragariastrum* in flower April 24th. *Primula veris*, *Taraxacum dens-leonis*, and *Cardamine pratensis* April 25th. Wild Cherry *(Prunus avium)* in sheltered places April 27th, not observed in more exposed places till May 6th. *Prunus spinosa* by April 30th. *Saxifraga tridactylites* by May 3rd. *Lamium album* and *Geranium rotundifolium* by May 5th. The Wild Bullace and Wild Plum were in flower in the hedges May 6th. *Anthriscus sylvestris* in flower May 11th; *Cerastium glomeratum*, Ribwort Plantain, *(Plantago lanceolata,)* Beech, *(Fagus sylvatica,)* and *Sisymbrium alliaria* on May 13th; and Wild Pear *(Pyrus communis)* on May 14th. Brimstone Butterfly first seen March 19th, Tortoiseshell Butterfly March 28th, Red Admiral and Peacock Butterflies seen on April 8th, White Cabbage Butterfly first seen May 4th. Wood Crowfoot *(Ranunculus auricomus)* in flower by May 4th.—Robert Rogers, Castle Ashby, Northampton.

Gleanings.

Midland Union.—The Annual Meeting next year will be held at Northampton, on the invitation of the Northampton Natural History Society, the President of which is the President-elect of the Union.

Deep Borings.—In Hertfordshire the Colne Waterworks Company have long been engaged in putting down a deep bore-hole to obtain an additional supply of water. We understand that at a depth of about 1,000ft. they have struck Silurian rocks. The bores being of great diameter have yielded numerous fossils of Wenlock species.

Mock Sun.—On April 19th, whilst in the train from Ashbourne to Rocester, I saw, between 6 15 and 6 40 p.m., a brilliant example of mock-sun, varying in colour from white to yellow-and-red. It was near the horizon, about 20 degrees from the setting sun.—C. U. Tripp, Burton-on-Trent.

Snow in May.—A correspondent in the *Times* says there is yet (May 21st) enough snow on Snowdon to enable mountaineers to enjoy their favourite occupation within a few hours of London. The gullies which descend from the peak towards Glaslyn are still full of snow. This he adds is most unusual at this time of the year.

Freshwater Life.—Mr. Bolton, 17, Ann Street, Birmingham, informs us that, in continuation of his report (pp. 97 and 127) he has sent the following additional objects to his subscribers :—Young *Cristatella mucedo*, just developed from the statoblast; *Synchæta mordax;* Embryo of fresh-water Mussel, *Anodonta cygnæa; Nitella translucens*, with *Carchesium polypinum; Batrachospermum moniliforme;* Elver, or young Eel; Spawn of Perch; *Melicerta ringens; Melicerta tubicolaria* (or *tyro;) Pandorina morum; Volvox globator;* and *Fredericella sultana.* These were, as usual, all illustrated by drawings from under the microscope by Mr. H. E. Forrest, or by copies of Dr. Hudson's, Professor Allman's, Oersted's, or other drawings, with appropriate descriptions. It is interesting to know that Mr. Bolton has found a new habitat for the rare rotifer, *Melicerta tubicolaria*, (or *tyro*,) of which Dr. Hudson gave a most interesting account and drawings in the "Monthly Microscopical Journal," November, 1875, (vol. xiv., p. 225.)

Hardy Spring Flowers of the undermentioned kinds were exhibited in bunches, by Mr. W. Ingram, of Belvoir Castle, at the Conversazione at Leicester, on the 20th of May, on the occasion of the visit of the Midland Union. They were in superb condition, and showed what glorious decorative resources for our gardens we have in plants which are sufficiently hardy to withstand the severity of such a winter and spring as we have just passed through. We urge our horticultural readers to make a note of this list, and select from it for the enrichment of their gardens for next and future years. All the plants should be planted in the Autumn. Arabis albida, Alyssum saxatile compactum, Alpine auricula, Anemone apennina, A. fulgens, A. nemorosa plena, A. Robinsoniana, Cowslips and Oxlips in variety, Corydalis nobilis, Doronicum austriacum, Epimedium macranthum, E. sulphureum, Gentiana acaulis, Iris pumila, I. pumila cerulea, I. pumila bicolor (Ingram), Lamium maculatum, Leucojum æstivum, Lonicera fragrantissima, Lunaria biennis white and red, Muscari botryoides, Myosotis dissitiflora, Narcissus maximus, N. poeticus tripedalis and other varieties, Omphalodes verna, Orobus vernus, Primula acaulis, many excellent varieties obtained by cultivation, P. cortusoides amœna, Phlox verna, P. subulata, Pulmonaria azurea, Saxifraga cordifolia, S. crassifolia, Scilla amœna, Triteleia uniflora lilacina, Uvularia grandiflora. No one who saw these lovely flowers will ever forget how beautiful they were.

Parasites—A new work by Dr. Spencer Cobbold, F.R.S., is announced, (publishers, Messrs. Churchill,) in which the author treats of the subject of parasites as it affects the whole animal kingdom. The *Athenæum* says the volume is divided into two books, the first dealing with the parasites of man, and the second with those of animals, including birds, reptiles, fishes, &c. Great attention has been given to the department of epidemics, (epizoöty,) both as regards public health and the welfare of our domesticated animals.

Geology at the Crystal Palace.—Do many of the visitors seek out the interesting illustrations of geological facts which are to be seen in the Palace and its grounds? Inside the building there is a good exhibition of flint implements, of specimens of fuel peat, lignite, all the varieties of coal, &c., and also sections showing the structure of the London Tertiary Basin. In the grounds there is, near the lake, the representation of a coal-field, the rocks, limestones, sandstones, grits, clays, and shales having been brought from the Yorkshire and Derbyshire coalfield. Mineral veins and caverns are seen, faults may be noted; Permian and Devonian beds are shown above and below. On the shores and islands of the lake are full-size restorations of various extinct animals, as the Labyrinthodon, Ichthyosaurus, Iguanodon, Palæotherium, &c. These were executed under the direction of Mr. Waterhouse Hawkins and Professor Owen.

The Age of the Earth.—Mr. A. J. Richardson recently read a paper on this subject before the members of the Northampton Natural History Society, in which he dealt with the various theories which have been propounded, giving in detail the geological, biological, and physical estimates of the antiquity of the earth, and the methods by which the calculations were made. The discrepancies were stated as very wide, the physicists arguing that from sixty to eighty millions of years was the most that could be deduced from physical reasoning, whilst the biologists were of opinion that not less than 200 millions were sufficient to account for the vast quantity of species present on the globe, the geologists, however, being satisfied with an intermediate demand of somewhere about 120 millions. The theories of Croll's glacial epochs and many other very interesting points were fully explained, and in such a manner as to keep the attention of the meeting with the lecturer through the hard facts and mathematical formula which necessarily had to be quoted.

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—Geological Section.—April 22nd. Mr. C. T. Parsons sent a curious monstrosity in the flower of a fuchsia.—Mr. H. E. Forrest exhibited *Cladophora ægagropila*, a remarkable alga, which grows in large balls at the bottom of a few English lakes. It is supposed to acquire its globular form from being rolled about by currents at the bottom of the lake.—Mr. J. H. Lloyd gave an account of the rocks of the Lizard district, illustrated by a map and a large number of specimens.—Mr. S. Allport shewed some sections of the same rocks. General Meeting.—April 29th. Mr. Thos. Bolton exhibited in the microscope an elver, or young eel, shewing the whole internal organisation with great clearness.—Mr. T. Roberts exhibited spawn of the toad.—Mr. J. Levick exhibited a double flower of the garden anemone, and in the microscope—tadpole of frog, showing the circulation of the blood in the gills, and the action of the cilia which clothe them externally on the surrounding water.—Mr. J. E. Bagnall exhibited valves of *Pellia epiphylla*, and endothecium of crocus, to shew the fibro-cellular tissue; *Mnium subglobosum*, a moss from near Shirley; and *Cardamine pratensis* shewing prolification of the leaves, sent by Mr. J. Price, M.A., of Chester. May 6th.—General Meeting.—Mr. R. M. Lloyd exhibited *Succinea virescens*, a very rare mollusc, found by himself at Acocks Green.—Mr. T. Bolton exhibited spawn of Perch, (?,) showing curious radial striæ in the albumen.—Mr. J. E. Bagnall exhibited *Peziza trechispora*, a micro-fungus, from canal bank, Wilnecote, and *Viola hirta*, from Wooton Wawen.—Mr. W. H. Wilkinson exhibited a number of mosses from the Malvern Hills, comprising, among others, male and female plants of *Polytrichum piliferum* and *juniperinum;* also *Marchantia conica.*—Mr. H. E. Forrest exhibited and read some notes upon a living specimen of *Hydractinia echinata*, which had lived in a small marine aquarium, belonging to Mr. A. E. Bayliss, for six weeks. He described the alimentary, male, and female polypites, and the two kinds of defensive zooids, and pointed out the remarkable specialisation exhibited by them, no one polypite fulfilling two functions. He also called attention to the curious relationship existing between the Hydractinia and the Hermit Crab, the two being always found in company. This specimen was an example of a *triple* comensalism, the shell being occupied not only by the crab and the hydrozoon, but also by a species of Nereis. Mr. W. R. Hughes said that the bond which united them was probably one of mutual advantage, since both the Hydractinia and the Nereis would profit by the crumbs dropped by the hermit crab.—Biological Section.—May 13th. Mr. T. Bolton brought for exhibition the very rare thecated rotifer, *Melicerta tyro*, which he had recently found in a new habitat. Mr. Forrest read a paper by Mr. W. A. Lloyd, the curator of the Aquarium now in course of construction at Aston, and formerly for many years of that at Sydenham, "On the Principles of Aquaria." After reviewing the history of the earlier attempts to keep marine animals in confinement and the gradual development of the art of aquarium management, the author gave a highly interesting account of his own experiments, the result of which was seen in his long and successful maintenance of the Aquaria at Hamburg and at the Crystal Palace, and then passed on to a description of the system of circulation and aëration which is about to be carried out at Aston. He also fully discussed the problem of the application to the purposes of the Aquarium of "artificial" or compounded sea-water, and gave particulars of the formula by which it may be best prepared. A vote of thanks was cordially given to Mr. Lloyd for his paper, which was profusely illustrated by a great number of beautifully executed diagrams, drawings, &c. Considerable discussion ensued, in the course of which Mr. Jones, the consulting chemist to the Aston Company, gave many highly interesting details as to the materials required, to the total amount of fifty tons, in the manufacture of the artificial sea-water for the Aston Aquarium, and the *modus operandi* to be pursued in that very important operation. The Chairman of the Section (Mr. W. R. Hughes, F.L.S.) presided.

BIRMINGHAM AND MIDLAND INSTITUTE SCIENTIFIC SOCIETY. —April 23. Mr. Josiah Austin read a paper on the vegetable alkaloids used in pharmacy. Their occurrence in nature, preparation, and effects on the human frame were described; and it was shown how much more satisfactory it is to prescribe these chemically pure substances instead of the raw materials, which contain such variable amounts of the active principles. Specimens of aconitia, atropia, strychnia, morphia, and quinia, with the plants from whence they are obtained, were exhibited.

CHELTENHAM NATURAL SCIENCE SOCIETY, May 22nd.—Mr. Day read a most interesting paper on "Vivisection, and what it has done for Science."

EVESHAM FIELD NATURALISTS' CLUB.—April 17th.—Mr. T. J. Slatter in the chair. Mr. A. H. Martin reported the following appearances of migratory birds:—Chiffchaff, April 2nd; Swallow, April 7th; Sand Martin, April 7th. Mr. T. E. Doeg read an interesting paper on "Some of the Birds of our Neighbourhood," illustrated by numerous specimens of their eggs. May 8th.—Mr. F. Wright in the chair. Resolved that the first excursion shall be on Saturday, May 24th, to Buckland.

NOTTINGHAM LITERARY AND PHILOSOPHICAL SOCIETY.—NATURAL SCIENCE SECTION.—April 18th. Mr. B. Sturges Dodd read a paper on "The Stone and Wood-Penetrating Molluscs of our Coasts." Mr. Dodd directed attention to the power possessed by certain bivalve mollusca of boring in sand, wood, peat, and stone. The Pholades are the chief orders to which he referred, dated geologically from the Lias period. They were gregarious, and five species, all tolerably common, were to be met with on our coasts, inhabiting the littoral and coralline zones. They were phosphorescent, and lived and died in the holes which they excavated. The boring instinct was manifested at a very early stage; the animals being found in wood when so small as to be almost invisible. Some authorities stated that successive generations occupied the same hole, each individual living between the valves of the shell of its predecessor; and nests of five or six shells were sometimes found, one shell within the other. The Gastrochaenidae are distinguished by the case in which they are enclosed when arrived at maturity. This case appeared to be formed by a secretion of the mantle. Several exotic species are known, one boring in coral and another in granite. Several hypotheses have been advanced to account for the manner in which the Teredo, Pholas, and their allies bore into hard substances. The perforations are formed by means of the shells, which act as a sort of auger; the holes are made by rasping, by means of silicious particles embedded in the animal's body, currents of water set in motion by means of cilia, or the animals secreted an acid, the process being completed by rasping.—May 2nd.—MICROSCOPICAL MEETING.—Subject: Geology and Palæontology. Messrs. G. B. Rothera and J. Burton exhibited slides under microscopes. Mr. E. Wilson, F.G.S., exhibited a collection of fish teeth, obtained by him from Ticknall, and gave a description of them.—May 9th. Mr. J. Shipman read a paper on his recent "Discovery of coal measures, exposed at the surface, in the Trent Valley, at Burton."

MIDLAND UNION OF NATURAL HISTORY SOCIETIES.

SECOND ANNUAL MEETING, AT LEICESTER.

The Council of the Union met at one o'clock in the new Leicester Town Hall, on Tuesday, May 20th, 1879. There were twenty-six delegates present, representing sixteen societies. After the reading of the Secretaries' report, and the preparation of the business to be laid before the general meeting, the Council adjourned to the Royal Hotel, in Horsefair Street, where they were entertained at luncheon by the President, Mr. George Stevenson, together with the office bearers of the Leicester Literary and Philosophical Society, the Mayor of Leicester, (C. Stretton, Esq.,) C. Packe, Esq., (President-elect of the Leicester Literary and Philosophical Society,) &c.

During the progress of the Council meeting the visitors who were not engaged in officially representing the societies to which they belonged, were conducted to the principal objects of antiquity in Leicester by the members of the Archæological Section of the Literary and Philosophical Society, the arrangements having been made by the chairman (Mr. W. Kelly) and the hon. sec. (Mr. A. H. Paget.) The company met at the Museum, and proceeded to the Newarke, where Mr. W. Kelly, F.R.H.S., explained the celebrated gateway, pointing out that it was the principal entrance to the newest part of Leicester Castle, and derived its name of the New-works gateway in consequence. He further mentioned that a collegiate church formerly stood on the site of Mr. E. S. Ellis's house, and that the St. Mary's vicarage house and the residence of Mr. Lawrence Willmore were at one time canons' houses in connection with the church. Trinity Hospital was shown, and then the party walked on the turret gateway, which Mr. Kelly said was the old entrance to the Castle Turret. Thirty years ago, at a contested election for the county, part of the masonry fell, fortunately without doing any injury to anybody, and with a view to make the place a picturesque ruin (!), the old dome, which was perfect, was taken down by order of the Duchy of Lancaster, at the suggestion of Mr. S. Hardy. The stone work is now, unfortunately, crumbling away. Mr. T. Nevinson then explained the characteristics of St. Mary's Church, pointing out the interesting relics of Norman and early English work to be found there. He said the earliest part of the edifice would be erected about 1107, but other parts were added in 1170 and 1280. Mr. Kelly next conducted the party through the Castle, showed the traces of Norman architecture there, and then the Guildhall was visited. Mr. Kelly mentioned how the hall came into the possession of the Corporation after the dispersion of the Corpus Christi Guild, spoke of the uses to which it was put, and the circumstance that Shakespeare probably played in the hall. The Mayor's Parlour and Town Library attracted much notice, especially the chimney-piece in the first named apartment. St. Martin's Church was next entered, Mr. Nevinson explaining the principal features in the fine edifice, which, he said, however, was not so interesting as St. Mary's. A portion of the party then proceeded to St. Nicholas' Church, in some respects, perhaps, the most valuable of all in the town from an archæologist's point of view. The early Norman work was pointed out by Mr. Nevinson and the vicar, (the Rev. T. W. Owen,) and both gentlemen agreed that some portion of the building was probably Saxon. Mr. Owen exhibited the first register of marriages and burials bearing date 1559, a deeply interesting volume, which he has had bound to better preserve it. Walking from the church, the house in St. Nicholas Street, in which it is supposed Bunyan once resided, and in which Dr. Watts on one occasion passed the night, was noticed, and the journey of the company was brought to a conclusion by a visit to the Jewry Wall and the Roman Pavement, which is preserved *in situ*, in a cellar close by.

GENERAL MEETING.

The annual meeting was held in the Council Chamber of the Town Hall, at half-past three o'clock, Mr. George Stevenson, of Leicester, (the President,) occupying the chair. The attendance, which numbered about seventy, included Mr. E. W. Badger, of Birmingham, and Mr. W. J. Harrison, of Leicester, the two honorary secretaries; the Rev. H. W. Crosskey, Dr. Deane, and Messrs. W. Graham, W. R. Hughes, G. H. Twigg, J. Morley, J. Rabone, A. Scruton, J. F. Goode, C. J. Watson, Alfred Hughes, C. Pumphrey, J. Levick, F. Underhill, H. Burman, Lawson Tait, H. J. Devis, and Bernard Badger, (representing various Birmingham societies;) Messrs. George Perry and Thomas Bolton, (Dudley,) Mr. Edwin Wheeler and the Rev. W. Katterns, (Peterborough,) Colonel Basevi and Major Barnard, (Cheltenham,) Messrs. J. S. Hedderley, L. Lee, A. H. S. White, G. B. Rothera, and J. Mosley, (Nottingham,) W. Phillips, (Shrewsbury,) the Rev. C. F. Thornewill, (Burton-on-Trent,) the Revds. O. M. Feilden and G. G. Monck, (Oswestry,) Messrs. F. T. Mott, T. Carter, C. Packe, J.P., W. Kelly, A. Paget, A. H. Paget, J. B. Everard, E. Clephan, W. Kempson, M. Maxfield, E. L. Stephens, W. Pilsbury, F. J. F. Kirby, H. S. Jones, and W. Emmerson, (Leicester,) the Rev. J. D. La Touche, (Stokesay,) the Rev. J. E. Vize, (Forden,) the Rev. J. M. Mello, (Chesterfield,) &c., &c.

After the minutes of the last meeting at Birmingham had been read by Mr. E. W. Badger, and duly confirmed, the President proceeded to deliver his address, which has already appeared in full in our pages (see Vol. II., p. 187.)

The Rev. H. W. Crosskey, F.G.S., moved a vote of thanks to the President for his admirable address, and expressed his agreement with the advice given by Mr. Stevenson. They might solve many problems by instruments which were at hand, and many discoveries might be made in every field of science if they would set about the work. The advice which the President had given them was sound, and if they were determined to make discoveries he believed they would succeed. He trusted that meeting would be the starting point in systematic effort in several scientific directions, and that the Chairman would be repaid for his address by seeing the members of the Union act on the advice which he had given. If they pursued scientific pursuits they would find a fund of enjoyment which would be most refreshing to them in the present day, when there was so much excitement, and so many differences, both on politics and religion, and when so many things were reckoned by their mere money value. In answer to those who wondered how it was they could take such interest in the studies that had been referred to by the President, he might observe that all of them found in those studies their own sufficient reward, and he believed that in the heat and pressure and bustle of this modern life such studies were amongst the most reinvigorating and ennobling influences that could be brought to bear upon themselves and the society in which they moved.

The Rev. J. E. Vize seconded the motion, which was carried by acclamation, and briefly acknowledged by the President, who, in so doing, referred to the able and beneficial work which Mr. Vize, as a microscopist and a student of fungi, had lately done in his examination into the origin and precise nature of the disease known as diphtheria.

The following Report of the Council was then read by Mr. W. Jerome Harrison:—

At the first Annual Meeting of the members of the Union, held last year at Birmingham, the report of the Council included a general account of the origin and progress of the movement to that date. With regard to its origin, we may briefly recapitulate that the idea of a combination of the Scientific and Literary Societies of the Midland district was one which had occurred to many minds in many quarters, but that the actual commencement and practical inauguration of the work are due to the members of the Birmingham Natural History and Microscopical Society, who invited the other Societies of the Midlands to send delegates to a meeting, which was held in Birmingham on August 28th, 1877, at which the scheme was duly discussed, a council or governing body elected, and the Union constituted.

The first Annual Meeting of the new Union of Natural History Societies was held in Birmingham on Monday, May 27th, 1878. The attendance was numerous, and all the arrangements were prepared and carried out with great precision and success, under the direction of a committee appointed by the local scientific societies, and by Mr. E. W. Badger, upon whom, as the resident hon. sec. of the Union, there fell a great portion of the work. The excursion on the second day, Wednesday, May 28th, attracted a large attendance, and the arrangements for this were well carried out by the officers of the Dudley and Midland Geological and Scientific Society.

Of the present—the second Annual Meeting—it is as yet too early to speak. The winter has unfortunately been a very severe and prolonged one, and instead of the "sunny hours" which should characterise "flowery May," we have louring skies with cold east winds and rain, which cannot but have a detrimental effect upon the numbers attending from a distance. The Council desire, however, to record their recognition and appreciation of the earnest and thorough manner in which the Literary and Philosophical Society of Leicester has engaged in the arduous task of preparing for the accommodation, entertainment, and instruction of the many people of many tastes who are here met together. The Scientific Conversazione to be held this evening in the Museum Buildings is a new form of entertainment in Leicester, and the Council earnestly hopes that it may to some extent forward an appreciation of, and a liking for, scientific pursuits among the busy workers in this populous and flourishing town. To-morrow's excursion to Charnwood Forest only requires fine weather to prove most enjoyable, and also for those who have not previously visited that region, surprising in the character of its rocks and scenery. Leicester is to be congratulated on the vicinity of so splendid a field for the exertions of workers in natural science; if our grandfathers could have foreseen the spread of a love for the study of nature among all classes, and have foreseen too the great increase in the population of this country, we may think that instead of "enclosing" and "disafforesting" Charnwood, as they did in the early part of this century, they would have retained it as a national park, have planted it, and cared for it, and preserved it a safe home for all that is wild and free in the native fauna and flora of our country. This is what it is proposed to do with the New Forest in Hampshire, and the Council, on behalf of the members of this Union, desire to express their entire sympathy with the Hon. Auberon Herbert in his efforts in this direction.

The official organ of the Union, the "Midland Naturalist," has been duly published monthly. It has attained a recognised position among scientific periodicals, and the testimonials from all quarters as to its success have been numerous and encouraging. It chronicles monthly the doings of the various societies of our Union, and many most interesting and valuable contributions on points both of local and general interest have already appeared in its pages. It is disappointing, however, to find that such a comparatively small proportion—not more than one-sixth—of the members of the Union are subscribers to what is really their own magazine. Every member should support it, not merely by his own subscription and by recommending it to his friends, but by recording and promptly forwarding to the editors all interesting facts of natural history and general science which may happen in his (or her) locality. The volume for 1878 forms a book of some 350 pages, and, as a permanent record of Midland science work and workers must always be of interest. Only a very few sets of this first volume are now left. For the extremely moderate price at which the magazine has been published, and the very satisfactory nature of its printing and general get-up, the Council desire to thank the publishers most sincerely.

As to the work of the past year the Council have to report that the following societies have joined the Union during the past twelve months:

(1.)—Peterborough Natural History and Scientific Society.
(2.)—Nottingham High School Natural History Society.
(3.)—Small Heath Literary and Scientific Society.

The complete list thus includes twenty-four Societies, viz.:—

Birmingham Natural History and Microscopical Society.
Birmingham Philosophical Society.
Birmingham and Midland Institute Scientific Society.
Birmingham School Natural History Society.
Burton-on-Trent Natural History and Archæological Society.
Caradoc Field Club.
Cheltenham Natural Science Society.
Derbyshire Naturalists' Society.
Dudley and Midland Geological and Scientific Society and Field Club.
Evesham Field Naturalists' Club.
Leicester Literary and Philosophical Society.
Northampton Naturalists' Society.
Nottingham High School Natural History Society.
Nottingham Literary and Philosophical Society.
Nottingham Naturalists' Society.
Oswestry and Welshpool Naturalists' Field Club.
Peterborough Natural History and Scientific Society.
Rugby School Natural History Society.
Severn Valley Naturalists' Field Club.
Shropshire Archæological and Natural History Society.
Small Heath Literary and Scientific Society.
Stroud Natural History Society.
Tamworth Natural History, Geological, and Antiquarian Society.
Woolhope Naturalists' Field Club.

The number of members is now about 3,000, and the great object of the Union is to make these members and their work known to one another, to unite them in single efforts, and to endeavour to guide them in lines of useful inquiry which shall lead to the increase of scientific knowledge, the education and development of the observing faculties, and so far as is possible the good of our fellow men. Already during the past year many pleasant friendships have been formed, and some scientific investigations started through the medium of our Union; working together and with definite aims we hope to achieve solidity and thoroughness in our undertakings, to supply advice and information to those who are in need of it, and to prevent the waste of time and energy with which the scientific record of the past is teeming.

The Treasurer's report will give particulars of the income of the Union during the past two years. £11 4s. 10d. was received up to last meeting, and £11 10s. 4d. since, making a total of £22 15s. 2d. The expenditure for the two years amounts to £28, details of which will be submitted to you. A resolution was passed at the last Annual Meeting "That it be a recommendation from this meeting that the annual subscription be raised, and that hon. secretaries be requested to report to a future meeting of the Union the opinion of their societies upon the subject." The opinions of such societies as have been communicated are almost unanimous. One society has expressed its willingness to pay whatever annual contribution your Council may fix; the others either recommend that it shall not exceed threepence per member, or state that they will not pay a larger sum. So long as the Union is not engaged in any work involving much expenditure, a nominal subscription will probably meet all disbursements; but, in an organisation numbering 3,000 members, it must be obvious that a sum of one penny per member must be totally inadequate to defray even the cost of a circular to each member and the postage thereof. Three-fourths of the cost of the programme of the Birmingham meeting were defrayed by the local conversazione committee, who were so fortunate as to provide the members with a most instructive and enjoyable meeting, which was self-supporting. What will be done in the present year remains to be seen, though your Council are satisfied that the local Society has done everything in its power to ensure the success of our gathering. At the same time they cannot but feel that as the meetings of the Union must in turn be held in smaller towns where the members will be few in number, it behoves them to adopt such measures as will place at the disposal of the Union funds to supplement where needed those which may be forthcoming from the locality. For they cannot but think that these annual gatherings of naturalists in various parts of the midland counties must result in increased attention to the study of natural science, and they feel assured that all who have any interest in the encouragement of such studies will gladly co-operate by contributing where necessary to the expenses incurred by those who undertake the onerous duty of providing for the entertainment of such a large number of visitors as our experience so far justifies us in expecting at our annual meetings. Your Council, therefore, recommends that the annual subscription be raised to threepence per member.

Your Council have received an invitation from the Northampton Naturalists' Society to hold the annual meeting in 1880 at Northampton. They have had much pleasure in unanimously deciding to recommend this meeting to accept the invitation.

The Council regret to state that they have received the resignation of Mr. W. Jerome Harrison, one of the hon. secs. He has, however, consented to continue his connection with the "Midland Naturalist" as one of its editors. Mr. Harrison has resigned from a conviction that it is necessary and will be beneficial for the Union that one of the hon. secs. should belong to the town in which the annual meeting is held.

The report was received on the motion of Dr. DEANE, seconded by Mr. A. PAGET.

Mr. A. H. SCOTT WHITE moved the adoption of the report, suggesting, however, that the subscription for school societies should be one penny instead of threepence per member.

The Rev. C. F. THORNEWILL seconded the proposition.

Mr. LAWSON TAIT, in supporting the resolution, expressed his opinion that the Council should have power to reduce the subscription from threepence to a penny in the case of any affiliated society they thought proper.

Mr. E. W. BADGER supported the suggested reduction, saying that he looked forward to the time when not only the endowed grammar schools of the large towns, but board schools in all parts of the country, would have their Natural History Societies, and that many of them might join the Union. (Hear, hear.)

The PRESIDENT endorsed Mr. Badger's remarks. He said he believed that the reflex action of such studies would have the highest value in the development of the character of boys and young men.

The report was then adopted, the suggestion of Mr. Lawson Tait being accepted.

The Treasurer's report, which was read by Mr. BADGER, and showed a balance of £5 10s. against the Union, was, on the motion of Mr. MOTT, seconded by Mr. CARTER, also adopted; a vote of thanks being at the same time accorded to Mr. Badger for his services to the Union.

On the proposition of Mr. MOSLEY, Messrs. E. W. Badger (Birmingham) and G. C. Druce (Northampton) were appointed hon. secretaries, and Mr. H. E. Forrest (Birmingham) was elected assistant hon. secretary. Mr. Egbert D. Hamel (Tamworth) was re-elected treasurer.

Mr. HARRISON read a letter which he had received from the hon. sec. of the Northampton Natural History Society, inviting the Union to hold its next annual meeting in 1880 at Northampton. On the motion of the Rev. O. M. FIELDEN, seconded by the Rev. G. G. MONCK, and supported by Dr. DEANE and Mr. ROTHERA, it was resolved to accept the invitation. It was stated by the Nottingham representatives that they hoped to invite the Union to visit that town in 1881.*

On the proposition of Mr. GRAHAM, seconded by Mr. LAWSON TAIT, and supported by Mr. W. R. HUGHES, a vote of thanks was passed to the Leicester Literary and Philosophical Society and the Leicester School of Art for their complete arrangements for the gathering of the Union this year, to the Corporation for allowing that meeting to be held in the Council Chamber, and to Mr. W. Jerome Harrison for his services as secretary.

The PRESIDENT responded, and a vote of thanks to him for his conduct in the chair terminated the proceedings.

After the meeting several gentlemen went on a visit to the Roman pavement in Jewry Wall Street, directed by Mr. A. H. Paget, while others inspected the muniments of the Corporation at the Town Hall, Alderman Paget pointing out their character and special points of interest.

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* A formal invitation for 1881 has, since the meeting, been forwarded by the Nottingham Literary and Philosophical Society to the Hon. Secs. of the Union.

THE CONVERSAZIONE

Was held in the Leicester Town Museum, on Tuesday, May 20th, from 7 30 to 10 30 P.M. A scientific conversazione was a novelty in Leicester, but the arrangements for the evening were so well planned, and so ably carried out, that we fancy the members of the Leicester Society will make an annual thing of it in future, so pleased did the local visitors appear to be with the rich stores of scientific objects which were exhibited and explained. The Leicester Town Council had resolved on permanently connecting the old and new Museum Buildings by a handsome structure which will serve as a receptacle for the Roman pavements, columns, &c., in which the Museum is so rich. Unfortunately this could not be completed in time for the meeting of the Midland Union, so a temporary corridor was put up connecting the new Lecture Hall with the Museum; the walls of this corridor were completely covered by scientific diagrams, lent by Mr. W. J. Harrison; some very fine diagrams illustrating botanical subjects were lent by Mr. F. T. Mott, others of rock sections, &c., were shown by Mr. Frank Rutley, and meteorological diagrams, by R. H. Scott, Esq., F.R.S.; these were all hung in the lower rooms of the Museum. In the New Lecture Hall a long centre table supported about forty microscopes, whilst on tables ranged against the walls were placed exhibits in general science, geology, biology, archæology, &c. The walls of the Lecture Hall were covered with a fine collection of pictures, lent chiefly by the Rev. A. A. Isaacs and Mr. G. Stannage, in which the works of the local artists, Messrs. Fulleylove and Ward, were well represented. In the adjoining rooms of the School of Art an excellent collection of the works of past and present students had been arranged under the direction of the Head Master, Mr. Wilmot Pilsbury.

In speaking more in detail of the various exhibits we may class them under the following heads:—

Microscopy.—Mr. Washington Teasdale (Leeds) exhibited some very fine specimens of ruled patterns on glass, also sections of *Nerium oleander*, showing cellular tissue breaking through cortical layer to form a leaf-bud, &c.; Mr. J. Levick, specimens of pond life; Mr. W. R. Hughes, numerous specimens of echinodermata and other objects illustrating marine zoology, prepared by Mr. Sharpus, of London; Miss Beale, three boxes of biological objects for the microscope; Mr. F. T. Mott, microscope arranged horizontally for drawing and measuring objects; A. Paget, Esq., fine binocular microscope; Mr. Thos. Bolton, two microscopes, with a large selection of living objects, rotifers, diatoms, &c., and revolving table, with slate top, for microscopical purposes; Mr G. C. Turner, micro-photographs; Mr. E. Wheeler, of London, 1,000 microscopical preparations, no two alike, including Nobert's lines, Möller's typen-platten, with three microscopes; Rev. J. E. Vize, microscope and slides of hepaticæ, fungi, lichens, mosses, &c.; Mr. J. Potts, circulation in frog's foot, &c.; Mr. Young, a Ross's binocular, with photographs, insects, &c.; also microscopes and miscellaneous objects by Dr. Emmerson, and Messrs. A. Baines, J. Morley, J. W. Burton, C. J. Watson, F. Parsons, F. Rutley, (rock sections,) &c., &c.

Biology.—Mr. B. Sturges Dodd (Nottingham) showed a very fine collection of British stone and wood-boring mollusca, with large illustrative diagrams; specimens of Atlantic ooze and foraminifera, from great depths; British hydrozoa, and British marine algæ; Mr. H. F. Johnson, (Nottingham,) a pair of kestrel hawks, with six eggs; Mr. J. E. Weatherhead, a series of skulls of hippopotamus, dugong, &c., shells, as *Triton*, *Fusus*, *Chiton*, *Magilus*, &c., fine echinoderms, &c.; Mr. F. T. Mott, a collection of expensive and rare books on biological subjects; Mr. Theo. Walker, some exquisitely-prepared groups of British birds, set up as in their native haunts, with all their natural surroundings. These have been done by Mr. Walker, as a gift to the new Natural History Museum at South Kensington.

Geology.—Mr. W. J. Harrison exhibited a complete series of the crystalline and metamorphic rocks of Charnwood Forest; Mr. J. R. Gregory, (London,) a grand group of *Trigonia clavellata*, fern *Adiantites Hibernica*, from the old redstone of Kiltorcan; polished specimens of *Labradorite*, *Hippurites*; and large photographs of a restoration of the mammoth; Mr. J. E. Weatherhead, select specimens of minerals and fossils; Mr. J. S. Hedderly, (Bulcote,) flint implements from the coast of Lincolnshire; Dr. C. Callaway, Pre-cambrian rocks from Shropshire and South Wales; Mr. E. Wilson, (Nottingham,) *Ceratodus altus*, (tooth,) mountain limestone, fish-teeth from Ticknall, &c.; Mr. E. Hollier, (Dudley,) a magnificent collection of trilobites and other Silurian fossils from the neighbourhood of Dudley; Mrs. Islip, drawings of glaciers, &c.; Mr. C. Packe, geological maps, &c., of the Pyrenees; Mr. P. Mackennal, polished rocks, &c.

Archæology.—Mr. H. Longhurst, collection of Egyptian antiquities; Mr. J. E. Weatherhead, Roman pottery and Loseby ware.

General Science.—Mr. W. J. Lancaster (Birmingham) had a very successful electric lamp, electric suspender, zoescope, and a large collection of physical apparatus, including telephones, (Reiss transmitter,) microphones, &c.; Mr. E. T. Loseby, a new method of insulating the wires of induction coils, and spun glass as a substitute for "spider-lines" in telescopes; Mr. F. Parsons, a collection of pneumatic, electrical, and photographic apparatus; Mr. T. Bolton, the collographic process of printing, by which numerous *facsimilies* were printed off from drawings done by the spectators; Mr. W. P. Marshall, the "rigid chain," devised by Dr. Hopkinson. Mr. Marshall has devised new experiments for this apparatus; he throws the rapidly revolving chain altogether off the pulley, and it continues to retain its shape for some seconds whilst rising through the air or moving along the ground; Mr. W. S. Franks, a five-inch achromatic refracting telescope, with equatorial stand. Spectroscopes were placed in a separate dark room. Mr. C. Packe exhibited his large instrument which very widely divides the D line, and others were shown at work by Messrs. E. T. Loseby, J. W. Burton, &c.

Miscellaneous.—Mr. Barfield's carvings on wood and marble were much admired, as also were paintings on porcelain, by Abbott, exhibited by Mr. P. Mackennal.

The extensive collections in the Town Museum attracted the attention of visitors from a distance. The collection of Roman antiquities is very extensive and abounds in fine specimens, whilst the Natural History, Geological, and other collections, are also on a very large and complete scale for a provincial Museum. The Institution is rate-supported, and is also the head-quarters of the Leicester Literary and Philosophical Society, whose members have always taken the greatest interest in its prosperity.

Among other attractions of the Conversazione we must not omit to mention Mr. H. Nicholson's excellent band, which discoursed sweet music throughout the evening. The refreshments were well served by Mr. Roberts. The total number of visitors was about 400, and as the weather was propitious, it appeared to be generally felt that the affair was all that could be desired. The whole of the arrangements had been made by the Council and sections of the Literary and Philosophical Society of Leicester, the principal workers being Messrs. F. T. Mott, T. Carter, A. Paget, W. Kempson, E. F. Cooper, G. H. Garnar, C. Baker, and W. J. Harrison.

EXCURSION TO CHARNWOOD FOREST.

The programme of the second Annual Meeting of the Midland Union, held in Leicester, was carried out on the second day by an excursion to Charnwood Forest. A party of about 200 left the Museum at 9 30 A.M., being divided into two sections—one botanical and the other geological.

The botanical party numbered eighty-five, and were under the guidance of Mr. F. T. Mott, F.R.G.S. Among the visitors of well-known scientific reputation were Mr. W. R. Hughes, Mr. T. Bolton, Mr. J. Morley, Mr. J. Levick, Mr. W. P. Marshall, all of Birmingham; Rev. J. D. La Touche, of Stokesay; Rev. J. E. Vize, of Forden, Shropshire; Mr. G. B. Rothera, of Nottingham; Rev. O. M. Fielden, and others. The President of the Union, George Stevenson, Esq., with Miss Stevenson and Miss Florence Stevenson, were also with this party. The route was by Groby Pool, through Bradgate Park, Swithland Wood, Woodhouse Eaves, the Hanging Rocks, Beacon Hill, Hammercliff, Ulverscroft, and thence to Newtown Linford for tea. The lateness of the season making vegetation very backward was unfortunate for the botanists, but the weather was so mild and genial that this first foretaste of summer made up for the absence of many of the usual flowers. The Moonwort *(Botrychium Lunaria)* was found in two unexpected places. A specimen was taken from each locality for preservation in the herbarium of the Leicester Museum, in order that a permanent record of the discovery might be secured; but, with a self-control worthy of the members of a scientific society, but too seldom exercised among amateurs, the remaining fronds of this rare fern were left untouched, that it might not be extirpated and lost to Charnwood Forest like its congener *Osmunda regalis*. *Alchemilla vulgaris*, *Cardamine amara*, *Chrysosplenium oppositifolium*, *Polygonum Bistorta*, *Carex præcox*, *Teesdalia nudicaulis*, and a few others of the usual early spring flowers, were gathered in fine condition. Several of the party interested in microscopic fungi found a rich collecting ground in Swithland and other woods. About twenty species of mosses were collected, chiefly in Bradgate Park. *Volvox globator* was taken from a pond on Beacon Hill, and a fine colony of *Melicerta ringens* was procured by Mr. Levick, on a spray of *Ranunculus aquatilis* in Ulverscroft fish pond. During the stay at the Hanging Rocks, where the party sat down on various rocks and crags for lunch, Mr. F. T. Mott delivered an address on the "Colours of Flowers," which appears in the present number, (page 175.) On the conclusion of the address, the party ascended Beacon Hill, enjoyed for a few minutes the magnificent panorama visible from the summit, and then drove to Hammercliff, walking over the hill to the fish pond below. Here it was necessary to cross the broad weir which discharges the surplus water, and the only bridge was a narrow plank about nine inches wide and thirty feet long. The ladies and some of the more ponderous gentlemen looked aghast at this prospect. But necessity is the mother of courage as well as of other things, and the whole party came bravely and safely over, Mr. T. Carter distinguishing himself by the gallant assistance which he rendered to the ladies. The ruined Priory of Ulverscroft was then visited, and the party drove off to Newtown. The time was well kept, and Beck's was reached at four o'clock, the appointed hour, where a substantial and well prepared tea was awaiting them. Afterwards the party enjoyed a pleasant ramble in Bradgate Park. The geologists arrived an hour later, and both parties returned home together, reaching Leicester at 7 30. The success of the excursion was heartily acknowledged, and was largely due to the exertions of Mr. G. Hull, one of the secretaries of the Society.

The geological party made their first halt at the syenite quarries near Groby Pool. Here Mr. Harrison pointed out the character of the rock—a crystalline aggregate of reddish felspar and green hornblende, with some quartz. The red marls of the Trias were seen dipping away from the syenite in all directions. Passing the botanical party at Groby Pool, the carriages drove rapidly through Bradgate Park to Swithland Wood. Here the deep slate pit was examined, and the stripe which denotes the eastward dip of the strata specially noted. Passing on through Woodhouse Eaves, the visitors next (by the kind permission of Mrs. Herrick) passed over the fine ridge of the Hanging Rocks. Here the leader enlarged on the physiography of the district, showing how the Charnwood Hills stood up above the surrounding plain by reason of their superior hardness, which enabled them better to resist denudation. Driving round Beacon Hill, the interesting quarry for hones, at Whittle Hill, demanded a flying visit. The rock here is a siliceous slate of fine texture. From this point to the Oaks Church the ground was quickly covered, and the party again dismounted to examine the stretch of wild moorland which lies between this point and the Forest Rock Hotel. The mode of formation of *logans*, or rocking stones, was pointed out by Mr. Harrison, and both at this point and at the great mass of volcanic agglomerate, which stands like a wall further on, the evident volcanic nature of the strata was described. Showered out from volcanic cones—perhaps many in number—the material of our Charnwood rocks formed stratified deposits, either on land or in shallow seas or lakes. These have since been greatly altered and denuded by the natural agents always at work—rain and rivers, frost, ice, and snow, chemical and electrical actions. They have alternately been depressed below, and raised thousands of feet above the sea level, until we find them at the present time forming a low chain of hills in the very centre of England, of strange and somewhat bizarre appearance when compared with the heavy clay land formed by the carboniferous, triassic, and liassic strata by which they are surrounded, Whilst baiting the horses at the Forest Rock Hotel, the High Towers ridge, with its singular breccia bed, was noted with interest, and the position of the great Coleorton fault, which runs at the foot of the ridge, and separates the Forest Rocks from the coal measures, was pointed out. Passing Bardon Hill, the Markfield syenite quarries were examined with much interest, and here the party had the advantage of the guidance of Mr. J. B. Everard. From this point Newtown Linford was soon reached, and tea enjoyed at the well-known Bradgate Arms, whose resources were taxed to the utmost, but provided satisfactorily for every one. A pleasant walk in Bradgate Park closed a very enjoyable and satisfactory day. Among the gentlemen from a distance of scientific reputation who accompanied the geological party were the Rev. J. M. Mello, of Chesterfield; Rev. T. F. Fenn, of Trent College; A. H. Scott-White, Esq., and Dr. Dixon, of Nottingham; Mr. E. Hollier, of Dudley; Mr. J. T. Cook, of King's Lynn; Major Barnard, of Cheltenham; Mr. W. H. Holloway, of the Government Geological Survey, &c.

The success of this combined excursion was great beyond anticipation. The arrangements were most complete in every respect, and, as in addition the day was gloriously fine, nothing was left to be desired. Mr. Harrison and Mr. Mott earned the grateful thanks of every excursionist for the admirable manner in which they conducted and instructed their respective divisions.

THE COLOURS OF FLOWERS.

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

There is a school of modern philosophers who assert that flowers are produced by insects, that their sole purpose is to attract insects, that their forms and colours have no other function whatever, and that without insects they could never have come into existence. Now, although I believe in the doctrines of evolution and selection, I do *not* believe in *this*. I think those doctrines are made to cover too wide a field; that their extreme advocates regard them too one-sidedly, and do not sufficiently take account of other natural laws and forces which are of equal importance. We may admit that insects have helped and hastened the development of coloured flowers, as a man who widens the channel of a stream helps and hastens the discharge of water, but that flowers could never have existed *without* insects seems to me an untenable theory. This one fact alone is I think fatal to it, viz., that before insect selection could possibly come into play colour must have been already developed to some extent; and surely the organic forces which were competent to originate colour are competent to perpetuate and to increase it, only give them time. It seems evident that there is in vegetable life some profounder cause for the development of coloured blossom than the mere external influence of insects. What *is* that cause? Consider what colour means. Everyone is now supposed to know that white light is compounded of a variety of coloured lights, which may be classified into three primary types, the red, the green, and the violet—the red being those in which the ether-waves are longest, the violet those in which they are shortest, and the green those in which they are of intermediate length. The colour of any object depends upon its power to stop, or neutralise, or absorb some of these waves, and to reflect the balance. A blue object is one which absorbs the long red waves and reflects the green and violet, the combination of these without the red giving the sensation of blue to our eyes. A yellow object absorbs the short violet waves, and reflects the red and green, whose combination produces yellow. A red object absorbs both the green and the violet, and reflects the red only, and so on. If all the waves are reflected without absorption or alteration, the object has a shining appearance, like glass or water, or some glazed leaves. But when they are not only all reflected, but very much scattered by a number of surfaces which are not parallel, then the object appears *white*. If all the waves are absorbed and *none* reflected the object is black. If some waves of all the different lengths are reflected, while some of them are absorbed, the colour will be *grey*. It would be *white*, only that there is too little light reflected altogether to produce the effect of white. Grey is simply a *dark* and *feeble* white. In the same way brown is a dark feeble yellow, olive a dark feeble green, and lead colour a dark feeble blue. Now look at the colours which surround us in the vegetable world. The type of a perfect and complete vegetable is a flowering tree or shrub, such as a hawthorn, an apple, or a laburnum. In plants of this kind we have all the great systems of vegetable structure fully developed—the stem, the foliage, and the blossom. In herbaceous plants and all monocotyledons the stem system is imperfect; in cactuses and some euphorbias the foliage is never developed; in grasses, conifers, and many forest trees the flower system is defective; but in a true flowering tree you have everything complete. Look then at an apple tree or a laburnum; the prevailing colours in the stem and branches are brown, grey, or olive; in the foliage, green; in the blossom, white, pink, and yellow. And this relation of colour to each system of structure will be found throughout the vegetable world with few exceptions—dark feeble colours in the stem system, the primary green in the foliage, and the brilliant secondaries in perfected blossom. Now look a little deeper and see why this should be so. Stems are grey or brown because they absorb nearly *all* of the three component colours of white light, and in nearly equal proportion, reflecting a little of each. Leaves are green because they absorb *two* of the component colours, and reflect nearly the whole of the other. Flowers are yellow, blue, or pink because they absorb only *one* of the component colours, reflecting the other two. Here, then, is a regular gradation from the stem, through the foliage, to the flower. First three colours are absorbed, then two, and, lastly, one. How is this to be accounted for? It is not pretended that insects have anything to do with differentiating the foliage from the stem. Why should their interference be thought necessary in differentiating the flower from the foliage, which is a precisely analogous process? It is surely a process dependent upon the fundamental laws of organic growth. I think an explanation may be found, but it is, perhaps, too abstruse to be more than hinted at in this address. The absorption of light waves depends upon the molecular structure of the material on which it falls. Where such material contains molecules capable of vibrations of all lengths mixed up together, *all* the light waves will be absorbed. This is probably the condition of vegetable stems. When the molecules are so far sorted out and reduced to order that they will only vibrate in two modes, two only of the primary colours are absorbed, and the other reflected. This is the condition of leaves. When actual uniformity of molecular conditions is attained only one colour can be absorbed, the other two must be reflected, and the object appears brilliant with one or other of the showy secondary colours. This is the condition of flowers. I believe it can be shown that the reducing to order, and, finally, to uniformity of a group of very diverse molecules is one of the essential conditions of organic life; that the gradual development of colour is a necessary result of this universal law; that, therefore, coloured flowers were to be expected at a certain epoch in the development of this world, and that their number and brilliancy will still increase as the ages roll forward. Insects may help the process, but the great flood of organic life would not be stopped in its career though every bee and butterfly should perish.

CATERPILLARS:
HOW TO FIND, AND HOW TO REAR THEM.*

BY THE REV. C. F. THORNEWILL, M.A.

I must confess to a certain amount of apprehension with regard to my subject of this evening how far its title may have tended to frighten away some proportion of my possible auditors. To many persons—and more especially perhaps to those of the fairer sex—a caterpillar is an exceedingly repulsive creature, known chiefly as a disagreeable intruder at the dinner-table when a careless cook has served it up in the company of the vegetables on which it feeds. To the British schoolboy—at all events in the days before natural science was so extensively taught in our schools as it is now—it was principally known as a thing to be stamped upon, or sometimes used as an instrument of torture upon a nervous schoolfellow; and I have recently heard of it, strange to say, as an unwitting agent for the encouragement of gambling, it being reported that the desolate condition of a certain estate in this neighbourhood is due to the former owner having lost all his money by betting upon races of caterpillars. "To such base uses," as the immortal Shakespeare has it, "may we all (even caterpillars) return."

But to-night I am going to speak of caterpillars as they appear to the eye of the Naturalist, and especially to that of the Entomologist. And to these—more particularly of course to the latter—a caterpillar, when not ridiculously common, is a treasure to be picked up with avidity, watched over with solicitude, and reared with care through all its stages, until it finally appears as a "bred specimen" in the well-secured drawers of his cabinet. One of the best specimens in my own collection, a fine *Acronycta Alni*, has such a history as this. I found the caterpillar, a splendid fellow in black and gold, crawling across the path one day in 1877, as I walked down from my house into the town; and, although I could have bought a perfect specimen from a London dealer for 15s., I felt quite as much pleased as if I had found a sovereign.

But I have undertaken to-night to give you some information upon two points connected with caterpillars, viz., how to find, and how to rear them. There are two members of this Society, if not more, who could have told you all about it much better than I can; but I tried both of them in vain, and at last I followed the advice of the proverb, "If you want a thing done, do it yourself."

First, then, let me give a few hints—partly gathered from my own experience, and partly derived from books—upon the best methods of finding caterpillars. There are three such methods commonly employed, viz., searching, beating, and sweeping; and of these three the first is of course by far the most scientific, and therefore the most to be recommended to the earnest student of nature. It consists in the examination, more or less minute, of the objects upon which the insects feed, with a

* This paper was read at the meeting of the Burton-on-Trent Natural History and Archæological Society, on Tuesday, April 8th, by the Rev. C. F. Thornewill, M.A., Vice-President of the Society.

view to the detection of their presence; and, although this may seem at first sight a very hopeless method of proceeding, it is remarkable how much success may attend it if pursued systematically and perseveringly. Two points, if borne constantly in mind, will help the collector greatly, and they are these:—First, that it is impossible for a caterpillar to live upon a plant without leaving some traces of its presence; and second, that we may generally expect to find in the outward appearance and colouring of the caterpillar some resemblance to that of the object upon which it rests. The great thing, then, in finding caterpillars is to educate the eye to discern the distinctions which exist between them and the objects on which they feed; and this sometimes is no easy matter. Some caterpillars resemble so closely pieces of stick, leaf-buds, &c., that it is almost impossible to detect them by any method short of actual touching. And the habits of many render them almost equally difficult of discovery. As a rule, caterpillars feed almost entirely by night; and during the day they rest either upon some part of the food-plant, or upon some object near to it. The best time for searching, then, is unquestionably at night—or, perhaps, to speak more accurately, in the dusk of the evening. At this time, aided by a lantern, we may sometimes take in favourable situations many species which are not otherwise easily to be procured, especially among the Noctuæ. And, indeed, it may be taken as a general rule that the caterpillars of this family are rarely to be taken during the day. Like the perfect insects into which they develop, they prefer the darkness and security of night; and if we wish to obtain them it is by night that we shall meet with the greatest measure of success. Some of even these, however, may be sought for during the day in their retreats. For example, the caterpillars of *Orthosia Upsilon* may be found sometimes in great abundance under loose pieces of bark on willow trees at the beginning of May, while *Cirrhœdia xerampelina*, a decided rarity, is to be met with about the same time among the loose rubbish and grass at the roots of ash trees. Not a few caterpillars are likewise to be found—at least, so it is said—during the early months of the year among the dead leaves, which may be gathered into a large bag and brought home to be examined at our leisure. The majority of the caterpillars, however, which we find during the day-time, belong either to the order of Bombyces or to that of the Geometræ. The former of these are not difficult to discover, being generally hairy, often brightly coloured, and feeding in much more exposed positions than do other caterpillars. It is as well, however, to be cautious about touching them, as the hairs often come off, and in some cases—as, *e.g.*, *Liparis chrysorrhœa*—possess irritating properties which produce painful swellings on the hands. The caterpillars of the Geometræ, on the other hand, are destitute of hairs and perfectly harmless; they lie during the day closely pressed to the mid-rib of a leaf, or the branch of a tree, the green species usually choosing the former situation, while those of a brown or buff tint prefer the latter. The best way to find them in such situations is to get underneath the tree and look up through the leaves against the sky, when the caterpillars will frequently be seen. Some of them, however, as well as some species of Noctuæ, spin together two or more leaves into a sort of hut, in which they live by day, coming out at night to feed; and in order to obtain these we must of course examine the spun-up leaves. In this way *Tethea subtusa*, *Cymatophora flavicornis*, and several other species, may sometimes be obtained in abundance. Searching for caterpillars, however, is just one of those things in which practice makes perfect; and a little study of books at odd hours to see what species we may expect to find at any particular time, and upon what plants they feed, will enable us to save ourselves a vast amount of time and trouble. There are various manuals upon the subject—the best, in my opinion, being Merrin's "Lepidopterist's Calendar," which contains a list of the eggs, caterpillars, pupæ, and perfect insects to be found in each month of the year, and may be had interleaved with writing paper, on which to record the results of our own expeditions, a thing well worth doing in any case. But we are still without one list which to my mind would be even more useful—a list of plants, with the caterpillars which feed upon each. I wish I had the time and the ability to compile such a list, and thereby earn the gratitude of Entomologists for generations.

I might go on to say a great deal more upon the subject of searching for caterpillars; but it is time that I passed on to make a few observations upon two other methods of obtaining them, which, though less scientific, are certainly more expeditious—I mean "beating" and "sweeping." The former of these methods is employed to obtain those species which live upon the leaves of trees and shrubs, while the latter is used when we are desirous of getting those which feed upon grasses, dock, heather, and other low-growing plants. And the apparatus required, for beating at all events, is very simple, consisting of a large umbrella—an appendage which may be found useful in other ways likewise—lined with some light coloured material, or possibly even whitewashed inside, so as to render the contents more visible. This implement is unfurled when wanted, and placed upside down under the branch or shrub where we suppose caterpillars to be, while with the other hand we hold a stout stick, with which we strike the branch sharply and pretty heavily, when the caterpillars will fall into the umbrella, and may be picked up at our leisure. I remember upon one occasion last year obtaining about fifty caterpillars of *Fidonia piniaria* in this way, as the result of three or four strokes upon the boughs of a Scotch fir.

For "sweeping" we require a separate instrument, in the shape of a stout net, with the bag made of "cheese-cloth" or coarse canvas, and altogether more strongly made than the ordinary net. With this in his hand, the collector walks through the heather, fern, grass, or "what not," sweeping his net first to the right, then to the left, through the herbage, almost as if he were mowing, and stopping after every half-dozen sweeps or so to examine the result of his labours. I have not done much in this way myself, but in some situations it is a very effective method.

The caterpillars, when obtained, should be (with as little handling as possible) placed in boxes for conveyance to our homes, a leaf or twig of the food-plant being in all cases placed with them, and different species being, as a rule, placed in different boxes, a course which will save a great deal of trouble when we get them home. It is well, too, to be on the look-out for cannibal caterpillars, and to make ourselves familiar as soon as possible with their appearance. Such bloodthirsty creatures as *Cosmia trapezina*, *Scopelosoma satellitia*, and *Crocallis elinguaria*, should obviously be left in no company but that of their own species, though even this is not always safe. And any collector who may meet with the ugly caterpillar of the goat-moth, *Cossus ligniperda*, had better put it in a tin box, if he wishes to get it home safely, as its powerful jaws will make short work of any wooden receptacle.

Supposing, however, that the collector has arrived at home in safety with his captures, he has still a great deal to do before the perfect insect appears as an addition to his cabinet. As soon as possible the caterpillars should be placed in a roomy box, furnished with a supply of the plant upon which they feed, and so arranged as to admit air and a moderate amount of light. Much light is not a good thing, except in the case of the hairy Bombyces, which seem to need it in order to keep damp from their long coats, and revel in the hot rays of the morning sun. But air is imperatively necessary; and in the cases of some species nothing less than absolute exposure in the open air will suffice to bring them to maturity. An example of this occurred to me last year. I had a number of caterpillars of *Polia Chi*, which I had reared from the egg. I had been warned that they required very liberal ventilation, and this object I sought to effect by putting them close to an open window. But it was all in vain, my caterpillars died off one by one, and not one lived to undergo the change into a chrysalis. Matters of this description can only be learnt by experience, and it is almost impossible to give any definite rules with respect to them. It is well to remember, however, as a general rule, that caterpillars want plenty of fresh air, and will rarely thrive in the close atmosphere of a living room. They should be kept, if possible, either in an out-house or in some place without a fire, and with abundant ventilation, but not exposed to the direct rays of the sun. With respect to cages, the best are undoubtedly those of the "meat-safe" pattern, made of wood, with sides of perforated zinc, and a glass front, which are sold by the London dealers for 2s. 6d. each. These, however, are somewhat expensive when one goes in largely for breeding, and are likewise not very well suited for single specimens. I have made use now for some years of small tin canisters, such as are used to contain cocoa; these, with a piece of gauze stretched over the top instead of a lid, and confined in its place by an indiarubber band, answer very well, though, of course, those caterpillars which go into the earth to change must be placed in another cage when approaching the period of their transformation.

For very young caterpillars I use the lids of the same canisters, with a gauze lid as before. But more experienced collectors than myself obtain the greatest success by placing the young larvæ in a tumbler, with a piece of glass laid on the top, thus forming an air-tight house, which will keep the food fresh for some time. And this is a matter of great importance. The great majority of caterpillars object very strongly to dry or withered food; and it would obviously take too much time to provide fresh leaves for them every day; besides which, they should be moved or handled as little as possible. In some way or other, then, the food must be kept fresh; and this is effected either by sticking the stalks into damp sand, or else by putting them into a small bottle of water. In the latter case, we must take care that the water does not run out, by placing or supporting the bottle in an upright position; and, in addition to this, we must provide against the larvæ getting in, and coming in consequence to an untimely end by drowning. This they are prone to do; and, in order to circumvent their propensities, it is well to wrap the food-stalk round with cotton wool, paper, or some other material, so that it may fit accurately into the neck of the bottle. By this means, food may be kept fresh sometimes for weeks, and much time and trouble saved to the collector.

With regard to food, a few hints may probably prove of service. Of course, when we can, we should feed our caterpillars upon the tree, shrub, or plant upon which they are found in a state of nature. But sometimes, from various causes, this is impossible. We may not know upon what plant, out of several growing together, a caterpillar has fed; or we may have taken it at a distance from home, and be unable to obtain a fresh supply. In such cases as these, what are called "substitute foods" come in very usefully; and upon this subject some valuable remarks may be found upon pages 34-38 of Dr. Knaggs' "Lepidopterist's Guide," which is in the library of this society.

But, speaking generally, our best chance of success will lie in offering to the caterpillars some plant belonging either to the same genus or to the same family as that upon which it feeds naturally; and for this purpose a little botanical knowledge is requisite. Sometimes, however, we do not know even so much as this; and then we must fall back upon what are called "generally favourite foods," such as knot-grass for the larvæ of Geometers, and plantain, dock, and lettuce for those of Noctuæ. It is not a good plan, however, to crowd the breeding cage, either with food or with too many caterpillars. We shall stand a far better chance of rearing the perfect insects if we confine ourselves to a moderate number of caterpillars than if we take all we can find. And it is desirable to remove all dead stalks of food, as well as other decaying matters, pretty frequently, if we wish to ensure the well-being of our charges, taking care, however, to look the old food well over, as otherwise we shall be very likely to throw away some of the caterpillars with it. It will be necessary, too, to supply now and then fresh water to the bottles which hold the food, and likewise to examine the fresh leaves before we put them in, so as to avoid introducing with them slugs, earwigs, beetles, or spiders, which will sometimes do great damage before they are discovered. Against cannibal caterpillars I have cautioned you before. But there are other enemies still worse, because very difficult (almost impossible) to guard against—I mean the tribe of Ichneumons. It is hardly too much to say that more than half of the caterpillars which we find abroad have already within their bodies one or more mortal foes in the shape of the larvæ of Ichneumons, which will gradually eat away the whole inside of their victims, leaving nothing but the empty skin. Of course the earlier in life we obtain our caterpillars the more likely they are to be free from these pests, though we shall naturally have more trouble in rearing them. It is a choice of evils; but certainly it is worth while to take any amount of trouble rather than have our hopes destroyed by the appearance of a vicious-looking Ichneumon in the place of the moth we were so anxiously looking for.

It is well to provide a few pieces of bark and a little moss, or a few dead leaves, in our breeding cages for the caterpillars to hide under when not feeding, as they often enjoy a dark and cool place; and these also prove very useful when they are changing to the pupa state. We should also be careful to disturb our charges as little as possible while they are changing their skins, as they are then peculiarly liable to injury. But after all the best way to learn all the "dodges" with respect to caterpillar-rearing is to practise it regularly and steadily, observing carefully the habits of the different species, and treating them in accordance with what we know about their habits. Let me conclude by strongly recommending this practice of rearing caterpillars to all the young collectors who may be present. There are plenty of discoveries to be made in this field of observation. The caterpillars of our butterflies are many of them hardly known, and those of many moths very little more so. And until we know the habits of the caterpillar we can tell very little comparatively about the perfect insect. Above all, it is in this stage of the insect's life that we can exercise upon it most abundantly that faculty of observation which exists in all of us, but which requires exercise in order to bring out its full capacity, which, if we exercise it as we should do, will enable us indeed to find

> Tongues in trees, books in the running brooks,
> Sermons in stones, and good in everything.

MARINE ZOOLOGY AT ARRAN.—II.*

BY W. R. HUGHES, F.L.S.

The third marine excursion of the Birmingham Natural History and Microscopical Society, and the second annual one which was made to the Island of Arran for a week in the middle of July of last year, quite fulfilled the expectations of its promoters, and increased our knowledge of the marine zoology of the district, besides adding to it three specimens of Nudibranchs which have not been recorded in the very useful and interesting hand-book of the Island written by the late Dr. Bryce. A larger number of members than usual joined the party, which consisted of six ladies and twenty-two gentlemen. And it is significant as indicating the humanising influence which the study of natural history has upon the minds of those brought into communion with it, that the number included gentlemen of diverse political and religious opinions who do not often unite together for a common work; and as a natural

* Abstract of paper read before the Birmingham Natural History and Microscopical Society, 17th June, 1879.

result the most perfect unanimity and *bon accord* existed during our visit. Anyhow this is a gain to humanity if not to science! The general arrangements were similar to those adopted on our previous excursion but in many respects we improved upon them, and gained valuable experience. For the first time we had the advantage of a small steamer daily at our command, and, although the *Lizzie* was not altogether equal to our expectations, the saving of time and consequent addition to comfort was important.

As before, our dredgings were mainly confined to Lamlash Bay, the richest and most attractive ground. In the "Midland Naturalist," Vol. I., page 11, I gave an account of our captures during 1877, and, as we again took specimens of most of the species therein recorded, it is only necessary here just to allude to the additions which are of any special interest. The district, as stated previously, is richest in Echinoderms, and we secured specimens of every species observed on our last visit, with the exception of the somewhat rare aberrant form of *Thyone papillosa*. As a set off, however, we took a magnificent specimen of *Luidia fragilissima*, or Lingthorn, the glory of the late Professor Forbes, who has so graphically described its extremely brittle nature and its liability to break itself up into fragments immediately, if not even before, the dredge comes up. This star-fish is exceedingly interesting, not only from its comparative rarity, but because, as Forbes said, it is the "most remarkable and largest of all our British star-fishes." It is intermediate between the true star-fishes—those having ambulacral suckers—and the sea-urchins. Our specimen—notwithstanding the proverbial friability of the species—came up in the dredge entire, and a bucketful of pure sea-water having been speedily provided for its reception, we were enabled to examine and admire it and its moving spines and suckers in all their beauty. The specimen measured upwards of 18 inches across, was of brick red colour above, the under surface and lateral spines being a delicate straw colour. Well knowing its extreme friability, every means were taken to secure the specimen intact. It was preserved in sea-water for three or four hours, and, in order that when killed it should be unbroken, we carried it to a deep portion of the "brawling burn" in the grounds attached to the Brodick Hotel, and plunged it into fresh-water. Great and lasting, however, was our disappointment on returning to the hotel to see the rays one by one detach themselves at their junction with the disc, and presently not a single ray remained attached. If we had followed our "Carpenter," we might have killed the specimen without dismembering it, by immersion in glycerine; or, better still, by allowing it to die gradually in sea-water. In connection with the Echinoderms it should be mentioned that, although we were six weeks earlier than last year, and hoped by this we might secure some specimens of *Antedon (Comatula) rosaceus* in the stalked condition, not a single one was taken, all being in the free form, and many of them mature adults. It seems probable, therefore, that the specimens in the stalked condition which we took at Torquay in September, 1873, were the result of an abnormal second brood.

The very beautiful Nemertean annelid, *Carinella annulata*, another of the specimens taken, has been described by Dr. McIntosh as "one of the most handsome and graceful of the whole order." It was about two feet in length, the snout being wider than the rest of the body, and bluntly rounded anteriorly. The mouth is small. It is eyeless, with a white patch on the snout. The rounded body, when living, was of a rich red colour, passing into pink, striped longitudinally, and banded across at intervals by white belts. The development of Carinella has not yet been traced, but in an allied genus, *Lineus*, Johannes Müller, as referred to by Professor Huxley, (Anatomy of Invertebrated Animals, p. 186,) has shown that the ciliated embryo which leaves the egg is speedily converted into a body like a helmet with ear-lappets. The lappets are ciliated, and between them, where the head would fit into a helmet, is the mouth aperture, leading into a pouch-like alimentary cavity. Müller termed this larva *Pilidium gyrans*. That portion termed the Mesoblast gives rise to an elongated vermiform body, wherein the characteristics of a Nemertean soon appear. The worm on detachment carries with it the alimentary canal, the ciliated integument being left to perish. Professor Huxley observes "that in this remarkable process of development the formation of the Nemertean body may be compared on the one hand to that of a segmented mesoblast in Annelida, and on the other to that of an Echinoderm within its larva." The process of contraction and elongation peculiar to individuals in this order is wonderful, a specimen measuring several feet being capable of contracting to as many inches.

The three Nudibranchs referred to were all taken in Lamlash Bay. *Doto coronata* is a very beautiful and delicate animal. As usual, this was found on its favourite habitat, *Plumularia falcata*. Its filiform trumpet sheathed tentacles, and its body only half an inch in length, spotted all over, as well as the branchiæ, with brownish purple, made it a most charming object viewed by the two-inch objective, the pulsations of the heart (about sixty per minute) being readily perceived. *Doris pilosa*, another delicate little creature, is also not more than half an inch long, of pale, yellowish-brown colour. The branchial plumes of pearly white, freckled with brown, are exceedingly beautiful. Only one specimen was taken. *Ancula cristata*, also about half an inch long, is an elegant little Nudibranch. Its pellucid, tapering body, which permits the viscera to be plainly seen within, and its laminated tentacles and branchial plumes tipped with bright orange-yellow, mark it as one of the most beautiful of a beautiful tribe. We took many specimens of the little creature. Although not recorded in Bryce, the late Dr. Johnston is said by Alder and Hancock to have taken it off Holy Island, near which it was dredged.

One of the most interesting features of our last excursion was the effective display of microscopes. Under the able hands of Mr. Levick, Mr. Bolton, and Mr. Pumphrey, we were always sure of having any object of note well exhibited in the ladies' drawing room, in the evening, with every facility that "black back-ground" and other modes of illumination could afford. An improved tow-net, which was specially devised for us by Mr. Henry Allport, was used constantly with admirable effect.

This consisted of a metal rim, with lattice wire to keep out large objects, such as jelly-fishes, fitting into a stout outer rim of iron, to which was attached the bag made of bunting or muslin. Three small spring swivels attached as many lines to the rope which towed at our stern, or was left during the night, as the *Lizzie* lay at anchor in Brodick Bay, and collected a most interesting series of objects. We had thus the rare opportunity of examining the beautiful pseud-embryo stages of *Bipinnaria* and *Pluteus*, from which are developed the star-fish and sea-urchin. These pseud-embryos, or "zooids," are formed on a type quite different from that which characterises the adult animals, being bilateral instead of radial. In the last edition of his "Handbook to the Microscope," p. 609, Dr. Carpenter says, "This pseud-embryo seems to exist for no other purpose than to give origin to the Echinoderm by a kind of internal gemmation, and to carry it to a distance by its active locomotive powers, so as to prevent the spots inhabited by the respective species from being overcrowded by the accumulation of their progeny." Many other interesting larval forms, such as those of the crab and barnacle, were taken, as well as Radiolarians, Rotifers, and the *Noctiluca miliaris*, to which the phosphorescence of the sea on our coasts is mainly to be attributed. A small but very interesting collection of Algæ was taken and mounted by our most obliging friend, Mr. George Miles.

Several times during our dredging we had an opportunity of seeing the sea under exceptionally favourable conditions, not frequently observed. The weather was brilliantly fine, and had been so for several weeks before our visit. The wind was S.E. and almost a dead calm, and the sea smooth as oil, and clear as crystal. Not the slightest amount of sand or other detritus appeared mixed with the water, and thus we saw objects almost as plainly as though we were looking into a gigantic Aquarium. The bottom was in some places covered with the Chlorosperm algæ, *Ulva latissima*, and *Enteromorpha compressa*, like a lovely green grass plot. Between these, here and there, appeared a delicate Rhodosperm. Above these in places waved long broad fronds of the Oar-weeds *(Laminaria)* or slender filaments of the Whip-weed *(Chorda.)* Star-fishes and large sea-urchins were scattered among the vegetation, and the refraction of the light made some of them look, as our genial and accomplished friend, Mr. Sam. Timmins, (who has himself described it in his charming article on our visit in the *Daily Post* of 20th July, 1878) remarked, like "living turquoises." Occasionally fishes, both of large and small size, darted across. The depth in many places was between twenty and thirty fathoms.

And now we are looking forward hopefully to our forthcoming excursion to Falmouth. The Cornish coast has long been celebrated for its rich stores both of vertebrate and invertebrate marine life. The names of distinguished marine Naturalists who have investigated the fauna are as household words to us: Borlase, the historian, and Jonathan Couch, the eminent ichthyologist, and his gifted son Richard Q. Couch, who passed away so early in life; and Charles Peach, the Coastguardsman Naturalist, and the venerable W. P. Cocks. In many respects the fauna will be a contrast to that of Arran, which we have twice seen; but I venture with all confidence to say that, as hitherto, we shall be more than satisfied, and that we shall return, if not with any additions to the already well gleaned ground, certainly with large additions to our stock of knowledge and with increased admiration for and interest in the wonders of the "great deep."

METEOROLOGY OF THE MIDLANDS.

THE WEATHER OF MAY, 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 d.	TEMPERATURE. Greatest ht. Deg	Greatest ht. Date.	Great'st cold Deg	Great'st cold Date.
GLOUCESTERSHIRE.									
Cainscross, Stroud	W. B. Baker, Esq.	2·74	·74	27	14	92 0	20	27·0	10
Cheltenham	R. Tyrer, Esq.	2·60	1·00	23	21	65·0	21	23·4	10
Stroud	S. J. Coley, Esq.	2·83	·75	29	17	67·0	23	27·0	8 & 10
SHROPSHIRE.									
Haughton Hall, Shifnal	Rev. J. Brooke	2·55	·59	28	19	67·0	21	26·5	3
Woolstaston	Rev. E. D. Carr	2·25	·46	28	20	64·0	19 & 21	28 0	2
Leaton Vicarage, Shrewsbury	Rev. E. V. Pigott	1·65	·36	28	21	66·3	31	25·0	5
More Rectory, Bishop's Castle	Rev. A. Male	2·26	·37	28	22	67·0	18	26·0	3
Larden Hall, Much Wenlock.	Miss F. R. Boughton	2 50	·55	28	21	64·0	21	31·0	2
Bishop's Castle	E. Griffiths, Esq.	2·11	·36	28	22	69·0	5	28·0	2 & 3
Cardington	Rev. Wm. Elliott	2·11	·52	28	21				
Stokesay	Rev. J. D. La Touche	2 02	·42	28	22	63·9	12 & 31	26·5	3
HEREFORDSHIRE.									
Whitfield	W. Wheatley, Esq.	2·85	·82	28	22			24·0	3
Stoke Bliss	Rev. G. E. Alexander	2·75	·82	14	18	65·0	21	31·0	2 & 9
WORCESTERSHIRE.									
Orleton, Tenbury	T. H. Davis, Esq	2·88	·85	14	21	68·5	21	25·7	3
West Malvern	A. H. Hartland, Esq.	3·03	·54	14	19	68·5	21	28·0	9
Pedmore	E. B. Marten, Esq.	2·97	·66	28	20	73 0	31	31·0	2
Longlands, Stourbridge	J. Jeffries Esq.	2·98	·60	28	20	72·0	21 & 22	26·0	2 & 9
Dennis, Stourbridge	Mr. C. Webb	3·74	·92	17	20	69·0	21	25·5	9
STAFFORDSHIRE.									
Thorganby Villa, Wolverhmtn	G. J. C. Broom, Esq.	2·74	·69	28	19				
Dudley	Mr. J. Fisher	3·04	·61	28	17	74·0	30	28·0	9
Sedgley	Mr. C. Beale	2·74	·64	28	19	65·0	21	31·0	9
Kinver	Rev. W. H. Bolton	2·67	·64	14	20	70·0	21	26·0	2 & 9
Walsall	Mr. N. E. Best	3·10	·80	28	18	67·0	21	32·0	2
Grammar School, Burton	C. U. Tripp, Esq.	2·24	·31	13	19	69·0	5 & 21	24·0	10
Weston-under-Lyziard R'tory	Hon. and Rev. J. Bridgeman	2·81	·60	28	25	70·0	21	27·0	10
Wrottesley	E. Simpson, Esq.	2·61	·65	28	18	65·5	22	29·8	2
Heath House, Cheadle	J. C. Philips, Esq.	2·49	·31	31	15	61·3	21	28·0	10
Alstonfield Vicarage	Rev. W. H. Purchas	2·95	·60	16	17	64·7	21	18·0	15
WARWICKSHIRE.									
Coundon, Coventry	Lieut.-Col. R. Caldicott	2·53	·67	28	18	70·0	31	29·0	9
Coventry	J. Gulson, Esq.	2·62	·72	28	18	27·0	3	71·0	22
Bickenhill Vicarage	J. Ward, Esq.	2·82	·65	28	19	65·0		45·0	
St. Mary's College	Rev. S. J Whitty	3·22	1·08	14	16	67·1	21	28·6	10
Henley-in-Arden	T. H. G. Newton, Esq.	3·26	·75	28	19	66·0	5	26·0	3
Rugby School	Rev. T. N. Hutchinson	2·74	·77	28	17	66 6	5	26·0	10
DERBYSHIRE.									
Buxton	E. J. Sykes, Esq.	3·30	·71	15	20	63·1	21	23·0	10
Stoney Middleton	Rev. U. Smith	2·65	·61	29	10	62·0	5	11·0	9
Fernslope, Belper	J. G. Jackson, Esq.	3·10	·64	15	20	67·0	21	27·0	10
Brampton S. Thomas	Rev. J. M. Mello	2·70	·56	15	14	65·0	5	25·0	10
Linacre Reservoir	C. E. Jones, Esq.	2·84	·53	29	18				
Willersley Gardens	Jas. Tissington, Esq.	3·10			10				
Spondon	J. T. Barber, Esq.	2·93	·44	15	17			20·5	10
NOTTINGHAMSHIRE.									
Hesley Hall	B. J. Whitaker, Esq.	2·95	1·06	15	14	68·0	22	26·0	10
Tuxford	J. N. Dufty, Esq.	4·63				66·0	31	30·0	1
Hodsock Priory, Worksop	H. Mellish, Esq.	3·38	·64	14	19	65·3	21	23·8	3
Highfield House, Nottingham	E. J. Lowe, Esq.	3·56	1·21	14	19	68·8	21	24·9	10
Park Hill, Nottingham	H. F. Johnson, Esq.	3·80	1·12	14	19	65·7	26	32·3	9
LEICESTERSHIRE.									
Loughborough	W. Berridge, Esq.	2·29	·45	15	22	68·1	5	25·4	10
Ashby Magna	Rev. E. Willes	2·57	·68	28	21	72·0	21	24·0	18
Market Harborough	S. W. Cox, Esq.	3 09	·64	14	15	69·0	21	22·0	10
Kibworth	T Macaulay, Esq.	3·11	·71	28	17				
Town Museum, Leicester	W. J. Harrison, Esq.	3·22	·79	14	22	67·3	21	26·8	10
Belmont Villas, Leicester	H. Billson, Esq.	3·25	·83	14	17	70·3	21	26·2	10
Syston	J. Hames, jun., Esq.	3·07	·56	14	26	75·0	5	25·0	10
Waltham-le-Wold	E. Ball, Esq.	3 98	·96	15	19	67·0	26	30·0	2
Little Dalby Hall	G. Jones, Esq.	3·57	·70	14 & 15	21	74·0	5	21·0	3
Foxton Locks	Union Canal Company	2·26	·57	28	17				
Coston Rectory, Melton	Rev. A. M. Rendell	3·90	·96	15	22	65·3	5	19·3	10
NORTHAMPTONSHIRE.									
Towcester Brewery	J. Webb, Esq.	2·78	·93	28	13				
Castle Ashby	R. G. Scriven, Esq.	2·56	·82	28	16	67·0	31	29·0	9
Kettering	J. Wallis, Esq.	2·82	·65	28	17	68·0	22	30·0	10
Althorpe	C. S. Groom, Esq.	2·72	·73	28	16	68·0	21	24·0	9
Pitsford	C. A. Markham, Esq.	2·90	·83	28	19	71·0	6 & 22	26·0	3
RUTLAND.									
Burley-on-the-Hill	W. Temple, Esq.	3·83	·76	15	20	55·0	21	23·0	10
West Deyne, Uppingham	Rev. G. H. Mullins	3·15	·58	1[illegible]	20	67·2	5	28·1	10
Northfields, Stamford	W. Hayes, Esq.	3·37	·57	15	17	64·0	20	25·0	5
Radcliffe Observatory, Oxford	H. E. Bellamy, Esq.	2·62	·95	28	14	64·7	5	29·6	9
Ventnor Hospital	W. T. Ryder, Esq.	2·06	·34	26	12	65·5	5	32·0	8
Altarnun Vicarage	Rev. G. Tripp	2·58	·59	28	19	68·0	31	25·0	3 & 8

Another cold, almost wintry, month, making the seventh in succession with a temperature below the average! Polar winds prevailed, varying from N.E. to N.W., but of moderate strength, with some calms. The nights of the 3rd and 10th were extremely cold, the protected thermometer falling at many stations to from 7° to 9° degrees below zero. The thermometer exposed on the grass at Leicester registered 12·2° on the 10th. Snow fell at several stations on the 1st, 7th, 9th, and 26th. During the first three weeks the barometer ranged high, the pressure during the last week being nearly half-an-inch lower, indicating the passage of numerous depressions from west to east, accompanied by very unsettled weather. Rainfall rather above the average. Thunderstorms occurred on the 1st, 11th, 14th, 26th, and 28th; that of the 14th was accompanied by a remarkable gloom, lasting at Buxton from nine to 10 45 A.M., and commencing at Orleton (near Tenbury) at 2 15 P.M. All observers concur in noticing the great backwardness of vegetation generally, which is estimated at one clear month behind the average.

NATURAL HISTORY NOTES BY OBSERVERS.—*Tenbury*—Cherry trees in blossom on 3rd; Damson, 7th; Pear, 23rd; Apple, 27th. *Pitsford, near Northampton*—Swallows first seen on 3rd. *Weston-under-Lyziard*—Cuckoo first heard, 4th; Landrail, 19th. *Waltham-le-Wold*—Hawthorn blossomed on 31st. *Alstonfield*—Vegetation more backward than in any season remembered. Ash tree only flowered towards the close of the month, and on the hills here still (June 5th) shows no leaf, although it does so in the warmer valleys to the south of us. Wych Elm *(Ulmus montana)* had, in the more forward instances, leaves barely half-grown on May 31st, while some of the later varieties had no leaves at all, only the nearly fully-formed seed vessels; Beech had leaves three-parts grown; Sand Martin seen on May 12th; Swift on May 14th. *Cheltenham*—Walnut Trees killed by frost of 10th; still black and leafless at end of month. *More Rectory, (Bishop's Castle)*—Bats flying on evening of 12th; Goldfinches andBlackbirds are abundant; Thrushes more rare; Common Wren scarce; Landrail heard on 29th. *Shifnal*—Oak only in tender yellow leaf on 29th, and some just bursting; Asparagus cut on 4th; Wild Cherry flowered 16th; Turtle Dove arrived 16th; Swifts, 17th; Martins, 21st; Flycatcher, 27th; Orange-tip Butterfly, 27th; Nightingale heard on 7th. *Castle Street, Bishop's Castle*—Swifts arrived on 1st; Corn-crake heard on 11th. *Stoney Middleton*—Oak and Ash just opening into leaf on 31st. *Park Hill, Nottingham*—Everything extremely backward; a spinney near here which at the beginning of May last year was over four feet high in *Æthusa* and Nettles, was this year scarcely over the boot tops. The number of nests built in holly hedges is extraordinary, they being the only ones capable of concealing anything. *Stroud*—List of flowers and date of blossoming:—1st, Blackthorn, Fœtid Hellebore; 7th, Garlick, Hedge Mustard; 8th, *Veronica polita, Ranunculus acris, R. auricomus, Prunus domestica;* 10th, *Saxifraga tridactylites;* 12th, *Polygala vulgaris, Orchis mascula, Carex præcox, Luzula campestris;* 13th, *Alchemilla vulg.;* 19th, *Cardamine amara, Viola tricolor,* Yellow Dead Nettle; 21st, *Barbarea vulg., Ajuga reptans, Plantago lanceolata;* 22nd, Blue Bell, *Geranium Robertianum, Mœhringia trinervis, Orchis Morio, Stellaria nemorum;* 26th, Woodruff, Forget-me-Not, *Potentilla Tormentilla, Arum maculatum, Geranium lucidum;* 27th, Tufted Vetch, *Plantago major, Sherardia arvensis, Euphorbia helioscopia;* 28th, *Sanicula Europæa;* 29th, *Allium sativum, Lychnis dioica;* 30th, *Cochlear. officinal.;* 31st, *Carex pendula, Valerian. officin.* *Highfield House Observatory, Nottingham*—Narcissus, Wall Pears, Wild Cherry, fl. on 8th; Blackthorn and plum, fl. on 11th; Wild Hyacinth, fl., 23rd; Wisteria, fl., 25th; Lily of the Valley, Bird Cherry, fl., 26th; Landrail heard on 11th; Flycatcher arrived on 28th.

Correspondence.

Chrysosplenium alternifolium.—In answer to "Observer's" enquiry, I beg to say that I have found this plant twice this spring, once (about the middle of April) at Plaxtol, near Sevenoaks, and again (in May) at Loose, near Maidstone.—J. Thornhill, Maidstone.

Bee-eater.—I exhibited a fine specimen of that very rare bird, *Merops apiaster*, (Bee-eater,) at our Society's meeting on June 11th. It was shot near Derby, the day before.—L. Lee, Nottingham.

Ornithological Notes.—In my notes for last month, instead of "Merlin" (to whom I apologise for the mistake) I should have put the name of "Mr. Edwards," in respect of notes on the Hawfinch.—O. V. Aplin, Bodicote, Oxon, June, 1879.

Thrush's Eggs, &c.—Whilst out near here last month I found a thrush's nest, in which three out of the five eggs were perfectly plain and free from spots, the other two only having a very few. I should be glad to know if this is a common occurrence. On Whit-Tuesday, whilst rambling in some woods about eight miles from here, I came across a patch of *Paris quadrifolia*, and upon looking for any unusual forms, I found two plants with five leaves, but the other parts of the flower ran in fours, as is usual. On the same day I found very fine white specimens of *Myosotis sylvatica* and *Scilla nutans*.—H. F. Johnson, Nottingham.

Ornithological Notes.—This notice will complete the list of summer migrants, as the time for their arrival has now expired. Since my last communication I have noted the Swifts on May 14th, Redstarts May 15th, Yellow Wagtail May 23rd, Landrail June 8th, and Spotted Flycatcher June 13th. I have no doubt Ray's Wagtail was here on an earlier date, as I have observed the bird as early as the middle of April, and therefore the above date must not be considered as that of the *arrival* of the bird, but of my chance observation of it. It is not common, and may easily escape being seen for some time after its arrival. I have now recorded the arrival of twenty-three species, and there are of course some which have escaped notice, such as the Common Flycatcher, the Night-jar, the Whinchat, the Turtledove, the Quail, the Ring Ousel, the Red-backed Shrike, all of which have been seen in this neighbourhood in former years, and are doubtless here now, though overlooked. This would bring our list of ordinary summer migrants in South Leicestershire up to thirty at least. Some day I hope to be able to make the record complete. I hope your Oxfordshire correspondent will not feel offended if I say that he has not established beyond doubt the fact of the arrival of the Wryneck in that county as early as the first week in March. Should he succeed in proving that this bird ever takes precedence of all the spring migrants, and is heard three weeks in advance of the Chiffchaff, it will be something new. Meanwhile I venture to think that my theory, that the note was that of the Kestrel, is much the more probable. In your last issue I notice, as a curious coincidence, that your correspondent at Castle Ashby gives you the same date as myself for the arrival of the House Martin and the Nightingale.—Thomas Macaulay, M.R.C.S.L., &c., Kibworth, June 14th.

Seasonable Notes.—Owing to the long-continued wet and cold weather, the spring and summer flowers are unusually backward this year. I first noticed the Purple Orchis *(Orchis mascula)* and the Crab trees *(Pyrus malus)* in flower, May 19th; Buttercups, *(Ranunculus bulbosus* and *R. repens,) Stellaria Holostea, Veronica Chamædrys, Ajuga reptans, Orchis Morio*, and Bluebell Hyacinths *(Scilla nutans)* were in flower by May 21st; *Viburnum Lantana* and *Paris quadrifolia* by 22nd; Hawthorn, which is very late this year, 23rd; the Horse Chestnut and Lilac trees, *Asperula odorata*, *Rumex Acetosella*, *Poterium Sanguisorba*, May 29th; *Ranunculus acris*, *Ranunculus sceleratus*, *Berberis vulgaris*, *Arenaria trinervis*, *Vicia sativa*, and *Myosotis arvensis*, May 31st; *Potentilla anserina*, June 2nd; Laburnum, *Geranium Robertianum*, *Oxalis Acetosella*, *Valeriana dioica*, and *Veronica Beccabunga*, June 4th; *Geum urbanum*, June 7th; *Lychnis vespertina*, *Polygala vulgaris*, *Potentilla Tormentilla*, and Butterfly Orchis, (*Habenaria bifolia*,) June 9th; *Lotus corniculatus* and *Geranium dissectum*, first seen in flower June 12th; *Malva rotundifolia* and *Rhinanthus Crista-galli* in flower June 15th.—R. R., Castle Ashby.

SEASONABLE NOTES.—May 11th, Maythorn, bud, (flowered about 30th;) 16th, Oak, fl.; White Nettle, fl.; 17th, Wild Plum, fl.; 19th, Apple, fl.; 20th, Nightingale, at H. G. Tomlinson, Esq.'s, (Woodlands;) 24th, Ash and Sycamore, fl.; Early Purple Orchis, also a white variety; Glow-worm first seen.—C. U. TRIPP, Burton-on-Trent.

DISCOVERY OF A FOSSIL FRESH-WATER TORTOISE IN NORFOLK.—Remains of the common European *Emys lutaria*, obtained from the Post-glacial Freshwater-bed at Mundesley, have lately been brought under the notice of the scientific societies in Norwich. The specimen has been placed in the hands of Mr. E. T. Newton, F.G.S., and will shortly be described in the "Geological Magazine." In the meantime the fact of this discovery is of considerable interest, for only one other record exists of the occurrence of Testudinate remains in post-pliocene deposits in this country. The earlier discovery was communicated by Prof. A. Newton, (see his paper "On the Zoology of Ancient Europe," read before the Cambridge Phil. Soc., 1862,) and this consisted in the finding of remains of two individuals of the same species of Tortoise in a peat-bog at East Wretham, in Norfolk.—H. B. W.

BLACK BAND IN THE DRIFT.—In reply to Mr. Woodward's letter, which appeared last month, I regret that I have but little to add to my former communication. I was sorry to find that the bed in question does not extend far in the direction the cutting is being made, but appears to have its greatest dimensions at right angles, *i.e.*, east and west. The result is that the section is all but obliterated by the sloping banks which form the sides of the cutting. It was, however, too much decomposed to yield many recognisable remains, and after a careful search I have only found one good specimen. This appears to be a fragment of a twig from some tree or shrub, and is about two inches long by one-eighth of an inch thick. I have made enquiries from the foreman of the work, but the men have not met with anything sufficiently remarkable to attract their attention.—A. H. ATKINS, Birmingham.

Reports of Societies.

BIRMINGHAM AND MIDLAND INSTITUTE SCIENTIFIC SOCIETY. —WHIT-MONDAY, June 2nd.—EXCURSION TO STONEHOUSE AND DISTRICT.—A party of twenty-four members and friends left Birmingham at 6 30 for Stonehouse. Thence the way was taken, under the guidance of Mr. C. Pumphrey, over Doverow Hill to Randwick, just beyond which a quarry was found yielding an abundance of fossils. A most charming wood was next traversed, and many interesting plants collected. The walk was continued to the ancient camp on Standish Beacon, where a grand view was disclosed of the valley of the Severn, with the range of the Cotswold Hills stretching to the south, and on the other side the Malvern, May, and other hills. Signs of rain appearing, the party made a speedy return to Stroud, where tea was obtained. Afterwards some of the more enterprising of the party walked through the rain over the hills to Stonehouse, collecting fossils on the way.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—Geological Section.—May 27th.—Mr. Bolton exhibited *Brachionus pala*, one of the large shielded Rotifers, with two eggs attached. Mr. Waller exhibited photographs of some rock sections. Mr. C. Pumphrey gave some account of the Geological excursion to Charnwood Forest, on the occasion of the meeting of the Midland Union of Natural History Societies, at Leicester. Some discussion on the scheme for the united observation of glacial phenomena having taken place, the minute on the subject of the 22nd of October last was read. General Meeting.—June 3rd.—Mr. J. Morley exhibited bulbs of *Crocus nudiflorus*, from the Quarry, Shrewsbury. Mr. J. W. Cotton exhibited *Drosera rotundifolia*, *Polygala vulgaris*, *Pinguicula vulgaris*, and *Pedicularis vulgaris*. Mr. J. H. Pumphrey exhibited *Prunus Padus*, the Bird-cherry, from Millersdale, Derbyshire. Mr. H. E. Forrest exhibited *Tremella mesenterica*, a fungus, from Shrewsbury. Miss Ryland exhibited Geological specimens from Charnwood Forest. Mr. Walter Graham exhibited *Helleborus viridis* and other plants of the limestone, from the Doward Hill, near Monmouth; also, teeth and bones of extinct animals, from King Aurthur's Cave, Herefordshire. Biological Section.—June 10th.—Mr. J. E. Bagnall exhibited *Jungermannia excisa* and *J. sphærocarpa*, also *Saxifraga granulata*, from Sutton Park; *Tetraphis pellucida*, in fruit, from New Park, Middleton, a moss rarely found in this condition; also specimens of the long and short styled forms of Primula, the former of which is hairy, the latter only papillose. Mr. T. Bolton exhibited six slides given to the Society by the Rev. Lord S. G. Osborne, shewing the effects of carmine staining on animal and vegetable tissues. Mr. H. E. Forrest exhibited *Hydra vulgaris*, showing the ova and sperm-sacs; *Trifolium repens*, showing leaves with three, four, five, six, and seven leaflets; *Spirogyra quinina*, showing formation of spores from the contents of contiguous cells in the same filament, and various other fresh-water algæ. Mr. J. Levick exhibited *Pandorina morum* and *Uroglena volvox*, both from Sutton Park; and read a few notes on the latter. Mr. M. Browne exhibited *Euchelia Jacobææ*, the Cinnabar moth, taken at Bath. Microscopical General Meeting.—June 17th.—Mr. A. W. Wills exhibited several species of *Spirogyra* and *Zygnema*, showing formation of spores in conjugating filaments, and in contiguous cells of the same filament. Mr. W. P. Marshall exhibited newt and newt-embryos, shewing the circulation in the gills while within the egg. Mr. J. E. Bagnall exhibited *Cephalanthera ensifolia*, *Myosotis umbrosa*, and *Helianthemum vulgare*, from Oversley Wood. Mr. J. W. Cotton exhibited *Botrychium Lunaria*, the Moonwort, from Barmouth. Mr. T. Clarke exhibited slides of Crystals of Sulphate of Copper. Mr. W. R. Hughes read some interesting notes on the marine excursion to Arran last year, including full descriptions of the more remarkable animals captured, and illustrated by preserved specimens of the Nemertean Annelid, *Carinella annulata* and stalked examples of *Antedon rosaceus*, in various stages of development.

BIRMINGHAM SCHOOL NATURAL HISTORY SOCIETY.—May 9th, Annual General Meeting, the President (Rev. A. R. Vardy) in the chair. The officers for the ensuing year were elected, as follows:—President—Rev. A. R. Vardy. Vice-Presidents—Rev. E. F. M. McCarthy, Rev. J. H. Smith, R. Levett, Esq., J. Turner, Esq. Hon. Sec.—H. F. Devis. Curators—Biological Section, J. Chapman; Geological Section, — Stokes. A. B. Badger exhibited *Philodina roseola* and *Floscularia ornata*. May 16th, General Meeting.—A paper was read by A. W. Swayne, on "A Walk at Llanthony." June 6th, General Meeting.—A paper was read by J. Chapman on "The Fertilisation of Plants."

CHELTENHAM NATURAL SCIENCE SOCIETY.—We mentioned at page 164 that Mr. Day had addressed the members of this society on the question "What has Vivisection done for Science?" We have since been favoured with a sight of a *resumé* of the paper, and heartily regret that our limited space does not allow us to offer a statement of the admirable way in which he put the answer. We cannot, however, debar ourselves of the pleasure of stating that a more thoughtful and well-reasoned exposition of the views of most intelligent biologists on the subject has not been seen by us. Mr. Day stated his views most dispassionately, and showed most conclusively that the interests of suffering humanity would be sacrificed, and the advance of scientific enquiry seriously retarded, if properly conducted experiments on the lower animals were rendered illegal. We must content ourselves by giving Mr. Day's concluding remarks. He said:—"I have, although but briefly, sketched out how it has occurred that discussions upon vivisection have been raised during the last few years by those who do not believe anything has been discovered by their means. I have traced some of the advantages which humanity has reaped from these investigations, more especially as regards the circulation, the nervous system, and the therapeutic action of drugs; how, by its lessons, some prophylactics have been discovered, and the mode of treating asphyxiated persons has become more clear; how the changes in structures induced by disease have been followed out, step by step, and some organs, formerly unsuspected, are found to be the seat of certain complaints; how, by means of anæsthetics, operations have become painless, and, owing to the discovery of the antiseptic treatment, the pain of after treatment (as well as the mortality) has been greatly reduced; and, lastly, how by these means some poisoners have been convicted, and some persons unjustly accused have been saved from the gallows. But there are still many strong places to be attacked, remedies are required for many epidemics, as, for instance, cholera or fevers; or for poisons, as those of serpents; and curative agents, for the removal of disease; while a great boon would be an equally efficacious but safer anæsthetic than chloroform. The question is now narrowed into these grounds, first, that some experiments on living creatures are a necessity, but shall such be carried out in the wards of our hospitals and amongst patients? or on the convict population? or on the lower animals? Most of us in this room have been asked to sign petitions to except the lower animals from all experiments, thus throwing such upon human beings. The medical profession object to this plan, preferring the ancient adage, *Fiat experimentum in corpore vili.*"

DUDLEY AND MIDLAND GEOLOGICAL AND SCIENTIFIC SOCIETY AND FIELD CLUB.—The annual meeting of this Society was held on Wednesday, June 18th, at the Museum, Dudley. The report of the committee was read and adopted and the accounts passed. Dr. Fraser was elected as president for a second year, and some few names added to fill up vacancies in the committee. Mr. William Madeley was elected as secretary, an office which he held some years ago. A hearty vote of thanks was given to Mr. Marten, the retiring secretary. After slight luncheon, the members to the number of about forty started for the third field meeting of the season. Driving to Halesowen, after a look at the remains of the Manor Abbey, they inspected some interesting cuttings on the new line of railway from that place to Northfield, and then had a lovely walk, under the guidance of Mr. J. Amphlett, of Clent, from Romsley, through the romantic valley, near Farley Coppice and Shut Mill, to Walton and Hagley, having the usual meat tea at the Lyttelton Arms.

NOTTINGHAM LITERARY AND PHILOSOPHICAL SOCIETY.—ANNUAL MEETING.—May 29th, 1879. The following officers for the year 1879-80 were elected:—President, Rev. R. A. Armstrong, B.A.; Vice-Presidents, Rev. Dr. Dixon, F.G.S., R. Enfield, T. A. Stephenson, M.D., J. White, F.R.C.S.; Treasurer, G. B. Rothera; Hon. Librarian, H. E. Hubbart; Hon. Secretaries, Isaac Mosley, A. H. Scott-White, B.A., B.Sc.; Council, J. Beddard, M.B., A. Brunner, M.A., E. Goldschmidt, A. L. Kohn, W. H. Ransom, M.D., C. L. Rothera, B.A., R. Simon, E. Smith, M.A., A. C. Taylor, M.D., E. Wilson, F.G.S.

CORRECTION.—In the title of a paper read by Mr. J. Shipman before the Natural Science Section, May 9th, (*vide* "Midland Naturalist," Vol. II., page 164, bottom line,) for "Burton" read "Beeston."

NOTTINGHAM NATURALISTS' SOCIETY.—May 21st.—A special general meeting was held to consider the subject of an amalgamation with the Nottingham Literary and Philosophical Society. It was decided, with only one dissentient, not to amalgamate. May 28th.—Meeting of the Botanical Section for the exhibition of specimens collected during May. Mr. A. G. Webster exhibited specimens of *Lathræa squamaria*, found on the root of the elm, and *Paris quadrifolia*. Other members exhibited specimens of *Saxifraga granulata*, *Geranium lucidum*, &c. June 3rd.—A few of the members set out for a ramble in the neighbourhood of Loughborough, where, having arrived, they started by the Leicester road for Quorndon, on the left hand side of which, in a dyke, feeding on grass, was found, in abundance, the larva of *Odonestis potatoria*, (the Drinker Moth.) From Quorndon they passed on to Mountsorrel to inspect the Granite Quarries there. The deep ravine was grand and majestic. Quorndon Wood was then visited, where a rich flora was found, including *Convallaria majalis*, (Lily of the Valley,) and *Asperula odorata*, (Sweet Woodruff,) Yellow Lamium, *(Lamium galeobdolon,) Saxifraga granulata*, *Trifolium procumbens*, *Geranium lucidum*, Ferns, &c.

PETERBOROUGH NATURAL HISTORY AND SCIENTIFIC SOCIETY. —On June 2nd the members of this society had an excursion to Bedford Purlieus, permission having been granted to the society by Herbert E. Watson, Esq., steward to the Duke of Bedford. The party, consisting of twenty-three ladies and gentlemen, were under the guidance of the secretary, Mr. J. W. Bodger. The first halt was called at Alwalton, where half an hour was pleasantly spent in looking over the church; some interesting wall plants were obtained here. Chesterton Church was next visited, the Rev. — Gaudy kindly conducting the party and pointing out and describing the beautiful monuments erected to the memories of the Drydens and Nevilles; giving at the same time an account of these families. A lovely view of the surrounding country was obtained from the roof of the building. The rev. gentleman also showed the party over his gardens and surrounding grounds. Part of the programme had to be omitted, and the next stage was to the Purlieus, the favourite dwelling of many rare Northamptonshire plants. After dining the party dispersed by various paths into the depths of the wood, and returned laden with spoils.

SEVERN VALLEY NATURALISTS' FIELD CLUB.—EXCURSION TO BARMOUTH, June 10th to 13th.—Twenty-five members and friends of this club arrived at Barmouth on the afternoon of Tuesday, June 10th, quarters having been provided for them at the Cors-y-Gedol Hotel. A walk was taken to the panoramic view, a point on the hills above Barmouth, whence was seen in great beauty the scenery of the Mawddach, including the mountain ranges of Cader Idris and the Arrans. The sunset was one of remarkable beauty, the rich red afterglow continuing till ten P.M. On Wednesday, the 11th, the party drove along the north side of the estuary to Llanelltyd and thence up the valley of the Mawddach to a point where they alighted, and after a walk of two miles reached the Falls Pistyll-y-Cain and Pistyll-y-Mawddach, both of which were seen to great advantage, the sun shining brilliantly at the time. Near these Falls may be traced the junction of the Lingula Flags with the Cambrian Grit; outbursts of igneous rock (greenstone) are frequent. Lodes of metallic ore are numerous in the district. Near the Falls the party saw costly apparatus for gold washing, connected with the gold mine abandoned some years ago. Lead mining is, however, still carried on close to the Falls, the water from which supplies the power for driving the machinery for grinding and washing the ore. The Trilobite *Paradoxides Davidis* has been found near the Falls of the Mawddach Valley, but it is very scarce. A thunderstorm passing over prevented the visit to the third Fall, Rhaydr Du, and after sheltering at the little inn, Tyn-y-Groes, the party visited the small but picturesque ruins of Cymma Abbey, and after a drive back through the same noble scenery, reached Barmouth about six P.M. Thursday, June 12th.—An unsettled showery day, but the morning was on the whole favourable. The party drove by the Harlech Road to Llanbedr, and thence to Dolrheiddiog, whence they walked to Cwm Bychan lake and through the magnificent scenery beyond it, traversed by the path paved by the Romans with masses of Cambrian rock quarried on the spot, and known as the Roman steps. Weather cut short the walk after the summit had been reached, and in a pouring rain a retreat was made to the carriages, and Barmouth was reached about six P.M. In passing through the gorge of Cwm Bychat to Trawsfynydd, a fine section is obtained of the lower Cambrian grits and slates, and the scenery is remarkably wild. Friday, June 13th.—The party returned home by Cambrian Railway, leaving Barmouth at 12 35 P.M., Shrewsbury being reached at 4 45 P.M.

ENTOMOLOGICAL RAMBLES IN THE MIDLANDS.

No. I.—BEWDLEY FOREST.

BY W. G. BLATCH.

In a former paper on "Midland Entomology" I tried to prove, amongst other things, that the oft-repeated statement about the Midland Counties not producing any but the commonest insects was a fallacy. I now propose to take my readers, mentally, to several of the best hunting grounds in the district, especially such as lie within easy reach of Birmingham, and to point out some of the more interesting insects, from a collector's point of view, to be obtained from them.

Foremost amongst these is undoubtedly Bewdley Forest, and we have accordingly chosen that for our first Ramble.

Some "forests" to which I have been introduced are hard to find, and harder to see when you have found them, almost every distinctive feature having been long since swept away by the march of civilization; but this does not apply in the present case, the forest for which we are now bound being perfectly genuine.

Wyre Forest (its right name) is several miles in extent, and is situated between Bewdley, Cleobury Mortimer, and Arley, at the junction of the three counties of Salop, Stafford, and Worcester. Its distance from Birmingham is 22½ miles, and the railway journey occupies (by certain trains) about an hour. There are several ways of entering the forest, those most generally used being the Arley and Bewdley routes. The first is preferred by many Botanists and Entomologists, but the latter is perhaps the best, all things considered; we will therefore follow it on this occasion. Upon leaving the station we make for the fine bridge over the Severn, connecting Wribbenhall with Bewdley, and, having crossed it, turn down the steps on the right and go up the river-side as far as the quaint little church at Dowles. We then cross a bridge, turn sharp to the left, and, by ascending Dowles Brook, soon find ourselves surrounded by dense woods, and busily engaged in our entomological pursuits.

But, in truth, before we had left the side of the river our attention had been arrested by the myriads of dragon-flies, stone-flies, and other insects which sport amongst the rank herbage margining the bank, and our nets had been busily occupied in securing specimens of the pretty little moths, *Emmelesia albulata* and *E. decolorata*, that flit about so softly and yet so merrily amongst the grass, strongly contrasting with the imposing colours, and fussy, whirring flight of the Burnet moths, *Zygæna filipendulæ*, and *Z. trifolii*, which accompany them. The sweeping-net of the Coleopterist has also been vigorously plied whilst walking along, and yielded upon examination quite a host of nice beetles, far "too numerous to mention." Amongst those "bottled" the Phytophaga preponderate, and include *Lema puncticollis*, *Crepidodera rufipes*, *Podagrica fuscipes*, *Psylliodes chrysocephala*, *Apteropeda graminis*, and *Coccidula rufa*. The Sternoxi were represented by *Lacon murinus*, *Cryptohypnus quadripustulatus*, *Limonius cylindrus*, *L. minutus*, *Athoüs hæmorrhoidalis*, *A. longicollis*, *Corymbites pectinicornis*, *C. cupreus*, *C. tesselatus*, *C. quercus*, and *C. holosericeus; Dasytes plumbeo-niger*, *Œdemera lurida*, *Hedobia imperialis*, and the curious *Notoxus monocerus* are also amongst our captures. Before leaving this spot, being reminded of the beetle-hunter's maxim, "Leave not a stone unturned," we carefully overhaul the stones and rubbish lying beside the river, and are rewarded by finding some good beetles, including *Clivina fossor*, *C. collaris*, *Chlaenius vestitus*, *Stomis pumicatus*, *Trechus discus*, and several species of *Bembidium*. We also find under stones close to and in the water *Orectochilus villosus*, and on the sand and mud *Cryptohypnus riparius*, *C. pulchellus*, *Potamnius substriatus*, and *Parnus prolifericornis*.

By beating the sallows at the mouth of the brook we obtain specimens of *Cryptorhynchus lapathi*, which fall into the umbrella apparently lifeless, and look like dry bird-droppings. We know these actors of old, or we might throw them away, not imagining them to be living beings. From the same trees we obtain those insect gems *Crepidodera nitidula*, *C. helxines*, *C. aurata*, and *C. chloris*, as well as (from alder) *Campylus linearis*. By the side of the brook, on the fig-worts, *Scrophularia aquatica* and *C. nodosa*, we find the pretty tesselated beetles *Cionus scrophulariæ*, *C. hortulanus*, *C. blattariæ*, and *C. pulchellus*, whilst, on the rising ground on the right, by sweeping amongst wood-sage, we obtain the compact little *Gonioctena litura*, which, when captured for the first time, is almost always mistaken for a species of *Cryptocephalus*. A few steps further, on the railway bank, real *Cryptocephali* may be found, viz.:—*C. aureolus* and *C. moræi*, the latter, a pretty shining black insect with orange spots, on *Hypericum perfoliatum*, sometimes in numbers. On the same plant, and in the same place, we take *Chrysomela varians* and *C. hyperici*. By beating the broom, growing so luxuriantly all around us, we find the larvæ of *Pseudopterpna cytisaria* and *Chesias spartiata*, as well as the uncommon (at least in our district) *Apion fuscirostre*. Having left the railway we descend towards the brook again, plucking a handful of moss from the bank as we go. From this we shake out on to a sheet of paper carried for the purpose the curious, almost spider-like weevil, *Orobitis cyaneus*, and the tiny seed-like *Mniophila muscorum*, besides some Pselaphidæ, including *Bryaxis juncorum*, *Pselaphus Heisei*, *Scydmænus*

Godarti and *Cephennium thoracicum*. Stopping to examine some fine plants of the rather rare *Helleborus viridis*, we notice, close by, a dead hedgehog, strongly appealing to our sense of smell, and not in vain, for, knowing that what is so offensive to us is considered a rich treat by certain members of our favourite order of insects, we carefully and expectantly turn it over and examine it, being rewarded for our pains (literal meaning, if you please!) by several fine beetles. Amongst them are two or three species of *Choleva*, the Burying Beetles *Necrophorus humator*, *N. mortuorum*, and *N. vespillo; Silpha littoralis*, *S. thoracica*, and *S. sinuata*, also come forth in plenty; whilst Histers positively abound, and *Nitidula bipustulata*, *Omosita colon*, and *O. discoidea*, swarm upon the remains of poor "spiny." Of course there are also a good many "Staphs"—*Aleochara*, &c., but nothing to be specifically noted.

In rising from our unsavoury, but, withal, profitable beetle-trap, our attention is riveted on a handsome caterpillar feeding on the hawthorn above us, and which we recognise as the larva of *Trichiura cratægi* (one of the Bombycidæ,) which, if we take it home and carefully feed it, will become a moth in August or September, proving an acquisition to our cabinet.

We are now fairly in the forest, and find so much to claim our attention that it is at first somewhat bewildering. A little too early for the Silver-washed Fritillary, *Argynnis paphia*, the dark variety of which, *valezina*, also occurs here; and the Purple Hair-streak, *Thecla quercus*, (of which two or three laggard larvæ, which ought to have completed their feeding and changed to pupæ before this, have fallen to the beating stick,) we are gladdened with the sight of scores of "Pearl borders," *Argynnis euphrosyne* and *A. selene*, flitting about all around us, the former somewhat worn and showing signs of living beyond its time. Ah! what have we now? Not a Black-veined White, certainly, visions of which have more than once crossed our minds, and which is reported to have been formerly found here; nor a Camberwell Beauty, a butterfly assuredly netted here, once at any rate, not many years ago; but, fluttering in our net, we have a very interesting butterfly, nevertheless, viz., the "Greasy Fritillary," *Melitæa artemis*. This is soon boxed, and the net again in requisition. This time we have taken two curious day-flying moths, "Mother Shipton" and "Mother Shipton's Likeness," *Euclidia mi* and *E. glyphica*, the former having a droll caricature figure of a human face on each fore-wing. Here also is *Phytometra ænea*, likewise a lover of sunshine; and, flitting about in the shady parts of the walks, the prettily speckled Geometer, *Venilia maculata*. Sitting on the flowers in the hot sunshine, busily sipping their sweets, are several specimens of the small Angle-shades moth, *Euplexia lucipara*, and in yonder shady opening in the wood, moving with ghost-like flight, is the Wood-white butterfly, *Leucophasia sinapis*. Having boxed as many as required of the former, and netted the latter while at rest on a "lady's smock," we pass towards a number of large purplish flowers, descried growing just within the margin of the wood, and which prove to be those of two species of

Geranium, *G. sanguineum*, and *G. sylvaticum.* Whilst moving towards these, we notice a large and strikingly beautiful moth sitting on an oak leaf, and of course stop to examine it. It is one new to us, and we feel all the thrilling pleasure of a "first find." We gloat over it—the delicately outlined markings, and the silvery, pearly-gray gloss on the wings are inexpressibly exquisite, and a fine crest on the thorax, gently stirred by a passing zephyr, seems to be waved at the will of the insect. It is so lovely, and spreads all its riches of beauty so unsuspectingly before us, that we shrink from the idea of laying violent hands upon it. But the moth is the Silvery Arches, *Aplecta tincta*, and our cabinet hitherto knows not the species! Acquisitiveness overcomes sentiment, and in a moment the rarity is ours! In capturing it (of course you must understand that "perfect coolness" steadied our hands!) we rustle the tree, and out fly two other prizes, by name *Limacodes testudo* and *Lithosia mesomella*, which soon share a similar fate.

Now for the Geranium flowers, in which we find, quite in the centre of the blossoms, a chubby, rugose, intensely black-backed, white-bellied little weevil, which feigns death and falls to the ground at your slightest touch of the plant on which it is resting. This is a good catch, and rejoices in the name of *Coeliodes geranii.* We take plenty "for selves and friends," but scarcely seem to diminish their numbers. Two, male and female, in one flower, are common, and often three--generally one male and two females—occur in a single bloom. They eat the petals of the flower, and seem to like such fairy-food, as indeed they ought. But, tempting as these little beauties are, we must move on, seeking "fresh fields and pastures new." Lo! here, "where the bee sucks," is fine sport. In front of us is a grand specimen of the Guelder rose in full bloom, and swarming with insects. Where shall we begin, and what shall we take first? Beetles first, decidedly, and Longhorns before everything, and so we attack accordingly. *Clytus arietis*, *Rhagium inquisitor*, *R. bifasciatum*, *Toxotus meridianus*, *Pachyta collaris*, *P. octomaculata*, *Strangalia quadrifasciata*, *S. armata*, *Leptura livida*, and *Grammoptera ruficornis*—all are here, and all are captured. Some of them so covered with pollen-dust that it is hard, at first sight, to tell what they are. This is particularly the case with *Pachyta collaris*, which, instead of his usual genteel blue-black coat and red waistcoat, looks as if he had been made tipsy and then rolled in a baker's trough, "for a lark." We are glad to have him, though, and feel already more than satisfied with our success. There is, however, more work yet to be done before retracing our steps. But first let us think of responding to an increasingly powerful appeal from the "inner man," and, with that view, make bold to enter the house at Cooper's Mill, placed hereabouts as if on purpose to meet our gastronomic requirements. Mrs. Weaver, always kind and obliging, provides a bountiful supply of ham and eggs, and brews some excellent tea, upon which, with plenty of her own home-made bread, we regale ourselves with the relish inspired by good fare and keen appetites.

[TO BE CONTINUED.]

NOTTINGHAMSHIRE LAND & FRESHWATER SHELLS.

BY E. J. LOWE, F.R.S., ETC., AND C. T. MUSSON.

The following list of the Nottinghamshire Mollusca may be of use to some readers of the "Midland Naturalist." It is corrected to the present time, June, 1879.

AQUATIC.

CLASS I. CONCHIFERA OR BIVALVES.

FAMILY I., SPHÆRIIDÆ.

GENUS I., SPHÆRIUM.

Sphærium corneum, very common.
var. Pisidioides, Canal at Beeston.
var. flavescens, at Beeston.
var. nucleus, at Beeston.
rivicola, common in the Trent and the Canals.
ovale, rare, Canal at Beeston (B. S. Dodd.)
lacustre, Ponds at Beeston and Barton.
var., brochoniana, Clumber Lake and Attenborough.

GENUS II., PISIDIUM.

Pisidium amnicum, common in the Canals and River Trent, at Beeston.
fontinale, ditch at Barton.
var. pulchella, dyke at Beeston and Stanton-on-the-Wolds.
var. cinerea, Beeston and Lenton.
pusillum, Canal at Nottingham and elsewhere.
var. obtusalis, rare at Beeston.
nitidum, Beeston and Nottingham Meadows, not common.
roseum, rare at Sawley.

FAMILY II., UNIONIDÆ.

GENUS I., UNIO.

Unio tumidus, common in the Trent and the Canals.
var. radiata, not uncommon in the Canals.
var. ovalis, common.
pictorum, common in the Trent and the Canals.
var. radiata, Highfield House Lake.
var. curvirostris, ,, ,, ,,

GENUS II., ANODONTA.

Anodonta cygnea, common.
var. rostrata, Canal, Beeston.
var. radiata, Canal, Wollaton.
anatina, Canal, Wollaton, and several varieties.

FAMILY III., DREISSENIDÆ.

GENUS DREISSENA.

Dreissena polymorpha, common.

CLASS II. GASTEROPODA OR UNIVALVES.

ORDER I., PECTINIBRANCHIATA.

FAMILY I., NERITIDÆ.

GENUS NERITINA.

Neritina fluviatilis, common on submerged stones.

FAMILY II., PALUDINIDÆ.

GENUS I., PALUDINA.

Paludina vivipara, common.

GENUS II., BYTHINIA.

Bythinia tentaculata, very common.
var. decollata, Lenton and Attenborough.
Leachii, rare, ditch, Nottingham Meadows.

FAMILY III., VALVATIDÆ.

GENUS VALVATA.

Valvata piscinalis, common.
var. depressa, common.
cristata, ditches at Bulwell, Attenborough, and Nottingham, very plentiful.

ORDER II., PULMONOBRANCHIATA.

FAMILY LIMNÆIDÆ.

GENUS I., PLANORBIS.

Planorbis lineatus, brook at Oxton Bogs, and Highfield House Lake.
nitidus, rare, in Canal at Lenton and Nottingham, and Highfield House Lake.
nautileus, plentiful in ditch at Bulwell, and lake at Highfield House.
albus, rare, Bulwell and Lenton, and Canal at Nottingham.
glaber, Beeston and Mapperley, in ponds.
spirorbis, common.
vortex, ,,
var. compressa, Stanton-on-the-Wolds.
carinatus, common
complanatus, ,,
corneus, ,,
contortus, very plentiful at Bulwell, Colwick, and Canal at Nottingham.

GENUS II., PHYSA.

Physa hypnorum, plentiful at Beeston in ditches and ponds.
fontinalis, common.
var. curta, Beeston Meadows.
var. inflata, Lenton.

GENUS III., LIMNÆA.

Limnæa glutinosa, rare, Beeston Lock, in backwater of Trent.
peregra, very common.
var. ovata, very common.
var. oblonga, common.
var. acuminata, ,,
var. decollata, not uncommon.
auricularia, Canal at Nottingham and Wollaton.
var. acuta, lake at Highfield House.
stagnalis, common.
var. fragilis, common.
palustris, very common.
var. tincta, Beeston and Lenton.
var. corvus, Sawley.
var. decollata, not uncommon.
truncatula, plentiful in Trent at Beeston, ditch near Mansfield, also at Edwinstone and Lenton.
var. elegans, Beeston.

GENUS IV., ANCYLUS.

Ancylus fluviatilis, common on submerged stones.
var. albida, plentiful in a stream at Bulwell.
var. capuloides, Tottle Brook.
lacustris, Beeston and Radford.

TERRESTRIAL.

FAMILY I., LIMACIDÆ.

GENUS I., ARION.

Arion ater, common.
hortensis, „
flavus „
unnamed species, Highfield House.

GENUS III., LIMAX.

Limax flavus, Lenton and Nottingham.
agrestis, common.
arborum, trees at Wilford and Welbeck, &c.
maximus, Welbeck, &c.
lævis, Highfield House.
marginatus, Highfield House.

FAMILY II., TESTACELLIDÆ.

GENUS, TESTACELLA.

Testacella Haliotidea, Welbeck Gardens, (R. A. Rolfe.)

FAMILY III., HELICIDÆ.

GENUS I., SUCCINEA.

Succinea putris, common, and several varieties.
virescens, Sawley, Thrumpton, and Lenton.
elegans, not uncommon.

GENUS II., VITRINA.

Vitrina pellucida, common.

GENUS III., ZONITES.

Zonites cellarius, common.
alliarius, „
nitidulus, „
purus, Wollaton, Pleasley, and Creswell Crags, not uncommon.
radiatulus, common.
nitidus, „
excavatus, rare, at Attenborough.
crystallinus, common.
fulvus, plentiful at Wollaton, Stanton-on-the-Wolds, &c.
glaber, Highfield House, Sawley, Wollaton, &c.

GENUS IV., HELIX.

Helix aculeata, not uncommon at Thrumpton, Wollaton, and Stanton-on-the-Wolds.
aspersa, common.
nemoralis, common,
var. hortensis, plentiful on a roadside at Stanton-on-the-Wolds, and at Bulwell, rare.
var. hybrida, plentiful in a lane at Basford and Wollaton.
var. minor, Thrumpton.
arbustorum, Hazelford and Thrumpton.
concinna, common.
hispida, „
var. albida, not uncommon.
rufescens, rare.
sericea, rare, Clifton and Highfield House.
revelata, Stanton-on-the-Wolds.
fusca, rare, Highfield House.
virgata, (1 sp.,) Lenton Hall.
caperata, Creswell Crags, plentiful, also Ruddington, and Stanton-on-the-Wolds.

Helix ericetorum, Stanton-on-the-Wolds.
  var. alba, ,,
 rotundata, very common.
  var. turtoni, Highfield House.
 pygmæa, not uncommon, at Wollaton and elsewhere.
 rupestris, not uncommon.
 pulchella, not uncommon.
  var. costata, not uncommon.
 lapicida, one live specimen and fifteen dead ones at Creswell Crags; also at Pleasley Vale, under stones and leaves, on magnesian limestone district.

GENUS V., BULIMUS.

Bulimus obscurus, not uncommon at Stanton-on-the-Wolds, Colwick, Creswell Crags, and Pleasley Vale.

GENUS VI., PUPA.

Pupa umbilicata, very plentiful at Sutton-in-Ashfield and Creswell Crags; also at Chilwell.
  var. edentula, Highfield House.
 secale, Nottingham Castle.
 ringens, rare, Highfield House.
 marginata, rare, Highfield House.

GENUS VII., VERTIGO.

Vertigo pygmæa, rare, Widmerpool and Pleasley Vale.
 substriata, rare, Highfield House.
 edentula, plentiful at Widmerpool, and rare at Wollaton.
 antivertigo, Highfield House.
 pusilla, Highfield House.

GENUS VIII., BALIA.

Balia perversa, rare, Colwick (B. S. Dodd.) and Highfield House.

GENUS IX., CLAUSILIA.

Clausilia rugosa, very common.
 laminata, one dead specimen at Pleasley Vale.

GENUS X., COCHLICOPA.

Cochlicopa tridens, five dead specimens at Pleasley Vale; also recorded at Highfield House, Beeston.
 lubrica, very common.

GENUS XI., ACHATINA.

Achatina acicula, one dead specimen at Attenborough; also recorded at Radcliffe, (Rev. J. Peach,) Highfield House, and Tollerton.

FAMILY IV., CARYCHIIDÆ.

GENUS CARYCHIUM.

Carychium minimum, very common.

It will be seen from the above list that the total number of species is ninety-nine.

[We commend the above list to the notice of working Naturalists, and shall be glad to receive any additions to it, or fresh localities for the rare species from other workers in the county. We should be glad, too, to publish similar lists of the shells of other counties. The best work by far on the subject is Dr. Gwyn Jeffrey's British Conchology, Vol. I., (sold separately,) Land and Freshwater Shells, Van Voorst, 10s. In this work 121 species are described as inhabiting the British Isles, so that the county of Nottingham appears to be well represented by the ninety-nine species above recorded.—Eds. M.N.]

EXAMINATION OF DRIFT.

RAILWAY CUTTING, NEAR WALSALL.

BY G. H. TWIGG.

On June 14th, 1879, some members of the Birmingham Natural History Society, on the suggestion of Dr. Deane, visited the above locality, and subsequently I have examined it upon two other occasions. The railway is intended for a loop line to connect the South Staffordshire Railway with the Grand Junction Line, and starts from a point near the level crossing over the former, about one mile south of Walsall Station, and proceeds in a south-westerly direction, joining the latter line near James Bridge Station, the total length not exceeding one mile. The cutting commences before reaching the main road from Walsall to Wednesbury, and it is in the section lying to the east of this road that the principal boulders have at present been found; those which I have personally examined occurred in a deposit of fine soft clay varying in colour from red to grey, and mixed up with beds of gravel. They are as follows:—

Fine-grained Basalt boulder	18″ × 16″ × 16″
,, ,, ...	14″ diameter.
Decomposed ,, ,, ...	20″ ,,
,, ,, ,, ...	24″ ,,
Partly decomposed ,, ,, with geodic cavities (similar to Toadstone)	12″ ,,
,, ,, ,, but smaller cavities	28″ × 15″ × 15″
Carboniferous Sandstone boulder	30″ × 30″ × 15″
Red ,, ,, ...	12″ diameter.
,, ,, ,, ...	8″ ,,
Carboniferous Sandstone (with plant remains)	14″ ,,
,, ,, ,, ...	12″ ,,

The two boulders with geodic cavities appear to have one of their constituent minerals decomposed, the cavities now being filled with a pink mineral in which radiating marks are discernible; in the larger boulder this decomposition does not seem to have gone so far, for there are found on the face of a newly-fractured surface what appear to be green crystals, one point only of which is yet tinged with pink; but whether these are crystals of Augite or Olivine, or some other mineral, I have not been able to determine.

The cutting in this direction has not yet reached the turnpike road, but some hundred and fifty yards on the west side of the road other operations have been going on, and the cutting there exposes a deposit of quite a different character, the clay giving place to gravel, to which succeeds a considerable thickness of sharp white sand. Through this sand the cutting is not yet complete; but a little further on, at a point opposite to Bescot Hall, another cutting is being made, in which the deposit is distinctly stratified and has a dip of 8° north, the strike running in the same direction as the cutting, and along the banks the beds can be traced parallel and horizontal for some distance. The dip is shewn very distinctly on the face at which the men are at work, and when last visited the beds occurred in the following order:—

Top soil and gravel..	9 feet.
Red sand, with thin seams of drift coal	18 inches.
Band drift coal	1 "
Grey sand	6 "
Gravel ..	4 "
Coarse sand ..	6 "
Gravel, with drift coal	4 "
Sand	7 "
Band drift coal ..	2 "
Fine sand	4 "
Gravel, with drift coal in large pieces ..	18 "

The beds of sand in this section thin out into the beds of gravel towards the south, so that the latter beds are some inches thicker on the north side than on the south side of the cutting.

The whole locality abounds in pebbles of igneous rocks, but by far the most abundant are those of quartzite, and many of these are from 6in. to 8in. diameter. Striated pebbles have not yet been found, nor do the boulders examined appear to have any striations; the underlying formations are the coal measures, and coal crops out in the immediate neighbourhood. The nearest localities for basalt are Pouk Hill (one and a half miles due north), and Rowley Hill (five miles south); and for quartzite, the Lickey Hills (twelve miles south).

These cuttings cannot fail to give instructive information to anyone making a careful examination, and this should be done at once by whoever desires to do so, as the line is being rapidly proceeded with, and the sides are smoothed down and the boulders cleared away as the work goes on, so that the aspect of the deposit is rapidly changed. Anyone, therefore, who is interested in the subject, and has opportunity to visit the spot frequently, would be enabled to report upon it more completely and to greater advantage; and I commend this locality, as one well worth reporting upon, to those who may be examining the drift deposits of the district.

THE AUDIOMETER.

BY WRIGHT WILSON, F.L.S., HON. SURGEON TO THE BIRMINGHAM AND MIDLAND COUNTIES EAR AND THROAT INFIRMARY, ETC.

Recently I had the pleasure of introducing this instrument to the notice of the Birmingham and Midland Institute Scientific Society. It is the latest outcome of those wonderful inventions—the telephone and microphone. The apparatus was contrived by Professor Hughes in the course of experiments made by him in electric induction, as recently described by him to the Royal Society. It consists of a battery, a microphone, two primary coils, a secondary coil, and a telephone. The secondary coil is movable on a boxwood bar; at one end is fixed the large primary coil, which contains 100 metres of insulated wire; at the other end is the small primary coil, having only six metres of wire. The secondary or induction coil has 100 metres of wire. The horizontal bar on which it slides is graduated into 200 parts; this is the reading scale for hearing, and is divided into twenty centimetres, each of which is subdivided into ten, thus giving 200 units. The secondary coil depends entirely upon the current which is induced in it by the passage of a current through the primary coil, and is not in connection with the current from the battery. The telephone is in the circuit of the induced current, and has no other source of electricity. The microphone is nothing more than a small apparatus by means of which contact may be made or broken. For instance, a small electric bell, deprived of its bell, becomes a microphone in the sense in which it is applied to the audiometer.

The law from a knowledge of which this instrument was evolved is that a current passing through a wire will cause, within a certain distance, a current of an opposite character and direction in another wire placed near it. If a telephone is placed in the primary circuit, having a contact breaker or microphone in the same circuit, then every make or break sound will be heard in the telephone. Every time that contact is made or broken the secondary coil receives or loses an induced current, consequently the sounds produced by making and breaking contact are heard in the telephone, which is in the circuit made by the induced current. If, then, the secondary coil be steadily and slowly moved away from the large primary coil, the induced current becomes weaker and weaker, the sounds produced by the microphone or contact breaker become fainter and fainter, until the secondary coil arrives at a point called zero on the scale, where no sound can be heard at all. This is the place where the two primary coils exactly balance the secondary coil, which lies between them, and is also the average limit of hearing power in the healthy adult. Now, if the secondary coil be moved still further towards the lesser primary coil, the induced current begins to return, but is weaker than that which is induced by the larger primary coil.

By this instrument many morbid conditions, a knowledge of which is indispensable to a correct diagnosis, can be observed with an amount of certainty comparable to that derived from the use of a reliable thermometer in fevers. Throat deafness may now be diagnosed from deafness resulting from disease of the external ear, and the actual impairment ascertained. A chart may be kept of the daily progress of the case, and from it, in the course of time, valuable and reliable deductions will be made.

In examining patients with the audiometer many curious effects are noticeable. The power of hearing is found to differ in both ears in nearly all persons; it varies with the height of the barometer, with the amount of air in the lungs, with the temperature, and many other as yet ill understood causes. These causes will soon be classified, and then the future of deaf people will have a brighter look than it has ever had, and the treatment of their diseases must then assume a more definite position in the world of medical science. Besides the treatment of deafness this instrument is invaluable in all examinations of men's bodies for life insurance, the army, navy, telegraph service, railway servants, and others where good hearing as well as good sight is indispensable. By a slight modification the audiometer can be converted into an electro inductive balance, and becomes available for the analysis of metals; so delicate is it that it is said to have detected the 1,000th of a grain of silver in an alloy. Mr. W. R. Morris has exhibited this form of sonometer, as it ought to be called, to the society, when spurious coins were detected and the amount of waste due to wear and tear was shown upon the scale. It is difficult to say what uses this instrument will yet be put to, but it is clearly an exceedingly useful instrument for scientific research.

ON CARCHESIUM SPECTABILE.

BY H. E. FORREST.

Among the numerous, rare, and beautiful forms of animal life which were obtained from the Barnt Green Reservoir in such abundance last Autumn, by members of the Birmingham Natural History and Microscopical Society, was a species of Carchesium. I had the pleasure of spending several evenings with Mr. J. Levick in examining these rich gatherings, and both he and I noticed the wide difference between this and the common *Carchesium polypinum*, which also occurred in the same water. Since then I have received through Mr. Bolton a gathering of the same, made by Mr. Thompson, the secretary of the Microscopical Society of Liverpool. Mr. Bolton tells me he has also found it at the Hyde, near Stourbridge, and at the end of June, 1879, I found it again in the river Avon, at Evesham.

As *C. polypinum* was the only species of the genus with which I was acquainted, I thought, at first, that this was a new species; but as my knowledge of the literature of the subject was insufficient, I forwarded specimens to Mr. W. Saville Kent, of London, asking him if there was any described species which agreed with it. With great courtesy he sent me descriptions of no less than four species other than *C. polypinum*, and expressed his opinion that the one in question was *Carchesium spectabile*, an opinion which upon mature consideration I fully endorse. Mr. Kent writes that there is no good published figure, and that Ehrenberg's scanty and somewhat vague description seems to be all that is known of it. It is as follows: "Bodies conical-campanulate, dilated anteriorly; polypary two lines in height, forming an obliquely conical bush of considerable size."

This description is perfectly correct, but very meagre, and the following additional particulars will probably be found useful, as I feel sure that when once public attention has been called to it, it will prove to be quite a common species.

Carchesium spectabile grows in little tufts attached to weeds or roots in stagnant or slowly running water. The colonies are in the shape of a *solid* cone, while *C. polypinum* grows as a hollow cone. The bells are placed thickly together on the stalks, and when the cilia are in motion the rim is everted and dilated beyond the bell, but not so much as in *C. polypinum*. It is very sluggish in its habits, and its sensibility to irritation is so slight that in order to make it contract its pedicel it is necessary to tickle it with a bristle. This peculiarity may easily cause it to be mistaken for an Epistylis. It has a curious habit of investing itself all over with minute particles obtained from the surrounding water, and is often so entirely buried in this dirt as to be almost invisible. The cleanest specimens I have seen were those from the river Avon, but even they exhibited this tendency, though in a minor degree. Students of Infusoria are anxiously awaiting the issue of Mr. W. Saville Kent's work, in which this and the other known species will be well and amply figured.

Reviews.

A History of British Freshwater Fishes. By the Rev. W. HOUGHTON, M.A., F.L.S., Rector of Preston-on-the-Weald Moors, Wellington, Salop. In two handsome volumes, extra large 4to. Price (to subcribers only) £3 10s. Applications for copies should be made to the Author at the above address.

THIS work, being the production of an author in our own district, calls for special notice. Mr. Houghton is known to be an accomplished naturalist, and has already published several popular books on Natural History. The present volumes are of a more solid character. They contain a well-written description of every known British freshwater fish, illustrated by exquisitely coloured figures. Some of the *Salmonidæ* are figured for the first time. Each chapter is headed with a finely-engraved landscape, illustrating scenes dear to the angler. An introduction on the classification and structure of fishes is clearly written and copiously illustrated, the comparative anatomy of the several types being well displayed. The get-up of the work is really magnificent. It is at once the most complete monograph of this branch of natural history which has been published, and a most elegant ornament for the drawing-room table. The book is so good that we wish it were cheaper.

C. C.

Cardiff Naturalists' Society.—Report and Transactions for 1878.

THIS is the eleventh report of this large society, which includes 421 subscribing members. During the year fourteen lectures of a generally scientific nature were delivered, eight of which were given by local members, and the other six by professional scientists of high standing. The work of the sections of the society appears to depend (as in most of our local societies) upon a very few of the members. Mr. Franklin G. Evans furnishes an excellent detailed meteorological report; but the feature of the volume is the account by Messrs. T. H. Thomas and John Storrie, of the "Tridactyl Uniserial Ichnolites in the Trias, at Newton Nottage, near Porthcawl, Glamorganshire." This article, with its illustrations, may be considered as a continuation of the excellent series of detailed accounts of local geological features which have appeared in back volumes of the Cardiff Naturalists' Society, and which are chiefly due to the energy and love for thorough geological work of Mr. W. Adams, the founder of the society. The footprints described are five in number, and occur on a large slab of dolomitic conglomerate, *(Keuper,)* which has been removed to the Cardiff Museum. They are each about 9in. in length by 6in. in width, three-toed, and generally very similar to the footprints of *Brontozoum*, found so plentifully in the sandstones of Connecticut, also of triassic age. They also much resemble the tracks of the emu and cassowary of to-day. Such a discovery as this should lead dwellers in triassic districts to examine more closely the sandstone beds which are now so much neglected from the belief that they contain no organic remains.

W. J. H.

The Lichen-Flora of Great Britain, Ireland, and the Channel Islands. By the Rev. W. A. LEIGHTON, B.A., &c. Third edition. Shrewsbury: For the Author. 1879.

WE hail this book with pleasure as a valuable contribution to the Lichen literature of our country. It is now more than a quarter of a century since the Ray Society published a volume by the same author, "British Species of Angiocarpous Lichens," which was the first systematic attempt made to derive distinguishing specific characters from the spores, their form, size, and mode of septation. The present work being the result of the many years of subsequent close and careful application of the author to the study of Lichens may be accepted as the most complete, while it is the latest, British work on the subject. The branch of botany with which this deals is confessedly difficult, but the difficulty is much enhanced by the absence of useful handbooks like the present, and we look forward to a fresh impetus being given to the study in this country by its appearance. The Lichen-Flora of Great Britain, including the Channel Islands, comprises no less than 1,710 species, forms, and varieties. If we deduct from these the forms and varieties we have 1,133 species, which are distributed into 77 genera, and these again are arranged under 22 tribes, the whole forming four families, viz.: BYSSACEI, COLLEMACEI, MYRIANGIACEI, and LICHENACEI. Three of the larger genera, *Lecanora*, *Lecidea*, and *Verrucaria*, comprise no less than 677 species, considerably more than one-half the whole Flora, but, by a very easy method based on the character of the spores, these genera are sub-divided in such a manner as very much to facilitate their study. The classification adopted is mainly that of Dr. W. Nylander, with such modifications as the author considered necessary, and we are glad to find that there is no great departure from that with which we are already familiar. A diagnosis of every species, the material on which it grows, its synonyms, references to plates when they exist, geographical distribution, as well as the distribution in Britain, according to Mr. Hewett Watson's well-known method, a specification of the exact habitats, with the names of those gentlemen on whose authority it is recorded, are given. The chemical reaction used so extensively by all leading Lichenologists is given in cases where it is obtained to assist in the determination of species. Some botanists smile at the adoption of this method of testing, as being chemistry and not botany, but we see little chance of its being abandoned so long as it serves to help with the other characters of a plant in the distinguishing of species. Mr. Leighton has wisely devoted a little more space in the introduction than was given in former editions to explain the method of applying the chemical tests, about which there should exist no uncertainty in the mind of the student, as serious errors may result from their misapplication. Another valuable addition is the microscopic measurements of the spores, taken from Mudd's "British Lichens," the writings of Dr. Nylander and Thos. M. Fries, supplemented with the author's own measurement. Those from the first-mentioned of these authors are the least reliable, and should in all cases be carefully tested by those of Nylander, Fries, and Leighton, which may be safely depended upon. A few points of much interest are touched upon briefly in the introduction, such as the morphology and physiology of Lichens, and the Schwendenerian theory of their parasitism on fungi, which we should have been pleased to have seen greatly extended. A list of authors cited, and published Exsiccati quoted, are given at the end, with a full glossary of terms and a copious index of species.

W. P.

Robert Dick, Geologist and Botanist. By SAMUEL SMILES. London: J. Murray.

ON the last occasion when Mr. Smiles narrated the work of one of Scotland's humbler sons, to whom the name of working Naturalist could be fittingly applied—we refer to Thomas Edward—one could not but admire the manner in which the writer entered into his theme, and described with vivid clearness the struggles, successes, and disappointments which rendered the life of Edward so strikingly interesting. Consequently, it was with feelings of considerable expectation that we took up the life of Robert Dick, and after perusal we can cordially recommend it to the notice of such readers of the "Midland Naturalist" as have not already made themselves acquainted with it. The life of Dick may be briefly epitomised as follows: He was born among the lovely scenery of the Ochils in Scotland, at Tullibody, in 1811, his father being an officer of excise; his mother died when he was very young, and, as his father married again, the boy's home was rendered unpleasant to him by the unloving step-mother, who appeared to be jealous of any kindness paid to the children of the first marriage, so at the early age of thirteen Robert was apprenticed to a baker, and his life then was by no means of a romantic character; his work commenced at three in the morning, and he continued to drudge till seven, eight, and sometimes nine at night. The afternoons were his pleasant time, for then he had to deliver bread in the neighbouring villages, and it was on these walks that he began to take interest in Botany. At seventeen he left Tullibody to find work as a journeyman, and left it for the last time, as he was never able in his after life to spare money to visit it again. At the age of twenty he started for himself at Thurso, and here he remained all his life, at first succeeding well in trade, but eventually, through competition, scarcely making enough to supply himself with necessaries, but working hard till within a few days of his death.

The county of Caithness was at the time Dick went there a *terra incognita* to Naturalists; but, by his own unaided exertions, he made a complete collection of its flowers and ferns, his botanical reputation, however, resting mainly on his discovery of the *Hierochloe borealis*, or holy grass, a plant previously reported from Forfarshire by Don, but only on his own rather risky authority. Dick discovered this grass in several places on the River Thurso, growing on the boulder clay; besides this, he found *Osmunda regalis* and *Ajuga pyramidalis* in the county. Their discovery, although not reported till many years afterwards, brought a flood of correspondence upon the finder, and he distributed many specimens of the holy grass, of which the writer possesses one, which came through Mr. W. L. Notcutt—the gentleman whose list of Daventry plants in Northants is used by Watson in "Topographical Botany." Dick also gave Mr. Notcutt a splendid series of old red sandstone fossils; for Geology was taken up with ardent and unflagging interest by the Thurso baker, and it was principally by his aid that the geology of Caithness was made out; his discovery of shells in the boulder clay, and his supplying fossils of Diplopterus, Osteolepis, and Asterolepis to Hugh Miller laid science under great obligations to him.

Indeed, there was hardly a subject upon which Miller applied to him for information on which Dick did not give him invaluable aid. Agassiz and Sir Roderick Murchison testified to his claims on science, the latter again and again doing him homage. Among his most intimate friends was Charles Peach, born at Wansford, in Northamptonshire, and like himself an untiring labourer among the records of the rocks. Peach found fossil fishes in Cornwall, but eventually removed to Peterhead, where he added to the list of British fishes Yarrell's blenny, Ray's bream, and the anchovy, and then (he was in the Preventive service) came to Wick, when he and the baker became great friends. Dick pursued his researches with the greatest zeal, the principal part of his geological and botanical work being done between ten at night and eight in the morning, walking, as he says, sometimes fifty miles without sitting down, and with only a few biscuits to eat; and this not as an occasional thing, but repeatedly in order to visit a fern or search for traces of the boulder clay, or hammer out some fish from the rocky cliffs of Dunnet Head.

On laying down the book one cannot help regretting that with all the wealth of England a man like this could not have been provided with something to render the latter end of his life more comfortable.

The book is illustrated with some capital views, though the one of Wansford is not very good, and that of Morven exaggerates its height and steepness.

G. C. D.

METEOROLOGY OF THE MIDLANDS.

THE WEATHER OF JUNE, 1879.

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

June witnessed no improvement in the weather of this (atmospherically speaking) most disagreeable year. There were never two consecutive days without rain, which indeed fell on twenty-five days out of the thirty. Thunderstorms were frequent, and those of the 3rd, 8th, 9th, 12th, 24th, 25th, and 29th were general and severe; on the 11th there fell at Bishop's Castle 1·10 inches in twenty-five minutes! Temperature was greatly below the average, and there was little sunshine; Mr. Davis, of Orleton, writes :—" The mean temperature here of June is $3\frac{1}{2}°$ lower than the average; the rainfall has only once been exceeded (viz., in June, 1860) during the last forty-nine years. Up to the 1st of July this year the maximum of thermometer in shade has never reached 70°, this has not occurred for the last fifty-four years."

The barometer did not fluctuate much, but ranged somewhat low; light south-westerly winds prevailed, which gained, however, in intensity during the last week of the month. " Owing to the soaked and chilled condition of the soil, all garden crops, grass crops, and cereals have advanced nothing on the condition noticed last month, and are all a full month later than usual."—Rev. U. Smith, *Stoney Middleton.*

THE WEATHER OF JUNE, 1879.

STATION.	OBSERVER.	RAINFALL.				TEMPERATURE.			
		Total for M. In.	Greatest fall in 24 hours. In.	Greatest fall in 24 hours. Date.	No. of rainy d.	Greatest ht. Deg	Greatest ht. Date.	Great'st cold Deg	Great'st cold Date.
GLOUCESTERSHIRE.									
Gainscross, Stroud	W. B. Baker, Esq.	6·30	1·10	30	21	84·0	24 & 25	32·0	4
Cheltenham	R. Tyrer, Esq.	4·34	·82	30	26	68·8	13	35·2	4
Stroud	S. J. Coley, Esq.	4·28	·67	8	26	72·0	15	33·0	2
SHROPSHIRE.									
Haughton Hall, Shifnal	Rev. J. Brooke	5·21	·99	11	25	69·0	14, 17, 20	37·0	2, 4, & 5
Woolstaston	Rev. E. D. Carr	6·13	1·07	7	26	69·0	17 & 19	39·0	2
More Rectory, Bishop's Castle	Rev. A. Male	6·47	1·35	11	25	72·0	18	37·0	5
Larden Hall, Much Wenlock	Miss F. R. Boughton	5·28			20				
Bishop's Castle	E. Griffiths, Esq.	6·14	1·43	11	22	69·0	5	37·0	5
Cardington	Rev. Wm. Elliott	6·03	1·08	7	25				
Stokesay	Rev. J. D. La Touche	6·71	1·15	7	26	68·0	5	32·6	5
HEREFORDSHIRE.									
Whitfield	W. Wheatley, Esq.	7·84	1·00	12	25			28·0	2
Stoke Bliss	Rev. G. E. Alexander	5·92	·72	30	25	75·0	10	39·0	1
WORCESTERSHIRE.									
Orleton, Tenbury	T. H. Davis, Esq.	6·03	·98	30	26	69·8	20	35·0	5
West Malvern	A. H. Hartland, Esq.	5·22	·82	16	24	70·5	20	36·5	1
Pedmore	E. B. Marten, Esq.	4·91	·60	30	27	81·0	16	41·0	3
Longlands, Stourbridge	J. Jeffries Esq.	4·74	·58	30	23	76·0	20 & 23	36·0	3
Dennis, Stourbridge	Mr. C. Webb	4·61	·62	16	25	69·5	5	36·0	4
STAFFORDSHIRE.									
Thorganby Villa, Wolverhmtn	G. J. C. Broom, Esq.	4·28	·65	7	28				
Dudley	Mr. J. Fisher	4·43	·61	7	23	82·0	10	38·0	1 & 3
Sedgley	Mr. C. Beale	4·20	·63	7	25	68·0	20	41·0	1 & 3
Kinver	Rev. W. H. Bolton	4·19	·69	7	23	74·0	14	37·0	4
Walsall	Mr. N. E. Best	5·21	·66	7	26	71·0	5	40·0	1
Grammar School, Burton	C. U. Tripp, Esq.	3·96	1·25	7	25	74·0	14	35·0	5
Weston-under-Lyziard R'tory	Hon. and Rev. J. Bridgeman	4·73	·71	7	27	77·0	20	36·0	5
Wrottesley	E. Simpson, Esq.	4·30	·69	7	24	70·5	21 & 17	39·0	4
Heath House, Cheadle	J. C. Philips, Esq.	6·25	1·25	7	24	65·9	5 & 14	39·0	4 & 5
Alstonfield Vicarage	Rev. W. H. Purchas	7·89	1·14	30	23	70·0	17	31·0	5
WARWICKSHIRE.									
Coundon, Coventry	Lieut.-Col. R. Caldicott	5·82	·83	7	25	71·0	28	43·0	1, 3, & 4
Coventry	J. Gulson, Esq.	5·16	·92	7	24	71·0	28	38·0	2
Bickenhill Vicarage	J. Ward, Esq.	5·25	·78	30	26	68·0		47·0	
St. Mary's College	Rev. S. J Whitty	4·65	·74	7	24	67·9	20	39·1	2
Henley-in-Arden	T. H. G. Newton, Esq.	5·15	·72	30	26	70·0	5 & 15	37·0	2 & 5
Rugby School	Rev. T. N. Hutchinson	4·48	·81	7	24	69·0	14	39·4	5
DERBYSHIRE.									
Stoney Middleton	Rev. U. Smith	4·40	·81	11	20	66·0	17	25·0	4
Fernslope, Belper	J. G. Jackson, Esq.	6·05	·97	7	25	70·0	14, 19 & 20	37·0	5
Brampton S. Thomas	Rev. J. M. Mello	5·53	1·24	7	19	68·0	20 & 28	33·0	5
Willersley Gardens	Jas. Tissington, Esq.	7·98	1·12	11	19				
Spondon	J. T. Barber, Esq.	5·25	1·26	11	22	65·3		35·0	2
Duffield	W. Bland, Esq.	6·42	·96	7	24				
NOTTINGHAMSHIRE.									
Hesley Hall	B. J. Whitaker, Esq.	3·89	·93	8	21	74·0	20	38·0	5
Tuxford	J. N. Dufty, Esq.	4·43	·81	7		81·0	24	41·0	3 & 4
Hodsock Priory, Worksop	H. Mellish, Esq.	3·12	·80	7	20	68·9	20	34·0	5
Highfield House, Nottingham	E. J. Lowe, Esq.	4·53	·74	7 & 8	25	72·2	17	37·3	5
Park Hill, Nottingham	H. F. Johnson, Esq.	4·97	·80	7	21	69·0	14	42·8	1
LEICESTERSHIRE.									
Loughborough	W. Berridge, Esq.	4·32	·88	7	22	70·7	14	35·1	5
Ashby Magna	Rev. E. Willes	4·78	·94	30	25	74·0	14	37·0	2 & 5
Market Harborough	S. W. Cox, Esq.	4·23	·63	7	23	66·0	28	33·0	5
Kibworth	T Macaulay, Esq.	5·22	·84	7	25				
Town Museum, Leicester	W. J. Harrison, Esq.	4·34	·79	7 & 30	24	68·3	28	39·5	2 & 5
Belmont Villas, Leicester	H. Billson, Esq.	4·41	·62	30	26	71·5	5	29·5	1
Syston	J. Hames, jun., Esq.	4·06	·61	7	26	75·0	11	32·2	2
Waltham-le-Wold	E. Ball, Esq.	4·01	·68	7	23	69·0	10	38·0	3
Little Dalby Hall	G. Jones, Esq.	4·00	·64	7	22	79·0	28	33·0	5
Foxton Locks	Union Canal Company								
Coston Rectory, Melton	Rev. A. M. Rendell	4·19	·80	7	21	68·5	28	30·8	5
Belvoir Castle	W. Ingram	3·65	·75	8	25	71·0	21	33·0	5
NORTHAMPTONSHIRE.									
Towcester Brewery	J. Webb, Esq.	5·47	1·38	7	24				
Castle Ashby	R. G. Scriven, Esq.	4·74	·72	26	23	72·0	14	41·0	3 & 4
Kettering	J. Wallis, Esq.	3·77	·63	7	21	70·0	15, 20 & 21	41·0	4
Althorpe	G. S. Groom, Esq.	4·16	·99	7	24	70·0	14	36·0	1 & 4
Pitsford	C. A. Markham, Esq.	4·36	·93	7	25	75·0	5 & 14	36·0	2
RUTLAND.									
Burley-on-the-Hill	W. Temple, Esq.								
West Deyne, Uppingham	Rev. G. H. Mullins	4·39	·81	2	23	70·1	5	38·8	2
Northfields, Stamford	W. Hayes, Esq.	3·75	·74	7	19	74·0	7	34·0	5
Radcliffe Observatory, Oxford	H. E. Bellamy, Esq.	4·54	·50	30	28	68·1	28	40·4	2
Ventnor Hospital	W. T. Ryder, Esq.	4·34	·77	2	6	64·2	17 & 27	45·0	4 & 5
Altarnun Vicarage	Rev. G. Tripp	7·51	1·11	16	28	77·0	16	32·0	4

NATURAL HISTORY NOTES BY OBSERVERS.—*Highfield House Observatory, Nottingham.*—The following plants came into flower—1st, Azalea pontica; 2nd, Chestnut; 4th, Crowfoot; 5th, double White Narcissus; 11th, Rhododendrons, Lilac, Laburnum, and double White-thorn; 12th, Hawthorn; 21st, Snowball Tree; 26th, *Silene nutans* and Syringa. *Alstonfield Vicarage.*—Vegetation backward to a degree unknown to persons now living. *Veronica Chamædrys* only began to flower June 2nd. The Ash tree is scarcely in full leaf June 30th. The fruit of the Wych Elm only just now falling, June 30th. Hawthorn not fairly in flower until 26th. A flight of the Painted Lady Butterfly began to appear on the 12th, some of the specimens seemed hybernated. *Cheltenham.*—First Strawberry picked 29th, Currants just ripening 30th. *Kibworth.*—Hawthorn, fl. 8th. *Shifnal.*—Farmers on strong soils could not get in their swedes or cut their hay till the close. No butterflies except a few White and Orange Tip. Ash only bursting into leaf on 5th. Apples, of which there was a great show, all falling off. Not a rose in blossom except on the wall. *Bishop's Castle.*—No harvest commenced yet (July 4th), and grass beginning to rot at the roots. *Chesterfield.*—Hawthorn, fl. second week in month. *Burton-on-Trent.*—First Hawthorn, fl. on 5th, in general bloom on 12th; Horse Chestnut, fl. 6th; *Geranium molle*, fl. 7th; Guelder Rose, fl. 30th. *Stroud.*—*Veronica arvensis*, fl. 5th; Hawthorn, 8th; *Papaver Rhœas*, *Iris Pseudacorus*, *Aquilegia vulgaris*, *Scrophularia nodosa*, *Bunium flexuosum*, *Thymus Serpyllum*, *Potentilla nemoralis*, *Vicia sativa*, *Onobrychis sativa*, *Arabis hirsuta*, *Linum catharticum*, *Anthyllis vulneraria*, *Lotus corniculatus*, fl. 19th; *Rosa canina*, fl. 21st; *Lychnis dioica*, *L. flos-cuculi*, *Fumaria officinalis*, fl 23rd; *Lathyrus pratensis*, *Hippocrepis comosa*, fl, 26th; *Atropa Belladonna*, *Sambucus nigra*, fl. 30th.

Correspondence.

VANESSA CARDUI is this season much more numerous than usual. A good many have already been caught. It is generally rather uncommon just here.—O. V. APLIN, Bodicote, Oxon, July 3rd, 1879.

ACRONYCTA ALNI, NEAR NOTTINGHAM (from the *Entomologist.*)—The larva of the rare *Acronycta alni*, which Mr. Watchorn found at Cotgrave, in August last, came out on Tuesday, June 3rd, a perfect imago, and was exhibited at this Society's Room on Monday, June 9th.—J. BROOKS, Hon. Sec. Nottingham Working Men's Naturalists' Society.

THE BEE-EATER IN DERBYSHIRE.—The note at page 188 of the occurrence of the Bee-eater in this county is very interesting. But if the writer would kindly tell us the precise locality of the specimen, whether male or female, whether any others were killed or seen, whether it bore any marks of captivity, by whom it was killed, and its destination, and any other particulars he may be able to give, the value of the note to future writers on the Ornithology of the county would be immensely increased.—MERLIN, Derby, 17th July, 1879.

ORNITHOLOGICAL NOTES.—A correspondent in the "Midland Naturalist" for last month asks about Thrush's eggs without markings. A few years ago I found a nest of *T. musicus* containing four or five eggs, (I do not remember which,) two of which had the markings of a pale brown, in the others they were entirely wanting. The Spotted Flycatcher was observed here on the 21st, Corncrake on the 22nd, Whinchat (rare just here) on the 24th May, Turtledove June 18th, (doubtless this arrived before,) and Nightjar (rare) June the 27th. The Cuckoo was still in full song here on the 4th of this month. This is not in accordance with "in June he changes his tune." Rooks were very irregular in hatching this season. I heard young calling from the nests from April 16th till June 2nd. I was told of a fine male Cirl Bunting observed at Chinnor, a few miles from Thame, in this county, on the 13th inst.; it was not at all shy, and allowed my informant to get within a yard or two of it. Allow me to assure Mr. Macaulay that I am *not* offended with his assertion with regard to the Wryneck; if he will refer to my notes in the June number, he will see that I was aware I had not made it a *certainty*. About ten years ago, two, a pair probably, of Great Grey Shrikes were killed near Hook Norton, about eight miles from here, at the end of March or beginning of April, (March that year being very warm.) One is in the possession of Mr. J. Gardner, of Warwick, who had them both in the flesh, and who kindly furnished me with the particulars. I fancy this was rather late for them to be here, considering it was a mild spring; and it seems as if they might possibly have bred in the neighbourhood had they been left.—O. V. Aplin, Bodicote, Oxon, July 19th, 1879.

Ornithological Notes.—The migrant season being over, I have very little to communicate. In my last notes "*common* flycatcher" should be "*pied* flycatcher." A Greater Tit, *Parus major*, built her nest in a strange place—a letter box. The box is about eighteen inches deep, and the opening for letters at the top, in front, 3½in. wide by 1in. deep, and through this the parent birds conveyed the necessary materials for the nest. The nest was built on the bottom of the box, and during the building, laying, sitting, and rearing and feeding the young brood, the box was daily used by the postman, every letter and paper being dropped into the slit above and falling on to the young birds, or on to the parent sitting, yet no notice was taken of the disturbance. The box had an opening, falling outwards on a level with the nest, and through this the letters, &c., were daily removed without any apparent notice on the part of the old bird, who often remained on the nest during the operation. On one occasion, I visited the nest a few days after the young were hatched, and opening the flap, not only inspected the bird on the nest, but first stroked her gently with my hand, and then finally lifted her off the nest and released her, which she allowed me to do without manifesting the slightest fear. I have in my collection two Thrush's eggs, taken this year, no larger than a Redbreast's. I have also seen this season two eggs of the same bird, curious as a variety. The ground colour is a lighter blue than usual, and the spots are reddish brown instead of black, much the same in colour as the Missel Thrush's. I do not know whether this variety is common or not, but I have not met with it before. The Nightingale was last heard here on the 24th June.—T. Macaulay, M.R.C.S.L., &c., Kibworth.

Sea-birds in Birmingham.—The unsettled weather of late has brought under the observation of Mr. W. Wyatt, of the Edgbaston Reservoir, the following sea-birds:—*Larus canus*, L., two or three; *Larus*, (species uncertain,) immature; *Sterna fluviatilis*, (Naum.,) or *Sterna macrura*, (Naum.,) two; and one *Colymbus septentrionalis*, Lath., immature. As usual, one or two Grebes, *Podiceps cristatus*, L., visited the pool, but, though not interfered with, did not remain for long.—Montagu Browne, F.Z.S.

Black Band in the Drift.—(See *ante*, p. 189.) This deposit should be carefully examined: it may agree with the black implement-bearing bed at West Stow, Bury St. Edmunds, in which vegetable remains, fine bones, hairs, &c., are found in association with implements and flakes of Palæolithic age. Flint-flakes should be looked for, and the material of the black band carefully examined under the microscope.—W. G. Smith, 125, Grosvenor Road, Canonbury, London, N.

Bembidium adustum, *Schaum*, (rupestre, *Dawson*,) in the Midlands. —It is with great pleasure that I record the capture of this extremely rare beetle, which I have found in some numbers on a very small spot of ground in the neighbourhood of Tewkesbury. Until re-discovered by myself, only a very few indigenous examples were known. These were originally in the Stephensian cabinet; were said to have been found at Swansea, and upon them Dawson founded his description of *B. rupestre*, with which the Tewkesbury beetle perfectly agrees. Mr. E. C. Rye, to whom I sent specimens, endorses my insect as *adustum*, and warmly congratulates me on its capture.—W. G. Blatch, Green Lane, near Birmingham, 22nd July, 1879.

Register showing the Dates during the last fifteen years on which Wheat-ears were first seen in the neighbourhood of Kettering:—

	Rainfall to 30th June each year.
1865, June 5th	10·50 inches.
1866, ,, 12th	10·31 ,,
1867, ,, 9th	10·97 ,,
1868, May 30th	7·96 ,,
1869, June 9th	12·19 ,,
1870, ,, 9th	5·36 ,,
1871, ,, 16th	8·29 ,,
1872, ,, 15th	14·99 ,,
1873, ,, 14th	9·51 ,,
1874, ,, 2nd	7·26 ,,
1875, ,, 4th	8·57 ,,
1876, ,, 16th	12·39 ,,
1877, ,, 16th	11·16 ,,
1878, ,, 11th	12·83 ,,
1879, July 1st	15·51 ,,

John Wallis.

Instinct or Reason?—The instinct by which quadrupeds will sometimes find their way is quite as difficult to understand as that which teaches the bird to find his path through the air. When we removed from Coventry to our Stoke cottage, on the 7th May, our town cat accompanied the family. She travelled inside the brougham in a close hamper, and could see nothing beyond her basket. On her first arrival at Stoke, puss looked wildly about her and could not understand the change; but after a full inspection of the premises from the cellar to the roof, and the surroundings of the house, she settled down, apparently delighted with the pleasures of country life, and spent a fortnight very happily. Then suddenly she took it into her head to re-visit her friends in Priory Row, where, on my arrival on the 23rd, I found her, having trotted two miles by field or road she never could have seen, and about three-quarters of a mile of it through the intricate streets of Coventry. The sight of birds has been proved to be excessively long and keen, and it seems to be proved that the vultures and other birds of prey discover their food by sight, and not at all by scent; but the cat, which creeps along the ground, cannot get a bird's-eye view from any great height. How she can take her bearings and steer across an unknown country is one of the mysteries of instinct.—John Gulson, Coventry.

[We should be glad to be favoured with any good, unpublished instances of remarkable sagacity or "instinct" on the part of animals, which may come within the knowledge of any of our readers.— Eds. M. N.]

Gleanings.

MIDLAND UNION.—The Bedfordshire Natural History Society and Field Club has joined the Midland Union of Natural History Societies.

THE BOOK CIRCULAR of Natural History and Scientific books, just issued by Mr. Wesley, 28, Essex Street, Strand, London, is devoted to Ethnology, Botany, Conchology, Entomology, Ornithology, &c.

NEW ORNITHOLOGICAL SOCIETY.—An association, to be called the "Willughby Society," has been founded for the purpose of reprinting scarce ornithological works, commencing with Tunstall's "Ornithologia Britannica." The annual subscription is £1, and Mr. F. D. Godman, 10, Chandos Street, Cavendish Square, London, is the secretary.

MICROSCOPE FOR PETROLOGY.—Mr. Swift, the well-known optician, has lately supplied to the Science and Art Department a number of microscopes constructed after designs furnished by Professor Judd, specially for the purpose of examining rocks. The instrument is of strong and simple construction; it has a 1¼inch objective and a coarse adjustment only, but the latter works with the greatest smoothness. The stage is of black glass, rotating, with a divided circle. The polariser is fixed below the stage by an attachment which enables it to be thrown in or out of position by a touch of the finger; the analyser is placed in the body tube, immediately above the objective, and is manipulated with equal facility. We can testify to the excellence of the workmanship and to the convenience of the instrument for the purpose for which it has been designed. Its price is, we believe, £8. With the addition of a micrometer eye-piece, a quarter-inch objective, and a double nose-piece, it would form perhaps the best cheap working instrument for general scientific purposes with which we are acquainted.

FRESHWATER LIFE.—Mr. Bolton, 17, Ann Street, Birmingham, informs us in continuation of his report, (pp. 97, 127, and 162,) that he has sent the following additional objects to his subscribers:—*Brachionus pala* and *B. urceolaris; Uroglena volvox;* the "Glass" Larva of *Corethra plumicornis;* a very rich gathering of rotifers, including *Asplanchna Brightwellii*, *Triarthra longiseta*, *Synchæta mordax*, *Polyarthra platyptera*, *Rhynops vitrea*, and *Anuræa aculeata;* some leaves of *Myriophyllum spicatum*, literally covered with *Floscularia cornuta*, and other rotifers, infusoria, desmids, and diatoms; *Gonium pectorale*, and *Nostoc commune*. All these were sent out with admirable drawings and short descriptions. Mr. Bolton joined (by invitation) the marine excursion of the Birmingham Natural History and Microscopical Society in charge of the microscopes and apparatus, and took advantage of his visit to Falmouth to send out to his subscribers specimens of the beautiful Discophora, *Lucernaria auricula*, with a drawing from life by W. P. Marshall, C.E., and description by Professor Huxley. Mr. Bolton has now issued a portfolio of drawings and descriptions of Pond-life Organisms, (1s. post free,) which will be very useful to students. Mr. T. J. Slatter (on seeing Mr. Bolton's report, p. 162) writes, on June 2nd, that he had also found a new habitat for *Melicerta tubicolaria*, and that he had a flourishing colony on *Nitella* in the aquarium in his drawing-room.

SYMONS' BRITISH RAINFALL FOR 1878.—This volume furnishes another proof of the untiring industry and minute accuracy of its editor. Probably in no other country would it be possible for such an organisation to be established and controlled by a single private individual. Here we have some 2,000 observers in all parts of the British Isles recording with care, and by means of accurate instruments, the principal meteorological phenomena—especially rainfall; while in Mr. Symons they have a leader who is ever ready and competent to give advice, and by whose keen eye every return is checked, whilst by his collation, preparation, and publication of the results obtained most valuable data are made known, and the observers are encouraged to perseverance and regularity. From p. 105 we quote the following as the average rainfall for each of the three kingdoms in 1878:—

England	38·28 inches.
Scotland	31·46 ,,
Ireland	32·56 ,,

and Mr. Symons' summing up on these figures is, "in England and Wales an average fall, in Scotland and Ireland rather a deficiency, but not extreme in any part." The above is, however, the result of the average of the few stations on Mr. Symons' list where continuous observations have been carried on since 1850, and we can nowhere discover what is the average rainfall for 1878 when the returns from the whole of the recording stations are taken into account; nor can we find the average fall in each of the twenty-three "divisions" which Mr. Symons establishes for the British Isles. These figures if they could be given would, we think, be of considerable interest and importance. Finally, we may extract the "extremes of rainfall in 1878:"—

Largest rainfall at The Stye, Cumberland	149·04 inches.
Least rainfall at Keadby, Lincolnshire	17·35 ,,

Ray and Palæontographical Societies.—We are requested to state that the Local Secretary has received from the Rev. Thomas Wiltshire, the London Secretary, a small parcel of 8vo. lithographs of the curious appropriate *menu* designed by E. W. Cooke, Esq., R.A., F.R.S., for the anniversary dinner of these societies, held in 1877, and that he will be happy to forward (to the extent of the supply) a copy to any member of the "Midland Union" on receipt of a halfpenny wrapper or large-sized stamped envelope, addressed W. R. Hughes, 23, Union Street, Birmingham.

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—Geological Section.—June 24th. Mr. Waller showed a spike of *Cotyledon umbilicus*, from near Penzance, 30in. in length. It had also several supplementary spikes growing from the principal one.—Mr. Levick showed *Volvox globator*, *Paludicella Ehrenbergii*, *Alcyonella fungosa*, and an Amphileptus which he has been unable to identify with any recorded species.—Mr. Morley gave some particulars as to the arrangements for the marine excursion. He also showed some nature-printed British ferns, including varieties of *Scolopendrium vulgare*, *Polystichum angulare*, *Blechnum boreale*, and *Athyrium Filix fœmina*. In the discussion which arose Mr. Hughes gave an account of an observation on a specimen of *Ophioglossum vulgatum*, in Mr. H. Allport's collection, which showed that the fronds are thrown up from a creeping subterraneous rhizome, and are not solitary as usually they apparently are.—Mr. Southall reported that the cutting in the drift gravel, near Walsall, was visited on the 14th June, and specimens obtained of the included rocks. July 1st.—General Meeting.—Mr. A. W. Wills exhibited a freshwater alga belonging to the Oscillatoriaceæ, genus Spirulina.—Mr. J. Levick exhibited

Hydatina brachionus, a beautiful free-swimming Rotifer.—Mr. J. E. Bagnall exhibited, on behalf of Mr. T. J. Slatter, *Lathyrus Aphaca*, in flower, from Evesham; also, on behalf of Mr. J. W. Cotton, *Habenaria chlorantha*, *Melampyrum pratense*, *Vicia Orobus*, and *Orchis conopsea*, all from Barmouth. Mr. W. R. Hughes exhibited the skins of two moles found dead on his grassplot at Handsworth, and a short discussion followed as to the possibility of their having killed each other. Mr. H. E. Forrest exhibited a rare infusorian, *Carchesium spectabile*, (of which an account is given on page 204,) and read a letter from Mr. W. Saville Kent relating to it. July 8th.—Biological Section.—Mr. H. E. Forrest exhibited *Trichodina pediculus*, a pretty little infusorian, shaped like a kettle-drum, with a circle of cilia at both the upper and lower edges. It is parasitic on Hydra. Mr. Barratt showed tadpoles of frog in various stages of development, from the appearance of the hind legs to the atrophy of the tail. Mr. W. G. Blatch exhibited *Pterostichus lepidus* and *Cymindis vaporariorum*, two coleopterous insects new to the district, found at Cannock Chase; also a new and improved form of collecting bottle devised by himself. July 15th.—Microscopical General Meeting.—Mr. W. Wright-Wilson, F.L.S., exhibited a duck affected with a nervous disease, preventing it from performing any co-ordinated movements, due possibly to the presence of a cystic worm pressing upon the cerebellum. Mr. Montagu Browne, F.Z.S., exhibited *Acronycta alni*, the alder moth, very rare in this district. Mr. W. R. Hughes, F.L.S., then gave a very interesting preliminary account of the recent marine excursion to Falmouth. He said that scientifically it had been the most successful of the four marine excursions; the dredging, having been carried on in fifty fathom water, had resulted in many rare and interesting forms of animal life. On the present occasion he confined himself to noticing the living specimens only, which had reached Birmingham, the preserved ones being reserved until they had been more thoroughly examined.

BIRMINGHAM AND MIDLAND INSTITUTE SCIENTIFIC SOCIETY. —June 28th.—Excursion to Dudley and District.—On arrival at Dudley the party walked through the Castle Grounds to the Foxyards open workings, to see the outcrop of the thick coal; the coal in the workings being obtained direct from the surface, and worked as a quarry to a depth of twelve yards. The bed of ironstone which overlies the coal at the east end of the quarry was next examined, and in the nodules numerous specimens, containing plant remains, were found. The party then walked along the south-west flank of the Wren's Nest Hill, and secured some characteristic Silurian fossils. Passing under the hill through the tunnel, the visitors were charmed with the picturesque view which presents itself on emerging into the daylight caverns on the other flank. The party then re-entered the Castle Grounds, took tea at the Lodge, and returned to Birmingham about nine, having thoroughly enjoyed the afternoon. July 19th.—An excursion was made to California Clay Pits, Weoley Castle Quarry, and the Permian Breccia at Northfield.

BEDFORDSHIRE NATURAL HISTORY SOCIETY.—June 26th.—At the monthly microscopical meeting, (Mr. G. Hurst, F.S.S., presiding,) the Mayor of Bedford, Mr. T. G. Elger, F.R.A.S., Hon. Sec., read the first part of a paper on "The Micro-spectroscope." Having described the corpuscular and undulatory or wave theories, Mr. Elger next detailed very strikingly some of the more noticeable phenomena of light. He then explained, illustrating his remarks by diagrams, the construction of the micro-spectroscope and its adaptation to the microscope. He pointed out that the absorption observed in objects examined by means of it is caused by the peculiar molecular structure of the various substances, which refuses to allow light of certain colours to pass, and hence causes dark bands and lines to appear in those parts of their spectra where the absorption occurs. He showed examples of absorption in a variety of substances, solid and fluid. Among the former he exhibited the absorption which takes place in glass of various colours, in films of gelatine coloured with aniline dyes, &c., and among the latter the spectra of chlorophyll and of other preparations from plants of different kinds. The concluding portion of the paper is to be given in October. A hearty vote of thanks was unanimously accorded to Mr. Elger.

CARADOC FIELD CLUB.—The first Field Meeting was held on Wednesday, June 25th, at Buildwas. Visited Benthall Edge. Address by G. Maw, Esq., on "Glacial Drift in the neighbourhood." After luncheon at Benthall Hall, and examining Mr. Maw's valuable collection of Alpine plants,&c., to Lincoln Hill Lime Caverns and Buildwas Abbey, with paper on latter by F. Rawdon Smith, Esq.

NORTHAMPTON NATURAL HISTORY SOCIETY.—June 16th.—It was resolved to publish a quarterly journal for the society, each number to contain a photograph of one of the trees of the county, with description and measurements, or other object chosen by the committee; papers read before the society reports of the meetings; a diary of occurrences in natural history; meteorological report, &c. An editing committee was appointed.

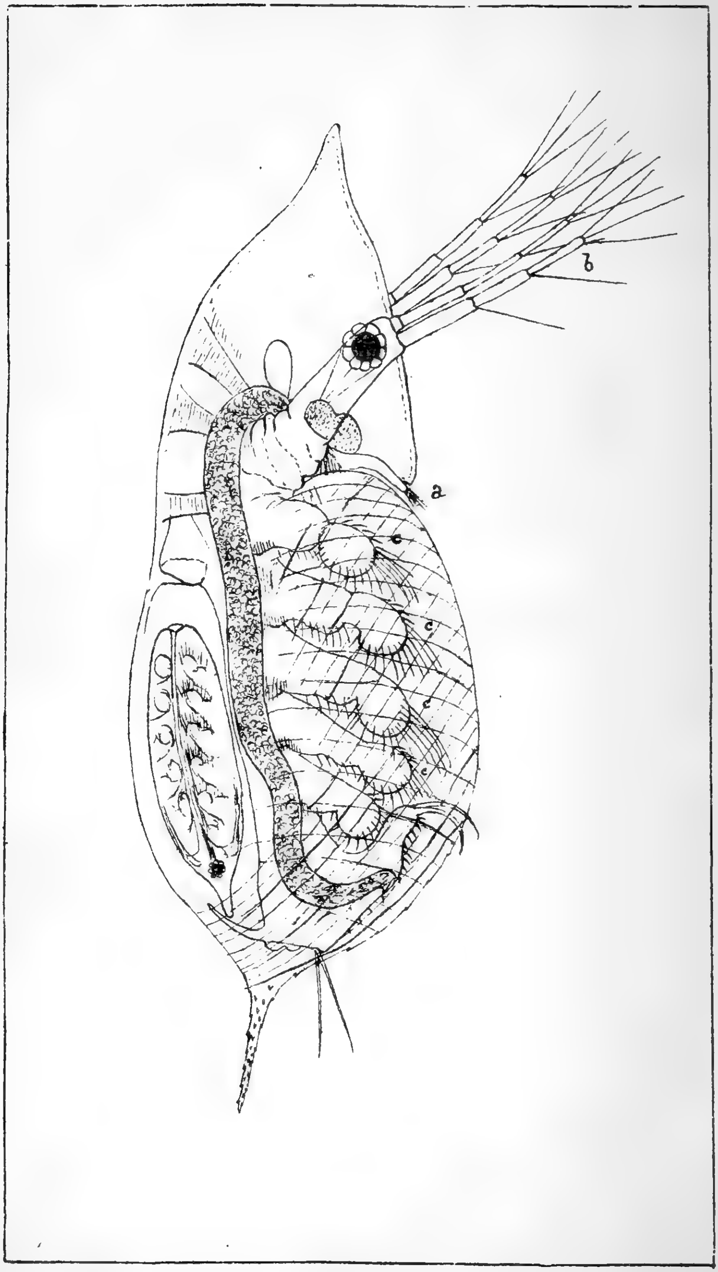
SEVERN VALLEY NATURALISTS' FIELD CLUB.—The Severn Valley Naturalists' Field Club visited Ludlow and neighbourhood on Thursday, July 17th. Carriages met the party at Ludlow Station, the drive being first to Oakley, where the party alighted and walked through the park up the valley of the Teme and on through the Downton Walks to the Hay Mill and Brow Bridge. Near this last named point the carriages took up the party for the return drive to Ludlow, *via* Burrington and Mary Knoll. This district is "classic ground" to the geologist, and under the guidance of the Rev. J. D. La Touche and Theophilus Salwey, Esq., the party were able to examine many points of geological interest. Proceeding from the old Red Tilestones, the passage beds were examined in the section at Tin Mill. Before reaching Forge Bridge the Downton sandstone was seen finely developed. At Forge Bridge the celebrated bone bed was found, and specimens were obtained from it, as also at another point in the walk. In the Downton Walks the upper Ludlow rock was reached, this being finely exposed as far as Hay Mill. At Bow Bridge the Aymestry limestone is finely developed in a perpendicular escarpment 60ft. to 70ft. in height. Mr. Theophilus Salwey read an interesting paper on the points of geological and archæological interest in the district. During the return drive the escarpments formed by the Wenlock and Aymestry limestones to the right and to the left of the road afforded a striking illustration of the result of the action of denudating forces upon an originally perfect dome of these strata. Till within the last hour of the drive, when a heavy shower fell, the day was fine and warm, and the excursion through the lovely valley of the Teme afforded a most enjoyable day to the party, which consisted of thirty-eight members and friends of the club. Time did not suffice for a visit to the church, castle, and museum at Ludlow.

STROUD NATURAL HISTORY AND PHILOSOPHICAL SOCIETY.—July 3rd.—This was the annual field day of this society, and Chedworth the place fixed for the excursion. Mr. E. Witchell, F.G.S., president, Mr. C. Playne, ex-president, and thirteen other members formed the party. They travelled from Stroud to Cheltenham by train, where a break and horses were in readiness, by which they were conveyed through a beautiful and interesting country to the Roman Villa, at Chedworth. The villa is situated on the line of the Roman Fosse Way, and diverges from the Roman Road known as Icknield Street leading to Oxford. It was discovered about the year 1866 on property belonging to the Earl of Eldon, who spent a considerable sum of money in its excavation, and also in erecting a museum and necessary covering for the remains. The discovery is said to have been made by a Mr. Farrer, whose attention was called to it in consequence of some tesselated pavement having been brought to light in digging out a ferret that had buried itself in a coppice wood, which at that time covered the remains. The villa proper forms three sides of a square, and the few buildings on the south side appear to have been offices or servants' apartments. The President read several extracts from the Rev. S. Lyson's paper to the Cotteswold Club, giving an interesting account of the neighbourhood. The party returned by way of Puesdown and Andoversford.

EXCHANGE.

Coleoptera—*Silpha littoralis*, from Bewdley Forest, for local Coleoptera or Lepidoptera.—F. B. Taylor, 36, Chapman Road, Small Heath, Birmingham.

Plate IV



H. E. Forrest, del.

Daphnia Bairdii.

ON A NEW ENTOMOSTRACON.

BY H. E. FORREST.

A short time ago Mr. Thomas Bolton sent me some water from Olton Reservoir, containing, amongst other things, a curious Entomostracon, which he wished me to examine and draw. At the first glance I saw that it was a form new to me, and forthwith set about drawing it. That done, the next thing was to find out its name, but vainly did I search through and through Baird's "Entomostraca"—it was not there. All that could be discovered about it was that it belonged to the Entomostraca, order Cladocera, family Daphniadæ, and genus Daphnia. Baird describes seven species, viz., *Pulex*, *Psittacea*, *Vetula*, *Schæfferi*, *Reticulata*, *Rotunda*, and *Mucronata*, but the one in question was none of these, and I have therefore the pleasure of describing it as a new species, unless it has already been described in some other work unknown to me. Every Naturalist, and especially every student of Entomostraca, will feel that it is but a just and graceful tribute to the name of one who did so much good work for science at a time when very little was known of these little creatures, if this new species be dedicated to Dr. W. Baird, the author of "The Natural History of the British Entomostraca," especially as no other animal is so named. I therefore christen it *Daphnia Bairdii*, if it has not yet received any other name.

The appearance of *Daphnia Bairdii* in the microscope is irresistibly comic. It has an immense head which terminates upwards in a sharp point, exactly as if it were wearing a "dunce's cap," and in this its one goggle eye rolls about with an air of supernatural wisdom. Its body is transparent and almost colourless. It has the following characters in common with the seven other members of the same genus:—Head produced downwards into a prominent beak, from the base of which spring the two very small, one-jointed, superior antennæ (*a*.) The inferior antennæ (*b*) are large and powerful, two-branched, one branch three-jointed and bearing five setæ, the other branch four-jointed and bearing four setæ. It has five pairs of feet (*c*) all enclosed within the carapace. The following characters distinguish it from its congeners:—The valves of the carapace or shell are oval, transparent, nearly colourless, and the surface is marked with striæ crossing each other obliquely. These markings are not nearly so apparent as in the other Daphniæ. The head is very large (larger than in any other species) and almost an equilateral triangle. The lower extremity of the valves terminates in a long, sharp spine, which is finely serrated; the edges of the valves, too, are sparsely serrated to about half-way up. Length from top of head to extremity of spine, 1-20in. The individual drawn on Plate IV. is an adult female, and has within her carapace and behind her body a young one, almost ready to issue forth. This young one is seen edgeways, and it will be noticed that the triangular head is not rounded but flattened at the sides, like an admiral's cocked hat. In young specimens the body is more rotund than in the adult, and the top of the head is not nearly so sharply pointed. *Daphnia Bairdii* does not appear to be very prolific, as I never saw more than two eggs in one female. The male I have not yet seen, though I have searched for it, and hope to obtain it eventually. Anyone desirous of seeing living specimens of this interesting animal can obtain them from Mr. T. Bolton, 17, Ann Street, Birmingham.

ON THE MEASUREMENT OF THE SEDIMENTARY DISCHARGE OF RIVERS.

BY THE REV. J. D. LA TOUCHE.

I propose in this paper to give a short account of some experiments which were made a few years ago with the object of estimating the quantity of sedimentary matter carried down annually by the waters of the Onny, a small stream in Shropshire. Unfortunately, at the very time when the arrangements for making these observations were matured and about to bear fruit, it was found impracticable to carry them further, since just then an extensive scheme of irrigation was started by an enterprising landlord, which involved the withdrawal at occasional intervals of large volumes of water from the stream, and thus my plans and methods of measurement were utterly disconcerted. Possibly others may be more favourably circumstanced; and I now record the results of my experiences in the hope that they may thereby be helped to pursue an investigation which requires but the simplest apparatus to carry it on, and which can hardly fail to lead to very interesting and important results. That such was the opinion of Sir Charles Lyell was shown by the energy with which he supported and encouraged my attempt, and advocated and succeeded in obtaining from the British Association a grant of money in two successive years to defray the expenses incurred in its prosecution.

Every one must be struck by the condition of a river in full flood. The water, at other times quite clear, is then loaded with sediment; this sediment is an exact measure of the work done by atmospheric influences carried on over the whole area drained by that river. Starting from the rocky ridges which generally crown the water sheds and higher lands, all along the slopes of hills and through the undulations of the surface, down to the valleys at the bottom of which flows the stream that carries off the water which falls on the whole area, a slow, but ceaseless, and mighty atmospheric action is for ever grinding up the hardest materials and reducing the rocks, through the successive stages of greater and lesser fragments, stones, pebbles, gravel, sand, and lastly, soil, to an impalpable powder, which floats readily in the water of the river for a sufficient time to permit its transportation over many miles on its way to the sea.

Here, as everywhere else in creation, the law of eternal change is maintained. Continents and all that is erected on them are swept away and give place to other continents to be built up out of their materials. What, however, we are now concerned in, is the fact that the measurement of this mud furnishes a proximate means of calculating the rate of geologic change; and, if we could eliminate the errors which attend the computation, would help us to correct those vague and unsatisfactory statements in which the words "millions and billions of years" figure so freely, exciting, I fear, the not altogether unmerited incredulity of the unscientific. It is evident that if we could form any reliable estimate of the number of cubic yards of solid rock which in the form of mud are carried down annually by a stream and divide this into the cubical contents of the basin excavated by its action, we should have as a quotient the number of years the operation took to accomplish. Of course many disturbing elements enter into the calculation to complicate it and render it more or less uncertain; and these must not be lost sight of. It may be that the average rainfall of past ages was very different from the present, or that climate had a different effect in modifying atmospheric action. Still, as a step towards removing our difficulty in the way of cyclic computation, to estimate the sedimentary contents of rivers is a problem of considerable importance.

The elements required for this calculation are, the quantity of water passing a certain spot in a given time, and the quantity of sediment in a given bulk of such water.

The mode I adopted to ascertain the first was as follows. Having chosen a reach of the river as straight and as free from obstructions as possible, I erected a post, painted white, and divided into feet and decimals of a foot, zero corresponding with summer level. By this was registered from time to time the height of the river. Along the bank a space of one hundred feet was measured off and three cross sections made, one at each end and the other in the middle of the measured space. From these it was easy to construct a mean section. When it was desired to note the volume of discharge, the speed of the surface was ascertained by throwing in small pieces of wood and marking the time that elapsed while they passed the measured hundred feet. Then by the use of certain tables, to be found in Neville's work on hydraulics, it was possible to arrive at the mean quantity of water that passed this spot per minute. It is necessary previously to construct a table from the data furnished by the average cross section, which gives the wetted surface of the river bed for each decimal mark on the gauge.

So much for the volume of water. The amount of sedimentary deposit held in suspension was determined by taking at intervals of the flood measured bottles of water, then allowing the mud to subside, which it sometimes required two or three days to do completely, decanting off the clear liquid, carefully drying the residuum on weighed filter paper, and afterwards weighing the whole in a balance which indicates correctly to the 50th of a grain. The solid matter contained in a given quantity of water was thus determined, and the remaining calculation was easy.

The object of registering the height of the stream on the post or gauge is to save the necessity of repeated observations on its velocity. The speed varies, of course, with the height, but is constant at any particular height. I found that by ruling a sheet of paper with lines at right angles and at equal intervals, thus covering it with a number of small squares, the divisions in one direction expressing equal heights on the gauge, and those in the other the speed of the stream measured in seconds and feet, and marking on these lines a number of observations, the curve of a rectangular hyperbola was traced, which enabled me to construct a table giving the mean volume of water proximately at any time when an observation had been missed, when, as during the darkness of the night, it would have been impossible to make it.

In the foregoing observations I had to rely on the accuracy of Neville's tables. I have, however, reason to believe that much has yet to be learned as to the discharge of rivers. The state of the bed, as well as its average inclination, materially affect the rate of the current, and must modify each case. In the portion, too, of the Onny which I selected I found afterwards that a mill sluice, which was sometimes open and sometimes closed, destroyed the value of much of my work. Many places, however, might be selected in which these sources of error do not exist, or in which they might be reduced to a minimum.

The following, taken from the record of my observations, may help to illustrate what has been said. The rainfall is taken from an average of four rain gauges situated in different parts of the basin of the Onny, an area of about eighty-four square miles.

Date.	Hour of Day.	Height on gauge.	Grains in 100 oz. of Water.	Discharge of sediment per minute, in lbs.	Rainfall.
1870.					
March 1st					·54
„ 2nd	10 A.M.	·60	12·31	362	·64
	12 M.		23·73	847	
	6 P.M.	·80	36·00	1318	
	10 P.M.	·85			
„ 3rd	9 A.M.	·70	14·45	711	·16
	12 M.		29·85	2128	
	1 P.M.	1·20			
	4 P.M.	·40	22·54	2104	·00
„ 4th	10 A.M.	·75	3·19	116	

It will be seen that the rainfall of the 1st March produced its effect on the 2nd, and that of the 2nd one much greater on the 3rd, when the maximum was reached.

Remembering that the breadth of the Onny is not more than some forty feet, the fact that at the rate of 2,128lbs. of mud per minute is sometimes carried down its bed in suspension is striking. But, besides this, a quantity of sand and pebbles must be rolled along the bottom, of which no account is taken here. The difficulty of arriving at any estimate of these in large streams is very great, but I would suggest that it might be possible to do so in smaller ones by simply sinking a suitable box in the bed when the water is low: into this the larger particles would fall and remain for further examination, while the sediment in suspension would pass away.

THE CRYPTOGAMIC FLORA OF WARWICKSHIRE.

BY JAMES E. BAGNALL.

In compiling this portion of the Warwickshire Flora I have endeavoured to bring together the various notes given from time to time on this subject, which are at present scattered through various works, so that those botanists who may feel inclined to follow up these investigations may be able easily to see what has been done already, and also to decide, with little trouble to themselves, whether the plants they find have been previously recorded, or are additions to our county flora. In compiling such lists as this the great difficulty is to settle the synonymy of the plants, many of the names of the older botanists being now obsolete, and some transferred to other and frequently very different plants from those intended by past recorders. In the Lichens and Fungi I have found it extremely difficult in many cases to decide what plant such an author as Purton meant by the name under which he recorded it. To take a single instance, Purton records from Oversley Wood a rare Lichen under the name of *Lichen digitatus;* in "The English Flora," Vol. V., page 240, this is called *Scyphophorus digitatus*, and by Leighton, in "The Lichen Flora of Great Britain," page 68, it bears the name of *Cladonia digitata.* Thus in three standard works the same plant is placed in three different genera. Nor is this a singular instance. Hence if I should omit to notice some of the plants recorded by the older botanists it will be because I have been unable to trace them to their modern name.

In the Fungi I have received great assistance from the notes of that eminent fungologist, the late Mrs. Frederick Russell, of Kenilworth, and I have to thank her niece, Miss Worsley, for having so courteously allowed me to copy the list of Fungi found by her aunt in the neighbourhood of Kenilworth, Warwick, &c.—a most extensive list, the result of many years' careful and successful study of these plants.

The Moss Flora, with one or two exceptions, is compiled entirely from my own note book, and the sign ! after the name of a locality indicates that I have myself collected and examined the plant cited from that locality. Authentic specimens which I have seen from localities given on the authority of other collectors I have indicated by the sign ! after the *name of the recorder.*

The past records of Warwickshire mosses are very scanty, the only works within my reach in which any such records are given being Purton's "Midland Flora" and Perry's "Plantæ Varvicenses Selectæ," the notes in the latter being entirely copied from the first-named work. Unfortunately Purton has not given localities for any but the rarer mosses, and has, therefore, left it uncertain whether the mosses recorded as "common," "frequent," &c., were found by him in Warwickshire or in other parts of the Midlands. I have only recorded those mosses for which he gives a Warwickshire station, although I am convinced that many that I omit were found by him in this county.

The Moss Flora of Warwickshire is by no means an extensive one, and our really rare species are few in number compared with those of such counties as Surrey, Kent, or Gloucester. Still the county has yielded a few rare species, and has the merit, if merit it be, of having added at least two new species to the British Flora. The present list is, I am convinced, an imperfect one. Much of the county has been at present neglected, and to many districts I have been able to make only flying visits. From the neighbourhood of Rugby I have no notes. The Edge Hill district has only once been visited by myself; and I know of no records from that part of the county which lies south-west of the Edge Hills; in fact, so far as I have been able to make out, very little has yet been done in the southern portion of the county, and I am convinced that much good work still remains to be done.

This list will include the Musci, Hepaticæ, Lichens, and Fungi. The Algæ I shall leave for a more competent botanist.

The following is a list of the books used in this compilation, with the abbreviations employed in these papers:—

Purt.—" A Midland Flora," 2 vols., 1817. T. Purton.

Purt.—" An Appendix to the Midland Flora," in two parts, 1821. T. Purton.

E. F.—" The English Flora," Vol. V., Part II. Rev. M. J. Berkeley, M.A., F.L.S.

MUSCI.

The classification adopted is that of " The London Catalogue of British Mosses," by C. P. Hobkirk and H. Boswell, 1877, a classification which in my opinion has the merit of being a very natural one, and which will probably be adopted by the majority of working botanists.

In the following list I have only quoted the synonyms of the "Midland Flora," and the three works on British mosses most generally in use in this country, which are indicated as under.

Wils.—Wilson—" Bryologia Britannica," 1855.

Berk.—Berkeley—" Handbook of British Mosses," 1863.

Hobk.—Hobkirk—" Synopsis of British Mosses," 1873.

SECTION I.—ACROCARPI.

SPHAGNACEÆ.

1.—*Sphagnum acutifolium* Ehrh. Marshes and bogs, local. A very varying species, both in size and habit, often tinged with a reddish tint, fruiting in Autumn. Abundant in Sutton Park! Coleshill Bog! Trickley Coppice, in drains! New Park! July, August.

Var. patulum *Schimp.* On elevated grassy places, rare, growing in smaller, looser tufts, of a pale green colour, apparently rare in fruit. Fruiting in Autumn. Sutton Park! near most of the streams. Coleshill Bog! July, August.

2.—*S. fimbriatum* Wils. In marshes and bogs, rare. Sutton Park! in marshy ground above Blackroot Pool, destroyed by railway embankment in 1876, not found there since. Marshy ground in Bentley Park, near Atherstone, 1878! July.

4.—*S. squarrosum* Pers. Boggy places, rare. Sutton Park! near Bracebridge! Blackroot! Windley! and Powell's Pools! readily known by its very squarrose leaves. July, August.

Var. b. teres *Angst.* Marshes, rare. In marsh by Windley Pool, Sutton Park! 1876.*

7.—*S. intermedium* Hoffm. *S. recurvum,* Beauv., Hobk., Berk. *S. cuspidatum, b. recurvum* Wils. In bogs and marshes, very variable, local, rare in fruit. Abundant in Sutton Park! but usually barren. Coleshill Bog! fruiting. Trickley Coppice, in drains! July.

8.—*S. cuspidatum* Ehrh. Near streams, rare. In a drain in Trickley Coppice!

11.—*S. subsecundum* Nees. *S. contortum, b. subsecundum* Wils. Turfy bogs, marshes, local. Sutton Park! Coleshill Bog! Haywoods, in first drive below Woodman's cottage! Spring Wood, near Hockley! Cut-throat Coppice, near Solihull! July.

* I am somewhat in doubt as to the plant I find here being the true *S. teres* (Angst.)

Var. b. contortum *Schultz.* S. contortum *Wils.*, *Berk.*, *Hobk.* In marshes, bogs, and watery places, local, rare in fruit. Sutton Park frequent! Coleshill Pool! Coleshill Bog! Arley Wood! Bannersly Pool! Drive by Chalcote Wood! Cut-throat Coppice, near Solihull! In fruit in a small bog, near Great Packington.

Var. b. contortum, forma rufescens, *Nees and Hsch.* occurs in small pools in bog, near Packington Park! July.

Var. c. turgidum *Mull.* S. contortum, c. obesum *Wils.*, *Hobk.* In small pools, bog near Packington Park! In bogs above Blackroot Pool, Sutton Park!

Var. d. auriculatum *Lind.* In drains and wet bogs, rare. Above Blackroot Pool! Pool Hollies Wood! near Long Moor Mill Pool in drains! Sutton Park.

13.—*S. rubellum* Wils. Elevated places in bogs, rare. On the turfy tufts formed by *Molinia cœrulea* in Coleshill Bog! fruiting in July. Dr. Braithwaite puts this as a variety of S. acutifolium in his Sphagnaceæ Britannicæ Exsiccatæ, No. 36, as I think correctly. July.

16.—*S. papillosum* Lind. Var. b. confertum. In bogs and near streams, rare. Sutton Park! fruiting in bog above Blackroot Pool! near stream above Bracebridge Pool! Pool Hollies Wood! July.

17.—*S. cymbifolium* Ehrh. In bogs and marshes. S. latifolium *E. B.*, 1405. Coughton Lane; Purt. Vol. II. The most frequent Warwickshire species; rare in fruit. Sutton Park! abundant, fruiting in Pool Hollies, 1875! Poor's Wood, Honily! Brown's Wood, near Solihull! Arley Wood! Trickley Coppice! New Park, Middleton! Coleshill Bog, fruiting 1876! bog near Packington Park! in quarry near Cornels End, fruiting! Fruits, Autumn.

Var. b. squarrosulum *Bry. Germ.* In bogs, rare; in several places in Sutton Park! Bentley Park, near Atherstone, 1878!

Var. c. compactum *Schultz.* On grassy hillocks near streams. This form I have only found in Sutton Park!

WEISSIACEÆ.

27.—*Systegium crispum* Hedw. *Phascum crispum* Wils., Hobk. On banks in fields, rare. In a field near Powell's Pool, Sutton Park, 1877! Fruiting, early Spring.

31.—*Gymnostomum tenue* Schrad. On sandstone rocks and walls, rare. On stone wall at Edgbaston! sandstone rocks, canal, near Rowington! sandstone embankment, Waterworks Reservoir, Aston! Fruiting Autumn.

35.—*G. microstomum* Hedw. On banks in a sandy or marly soil, local. Edgbaston (Cameron!) Olton, canal bank! Maxtoke, near the Priory! Sutton Park, on banks near Powell's Pool! 1877, Baker's Lane, near Knowle! 1879. Early Spring.

39.—*Weissia viridula* Brid. *Weissia controversa* Hedw., Wils., Hobk., Berk. Banks, common; near Knowle! Sutton Park! Acocks Green! Marston Green! &c.

Var. b. stenocarpa. Banks, local; near Knowle, Olton Canal bank. Spring.

40.—*W. mucronata* Bruch. On marly and clayey banks, rare. Olton Canal bank, March, 1868! on banks near Duke End! Spring.

42.—*W. cirrhata* Hedw. On trees, thatch, old palings, &c., frequent. Middleton Park! Olton! Solihull! Sutton Park, Maxtoke, near Priory! Arley, &c. Spring.

50.—*Dicranella crispa* Hedw. On sandstone rocks, very rare. On sandstone rocks, lane out of Sandy Lane, Milverton, April, 1877! It is probable that this species may be found abundantly in some of the districts on the Permian, as I find it plentiful on the Permian Rocks by the Hamstead Canal, Staffordshire. Fruiting, November.

54.—*D. cerviculata* Hedw. *Dicranum cerviculatum* Hedw., Wils., Hobk., Berk. On damp, turfy heaths and banks, near streams, somewhat local. Frequent in Sutton Park! Coleshill Heath!

55.—*D. varia* Hedw. *Dicranum varium* Wils., Hobk. On clay banks and heathy waysides, not common. Sutton Park! Plants Brook! Great Packington! canal bank near Knowle! Solihull! Shrewley Common! canal bank near Rowington! November.

56.—*D. rufescens* Turn. *Dicranum rufescens* Turn., Wils., Hobk. Very rare. On sandy banks, Tythall Lane, near Solihull! As I find this moss abundant on the Permian sandstone, near Hamstead, I think it probable that it may be also found in like places on the Permian rocks of Warwickshire. November.

59.—*D. heteromalla* Hedw. *Dicranum heteromallum* Hedw., Wils., Hobk., Purt. Common. Ragley Woods! Oversley Wood! Purt., Vol. II., p. 545. Sutton Park! Curdworth! Marston Green! &c. A form with very dark-green strongly cirrhate leaves occurs on damp banks, and is most frequently barren. Sandy and damp banks. November to April.

64.—*Dicranum montanum* Hedw. On the roots of oak trees, very rare. This plant was a new addition to the British moss flora when I first found it in 1870, and was abundant in Lower Nuthurst. The tree on which it grew has since been felled, and it is now only sparingly represented. Figured and described by Dr. Braithwaite, under the name of *Weissia truncicola* (De Not.,) to which species it was then referred, but afterwards decided to be *Dicranum montanum* by Dr. Lindberg. See "Journal of Botany," October, 1871, tab. 119, fig. 2. Recorded from Abbey Wood, Kent, "Journal of Botany," January, 1877, E. M. Holmes, Esq.

71.—*D. scoparium* L. Hedge banks, heaths, and woods, local. Rare in fruit. In fruit Brown's Wood, near Solihull! Tythall Lane, Solihull! School Rough, Marston Green! Oversley Wood! Poor's Wood, Honily! July, August.

72.—*D. majus* Turn. Woods, rare. Kirsley, near Coventry, in fruit, (T. Kirk!) Brown's Wood, near Solihull! Hart's Hill Hayes! July, August.

73.—*D. palustre* Brid. *D. Bonjeanii*, De Not. On banks, heaths, marshy places, old thatched roofs, &c., not rare. Sutton Park! always barren. Marston Green! abundant on an old thatched roof, Reddicap Hill, near Sutton! August.

75.—*D. spurium* Hedw. On damp heaths, very rare. On Coleshill Heath, (H. Webb!) This plant I have looked for frequently in the locality cited, but have never seen it. I have an authentic specimen collected by H. Webb from this locality.

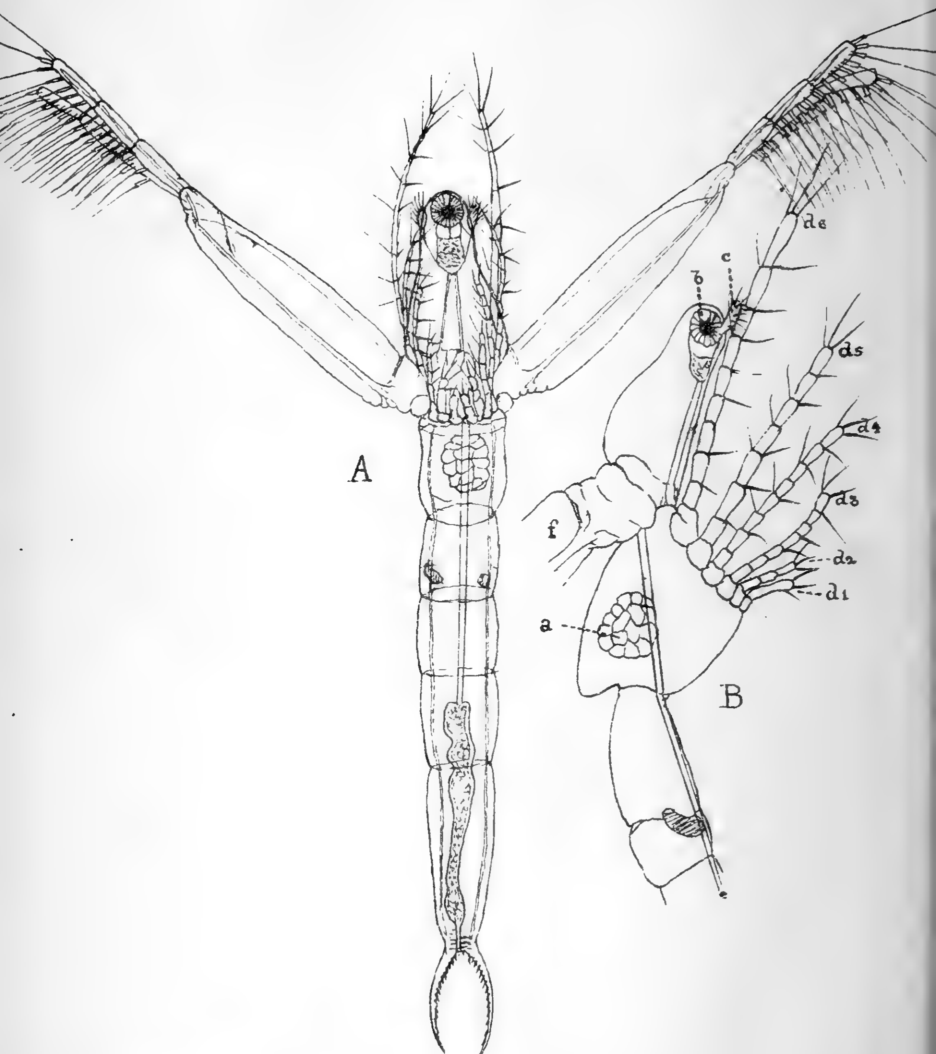
84.—*Campylopus flexuosus* Brid. *Dicranum flexuosum* Purt. "Rocks, high moors. The specimen which I found upon some very high ground in Ragley Woods was in close tufts." (Purt., Vol. II., p. 544.) I have never seen this moss in Warwickshire, but do not think Purton would make a mistake in the species.

88.—*C. fragilis* B. and S. *C. densus, b. fragilis* Wils. *C. densus* Berk. Heath lands, local. Sutton Park, frequent on heath lands, but very rarely fruiting. September.

90.—*C. pyriformis* Brid. *C. torfaceus* B. and S., Wilson, Hobk. On damp heath lands and the sides of streams and drains in a peaty soil, local. Abundant in fruit on boggy heath land above Blackroot Pool, Sutton Park, 1875. Coleshill bog, 1876. I believe that the variety b. Mülleri also occurs in Sutton Park, but I have never been able to get perfect specimens, so as to place the matter beyond a doubt. July, August.

[TO BE CONTINUED.]

Plate V.



H. E. Forrest, del.

Leptodora hyalina.

Fig. A × 50 diameters.
Fig. B, side view of Thorax and part of Abdomen × 60 diameters.

LEPTODORA HYALINA.

BY WALTER GRAHAM, F.R.M.S., PRESIDENT OF THE BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.

About three weeks ago a few members of the Birmingham Natural History and Microscopical Society visited a pool in the neighbourhood of Olton, which, being private property, is not often examined. Four of the party proceeded in a boat to endeavour to ascertain what treasures the water contained. The first dip caused no small excitement. A bottle of water, apparently containing diluted pea soup, was eagerly examined by one after another, for among the masses of a minute alga *(Clathrocystis æruginosa)* were swimming sundry apparently animated chips of thin glass. What was this translucent creature? was the question. The glass larva was speedily dismissed, but even the class to which the unknown capture belonged was doubtful, the best guess hazarded being that it was a larval form of some Entomostracan. Specimens were carefully secured for examination under higher magnifying power than pocket lenses afforded, and this examination revealed the fact that the mysterious stranger was no larval form, but a fully-developed Entomostracan, both eggs and young being detected beneath the carapaces of some specimens. But still its name was wanting. "Baird," and the "Micrographical," and "Pritchard" failed us, but Professor Ray Lankester came to our aid, for, on having specimens submitted to him, he pronounced it to be *Leptodora hyalina*, a species new to Great Britain, though found in Sweden and Germany. Curiously enough the same "dips" which gave us Leptodora gave us also another new British species, which is described at page 217.

In the hope that other students of this class may meet with Leptodora, the following imperfect description is given, which, with the help of the accompanying plate, (Plate V.,) drawn by my friend, Mr. H. E. Forrest, may enable them to identify the crystalline stranger. Leptodora belongs to Baird's Legion Branchiopoda, Order II., Cladocera, Family I., Daphniadæ. The head is elongated, not beaked. Superior antennæ long, and studded with setæ. The inferior (or propulsive) antennæ are large and very powerful, producing a motion similar to that of a man swimming. The first joint occupies fully half the length of the antenna. From it two equal branches proceed, which are four-jointed, and are studded with setæ, while the first joint is smooth. On each side of the head, immediately under the eye, is a small organ covered with cilia. The feet are ten in number, close together, and setaceous.

The carapace is extremely hyaline, divided into seven segments; the tail is produced into two curved extensions resembling that of an earwig, excepting that in Leptodora these extensions are furnished with long, slender setæ. The body is long and narrow, and so translucent that the

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REFERENCES TO PLATE V.

Fig. A.—Leptodora hyalina, × 50 diameters.

Fig. B.—Ditto, × 60 diameters. *a*, Pulsating vessel. *b*, Eye. *c*, Organ of hearing (?) *d* 1 to 5, Feet. *d* 6, Superior antennæ. *e*, Tube or intestine. *f*, Inferior antennæ.

internal organs can be clearly seen. A large contractile organ is situated immediately behind the eye, connected by two nerves (muscles?) with the muscular centre between the inferior antennæ. A pulsating vessel occupies the first segment behind the antennæ. A long straight tube or intestine passes from the first or head segment to the last segment but one, where it enters a wide cœcal vessel, somewhat convoluted or corrugated, which terminates at the bifurcation of the tail. Both male and female specimens were secured, the female differing in having a larger carapace, extending over the first and second segments of the body behind the inferior antennæ, under which carapace the ova and young are retained until the latter are sufficiently developed to leave the parent. The young resemble the parent, but are thicker in proportion to their length, and the antennæ are shorter than in the adult.

The specimens taken (adult) varied from ¼in. to nearly ⅜in. in length by about 3-64in. across the body, immediately in front of the inferior antennæ.

Sir John Lubbock has called attention to the capture of this species in some remarks made before the Biological Section of the British Association at Sheffield.

EXAMINATION OF DRIFT.

RAILWAY CUTTING NEAR WALSALL.

BY C. BEALE, C.E.

Referring to the paper with this heading (*ante*, page 201) I wish to make a few remarks, notes of a late visit to the work.

The excavation, though not to the full depth, has now reached the Walsall and Wednesbury road, which has been temporarily diverted. The character of the deposit at this point seems to have undergone a considerable alteration from that obtaining near the junction with the main line. At this latter place the deposit was exceedingly uncompacted, the sand appearing to have little or no cohesion, and being of a rather pale colour. Under the road, on the contrary, the colour is many shades deeper, the cohesiveness, also, is increased to almost the compactness of a conglomerate, and the pebbles composing the gravel are of a more uniform size than those at the beginning of the work.

Crossing the road to the cutting at the James Bridge end of the line, I find that in the progress of the work here a difference is exhibited in the character of the deposit.

The appearances here indicate, I think, that there must have been a considerable shoal or sand bank near the site of the old pools at the back of Bescot Hall. The white sand shown at this point may or may not be the top of this shoal, but judging by present appearances it looks probable that the top of the shoal was situated almost exactly on the site of the pools. That there was a shoal here may be inferred, I think, from the purity of the sand, its comparative freedom from pebbles and stones, (if not their entire absence,) and the rise of the deposits towards this point from either end of the new line. The thin band of drift coal and smut is now not far off the top of the cutting, and may be expected to be found on the surface in the course of the next fifty or sixty yards. This band of coal and smut, if found only on the north side of the shoal, would indicate that the current of the then existent sea set in a southerly direction, and that the coal was abraded from the outcrop of the fire-clay and bottom coals between here and Bentley.

One thing that struck me in Mr. Twigg's paper was the absence of all note or remark as to the wavy appearance of the various bands of the deposit at this north end, indicating, as I take it, the shallowness of the water, or the depth and strength of the wave force. The appearance is very curious, and is well worthy of examination. The waviness referred to is shown in Fig. 67 of Richardson's "Geology and Palæontology," 1851 edition, though not from the same cause as in the woodcut.

I should also like to direct attention to another cutting on the Old Grand Junction Line of Railway, about half-way between Newton Road and Great Barr Stations, where we find another instance of, I think, a shoal, but of very much grander dimensions than that just referred to near James Bridge. It begins near the present bed of the Tame, a little lower down than the Old Forge Pools, and runs inland for about a mile and a half, under "the Hem" on the Ordnance one-inch maps, towards the Birmingham and Walsall Road. The section exhibited in the railway cutting shows the base rather more than half a mile wide, and the height of the bank or shoal is about 80ft. above the present level of the stream, or about 60ft. to 65ft. above the level of railway. At the bottom of this cutting we have sand, and as we go up we get sand mixed with pebbles, at first few in number, but increasing in quantity till we come to the top, where we get the ordinary drift gravel of the district capped with clay.

At a height of about 25ft. to 30ft. above the rail level there may be found, sometimes in considerable quantities, pebbles or water-worn pieces of coal, varying in size from that of a marble to that of a cocoanut. These are principally found on the east side of the cutting, and from the configuration of the ground here it would appear as though this bank or shoal began to be formed against the high ground upon which the Walsall Road is situated, and was gradually extended to the point at which we now find it below the Old Forge.

The whole of the various deposits, with their associated foreign contents, suggest the belief that the general contour of the country, as it exists at present, remains unchanged from the date of the last great immersion, and that no great dislocation or contortion has taken place during the many ages that must have elapsed since that immersion.

I have, in these remarks, inadvertently used the words "the ordinary drift gravel of the district," but I do not think the gravels here *are* the ordinary drift gravels of the district. I think the gravels and pebbles about here are the gravels and pebbles of the bottom and shores of the sea—as it then existed—exactly similar to the gravels and pebbles lining the bottom and shores of now existing seas, and are in no sense to be confounded with the drift gravels covering such a large area of these Midland Counties, the component parts of the latter being principally derived from far distant localities, while those of the former are, on Mr. Twigg's evidence, derived from sources comparatively near.

EXCURSION OF THE BIRMINGHAM NATURAL HISTORY SOCIETY TO FALMOUTH,

JULY 5TH TO 13TH, 1879.

BY JAMES E. BAGNALL.

Although we had cold and wet weather during our excursion to this neighbourhood, a fair amount of botanical work was done, but in this note I can merely glance at some of the general features, reserving my full report for the present. In the immediate neighbourhood of Falmouth about 350 species of flowering plants and ferns were noticed, and adding to these the plants seen in our longer excursions to Land's End and Lizard Point, over 400 different species were observed during our visit. Many of these were very rare, and some of them special to the locality in which they were observed. But for the backwardness of the season and the inclemency of the weather, our list would probably have been very much longer.

The coasts and cliffs in the immediate neighbourhood of Falmouth, so far as I was able to notice, appear to be barren rather than prolific in truly seaside plants, such as the Saltwort *(Salsola Kali,)* Seablite, *(Suæda maritima,)* the Glasswort, *(Salicornia herbacea,)* Sea Lavender, *(Statice,)* *Glaux maritima*, Sea Holly, *(Eryngium maritimum,)* and other such plants. Still, I was very much pleased with the flora of the cliffs, covered as they were with masses of the Ladies' Fingers, *(Anthyllis,)* which were still beautiful, though past their prime. Dense patches of Stonecrop *(Sedum Anglicum)* greeted one's eye frequently, growing constantly in company with the rare variety of the Sand Spurrey, *(Spergularia rupestris,)* which is one of the common plants here. Dark-green tufts of Sea Plantain, *(Plantago maritima,)* glaucous tufts of beautiful Thrift, *(Armeria maritima,)* tangled masses of Sea Beet, *(Beta maritima,)* forests of the golden-flowered Black Mustard, *(Brassica nigra,)* here and there straggling patches of Scurvy Grass, *(Cochlearia officinalis* and *danica,)* Wild Carrot, *(Daucus carota,)* and abundance of the comparatively rare Alexanders, *(Smyrnium olusatrum,)* which is said to have been introduced here, but if so it is now well established and abundant; splendid specimens of the Navelwort, *(Cotyledon Umbilicus,)* bearing spikes of flowers more than a foot long, with large patches of the Pellitory *(Parietaria officinalis,)* and here and there the more rare Samphire, *(Crithmum maritimum.)* These are the principal and most striking plants on the cliffs round Falmouth Bay.

About a mile from Falmouth is a fine freshwater pool, called Swan Pool, in which I found the Sea Sedge, *(Scirpus maritimus,)* and *Scirpus Tabernæmontani*, and *Ranunculus Baudotii*, all fairly abundant.

The lanes about here are many of them very charming, beautifully bowered over with trees, and all so charmingly green, greener even than Warwickshire lanes, and rejoicing in such wonderfully verdant banks, often many feet high and clothed from top to bottom with a very profusion of growth. Wherever a particle of soil could lodge, something beautiful seemed to vegetate luxuriantly. The Hart's Tongue *(Scolopendrium* *vulgare)* was remarkably abundant, and in many cases the fronds were more than two feet long; beautiful tufts of the Black Spleenwort, *(Asplenium Adiantum-nigrum)* occurred on every bank, and plants were to be found varying from tiny fronds scarcely an inch in length to fine fronds considerably more than a foot long. Fine forms of *Polystichum angulare* were very frequent on the marly banks, whilst more rare, although fairly abundant, in some of the lanes was the hayscented Shield Fern *(Lastrea æmula.)* On some of the banks near Swan Pool, I found a fine crop of *Agrostis setacea,* a plant I had never before seen growing; and on the rocks near Maen Porth and other places the English Clary *(Salvia Verbenaca)* and Fennel *(Fœniculum vulgare)* were abundant.

It was very pleasing, too, to see some fine specimens of the Sea Spleenwort *(Asplenium maritimum,)* in caves near the Swan Pool, but in every case too far out of reach to be obtainable. Some splendid plants, however, were obtained by my friend Mr. Morley, near Mawnan, and with his usual generosity distributed to less fortunate fern seekers. I was also struck with the fine tufts of the Royal Fern *(Osmunda regalis,)* which were occasionally seen, but only rarely what I should consider as native, and some of the specimens of the Lady Fern, *(Athyrium filix-fœmina,)* were very beautiful and far more graceful, and in some cases much taller even than Osmunda.

ENTOMOLOGICAL RAMBLES IN THE MIDLANDS.

No. I.—BEWDLEY FOREST.

BY W. G. BLATCH.

(Continued from page 196.)

Having indulged in a fair amount of rest and refreshment, we long to resume our charming and instructive ramble, and are soon out again amongst the insects, at the first step meeting with "good things." One of the lads here brings us a fine male specimen of the Stag-beetle, *Lucanus cervus.* Just outside the door, close by the Mill, two species of *Dyschirius* turn up, viz., *D. politus* and *D. globosus;* and, in the same place, troops of *Steni,* like soldiers clad in close-fitting armour, some of them having their lead-coloured wing-cases relieved with orange spots, are marching busily to and fro ; amongst them we recognise (and capture) the aristocratic-looking *Dianous cœrulescens, Stenus biguttatus, S. bipunctatus, S. guttula, S. bimaculatus, S. Juno,* and others. The neat and extremely active little *Bembidium articulatum* abounds, as also do *Elaphrus riparius* and *E. cupreus.* Flying around a sallow by the mill-stream are numerous specimens of *Hoplia philanthus,* and from the same kind of trees a little further on are beaten two species of *Clythra—tridentata* and *quadripunctata,* the first-named being quite a red-letter capture. From nut and alder we beat *Phyllobius calcaratus,* and *C. pyri;* from birch, *Apoderus coryli, Zeugophora subspinosa,* and the marvellously beautiful larva of the scarce Vapourer moth, *Orgyia gonostigma;* and from young oak, *Attelabus curculionoides.*

On the large flowers of the "Moon-daisy" we find *Strangalia melanura* and *Grammoptera tabacicolor*—two desirable Longhorns; and on the milk-weed, (spurge,) especially by the brook-side, *Strangalia nigra*. Some species of *Donacia* are sunning themselves on the flags and Potamogetons, but we content ourselves with securing *D. bidens* and *D. typhæ;* the latter bears a purplish-coppery streak on each elytron, and is rather scarce in our parts. Amongst the stones by the brook swarms of *Bembidia* disport themselves, and examples of the following species are captured:—*B. obtusum, æneum, Mannerheimi, decorum, monticola, brunnipes, tibiale, atrocœruleum, bruxellense, flammulatum, varium, punctulatum*, &c., and in company with them a beetle new to us: it is red and black, runs with its tail curled over its back, and looks vastly like a *Myrmedonia*. To catch it and put it in a small glass tube is a momentary operation; the pocket-lens is then brought to bear on it, and we discover that our new friend is *Deleaster dichrous*, another name to be recorded in red ink. A bit further up the brook, on a spot from which every breath of wind is excluded by the encompassing woods, and where the sun's rays seem to actually broil us, are more good things, calling for the further use of "ink of sanguine hue!" What have we found now? Why, that graceful, girl-like beetle, with the slender waist, *Tachyusa constricta*, which we have not seen since taking it by the Mole at Leatherhead, and in company with it is the most curious and droll of all small beetles. Stoop down and look at it. You cannot see it? Lie down on the sandy bank of the stream and look closely. Do you now see a number of small grains of mud moving slowly about as if endowed with life? See, they march to and fro, hither and thither, evidently controlled by some hidden intelligence, and mark how certain of them seem to possess a powerful attraction for each other. As long as you lie quiet and look on, their activity appears rather to increase, but put forth your hand and touch the ground on which they move, and instantly all is still. Take one up as soon as it begins again to stir, and examine it: you will find upon rubbing it gently between your fingers, and thus removing the mud-case enclosing it, a small, roundish, rather long-legged, coarsely-punctured, black beetle, about three-quarters of a line in length, the *Georyssus pygmæus* of naturalists. It always covers itself with a coating of mud in this droll way—no doubt finding some advantage in it—not improbably protection from its active little neighbour *Tachyusa constricta*, and the hosts of *Lycosæ* and other spiders that watch and hunt for prey in the damp places in which it loves to dwell. This amusing though diminutive beetle is the only representative of its family and genus in this country, and is generally considered to be a coast insect; besides on this spot, I have taken it only at Luccomb Chine, in the Isle of Wight.

Having bottled as many *constricta* and *pygmæus* as required, and the stooping posture having made our heads and backs ache, let us for a few minutes assume the recumbent attitude on yonder heather-clad and shady slope, previous to breaking fresh ground. What is the matter? Ants? "Yes; and how they bite!" But never mind; even ants have their entomological uses. Where's their nest? Under this stone, perhaps; so over it goes! And what do we see? Not only ants, but positively some of those curious beetles of which we have often heard as inhabiting ants' nests are here—*Dinarda Märkeli*, *Atemeles emarginatus*, *Myrmedonia humeralis*, and *M. canaliculata.* Well, we have our revenge upon the ants for their keen bitings; but suppose we make other reprisals before abandoning them? Let us attack that large nest on the right, first tying our sleeves tightly at the wrists, and tucking our trousers in our socks, to prevent the ants making unpleasant reprisals upon us. Spreading a large sheet of paper on a convenient heather bush some distance from the nest, we advance upon the enemy, and boldly and quickly plunge our hands into the midst of their citadel, part of which we take away and carefully shake over the paper. This operation is repeated two or three times, care being of course taken not to destroy the nest, and upon reckoning up our captures we find ourselves in possession of more *Dinarda* and *Myrmedonia*, *Megacronus inclinans*, *Thiasophila angulata*, *Oxypoda formicetorum*, *Myrmetes piceus*, *Monotoma angusticollis*, and hosts of *Homalotæ*. From the mouth of one of the ants we took a fine specimen of *Myrmedonia humeralis*, much larger than itself, which it appeared to be carrying, with affectionate care, to a place of safety. Gladly would we renew the combat, but, remembering that "discretion is the better part of valour," we desist. (To tell the plain truth, the ants are too many and too active for us, and we feel compelled to retreat!) Upon reaching neutral territory we rest ourselves, pick off the stray ants which persist in following and worrying us, and examine by means of our glasses the queer-looking beetles captured from their friends, (or enslavers, as the case may be,) and which, but for our interference, would probably have passed the rest of their lives in the midst of a colony of *Formica rufa*, in comparative darkness, and surrounded with an atmosphere of formic acid. Looking through your glass you observe that such of the beetles as are peculiar to ants' nests, as *Dinarda*, *Atemeles*, &c., have their armour-plates, so to speak, sculptured in a special style, the whole upper surface of the body, especially the thorax and elytra, being beautifully chased in such perfection of execution as to shame even the most skilful worker in fine gold, who, were he willing, might learn valuable art lessons from these obscure and despised insects.

The questions you naturally ask as to the reason why of these beetles being domiciled with the ants are not easily answered. What the connection between them is—whether the ants attract the beetles, or the beetles fascinate the ants—whether the motives of either or both are those of friendliness or self-interest—is at present involved in mystery. It has been observed, as we ourselves have seen, that the ants certainly manifest some degree of attachment to their guests, and we know that, though very destructive to insects generally, they cherish these particular species with praiseworthy devotion and care. The subject is one of much interest, and the temptation to pursue it almost irresistible, but we must choose some other opportunity to speculate upon it. Both time and insects fly, and if we stop to talk now we shall soon find the hour of departure close upon us, and our entomological sport curtailed. Let us, then, now cross the brook and ascend the wooded hill, beating the birches and other trees as we go. Here are various species of *Rhynchites* in abundance—*R. pubescens* being one of them—and on the leaves of young oaks the curious and active *Agrilus viridis*, which must be bottled quickly, or it will be gone. By beating a crab tree we secure a specimen of the remarkable pupa of *Ledra aurita*, a fine name by which entomologists recognise a rather rare member of the "bug" tribe; from a small grove of young aspens we obtain *Saperda populnea*, *Gonioctena rufipes*, and *G. viminalis;* the sallows close by yield a new Longhorn beetle, which it is a great pleasure to see, viz., *Liopus nebulosus*, as well as some larvæ of *Notodonta ziczac*. In beating the margin of the wood a number of moths are disturbed, and, amongst others, are recognised and secured *Angerona prunaria*, *Melanthia albicillata*, *Melanippe hastata*, and the very pretty *Ennychia octomaculalis*. After disposing of these, we examine the proceeds of our beating exertions, and find lots of nice things, including the stick-like larvæ of *Phigalia pilosaria* and *Amphydasis prodromaria;* two odd-looking spiders, *Epëira bicornis* and *E. conica*, and a perfect swarm of wood-ants, which manifest an almost boy-like predilection for climbing up every available tree. On the flowers of a rhododendron, by the side of a small stream, are observed a number of gaily-decorated little moths, busily engaged sipping nectar, and as they prove to be *Anarta myrtilli*—a species that is "wanted"—we carefully box a few specimens. Turning over two or three stones lying near us brings to light a single example of the elegant beetle *Cychrus rostratus*, together with specimens of the glow-worm, *Lampyris noctiluca*, the female still bearing the semblance of its larva-hood, and the male looking like a beetle "Friend" in his straight-cut suit of sober brown-black. This species may be taken abundantly in the forest at night—the females amongst the herbage, and the males flying—both of them exhibiting their wonderful light, that of the female, however, being by far the most intense. I have found larvæ of this insect feeding on living snails, *Helix aspersa* and *H. nemoralis*.

Our steps are now resolutely set in the direction of the keeper's cottage, where we propose to take tea previous to quitting this fascinating region. But our resolution is soon put to the test and found wanting; for, although our success has been beyond our hopes, we are not able to pass by a likely-looking beetle-trap without subjecting it to examination. Hence that group of suspended moles, dead and dry, is tapped over the inverted umbrella, and lo! quite a shower of the beautifully-tinted *Dermestes murinus* drop out. Those rotting fragments of an old saddle must also be looked over with care. What! Insects there? Yes! here is *Trox sabulosus*, sixteen fine specimens, in appearance like bits of caked mud. That these apparently inanimate objects are endowed with vitality certainly seems open to question, until, holding one upside-down between your fingers, and applying gentle pressure laterally, you see the abdomen slightly move, and hear a sound almost like the wailing of a sickly infant.

But we really must not linger over this wailing mimic; our time has nearly run out, and tea and train must now occupy the leading place in our thoughts, to the exclusion of beetles and butterflies. It is hard, however, to drag ourselves away from the many attractions by which we are surrounded here, and only when a sort of compromise is mentally entered into, to the effect that we will take the first opportunity of returning, do we, reluctantly yielding to the force of circumstances, consent to rejoin the current of social life, which, during one day, we seem to have quitted for Fairy Land.

METEOROLOGY OF THE MIDLANDS.

THE WEATHER OF JULY, 1879.

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.	3·61	1·10	13	22	77·0	29	44·0	11
Stroud	S. J. Coley, Esq	3·45	·81	1	18	73·0	19	45·0	11
SHROPSHIRE.									
Haughton Hall, Shifnal	Rev. J. Brooke	3·69	·76	13	20	75·0	29	44·0	26
Woolstaston	Rev. E. D. Carr	3·12	·65	13	23	51·0	28	45 0	5
More Rectory, Bishop's Castle	Rev. A. Male	2·84	·48	13	22	77·0	28	44·0	6
Bishop's Castle	E. Griffiths, Esq.	3·58	1·25	13	21	76·0	29	46·0	6
Cardington	Rev. Wm. Elliott	2·89	·42	19	17				
HEREFORDSHIRE.									
Whitfield	W. Wheatley, Esq.	2·13	·36	14	21			40·0	11
Stoke Bliss	Rev. G. E. Alexander	2·61	·46	13	19	74·0	29	47·0	5, 10, 26
WORCESTERSHIRE.									
Orleton, Tenbury	T. H. Davis, Esq.	3·44	·86	13	22	77·2	29	42·0	6
West Malvern	A. H. Hartland, Esq.	3·29	·45	12	21	81·5	29	44·0	10
Pedmore	E. B. Marten, Esq.	3·67	·66	14	20	81·0	18	46·0	5
Longlands, Stourbridge	J. Jeffries Esq.	3·39	·45	14	17	82·0	29 & 30	42·0	5
Dennis, Stourbridge	Mr. C. Webb	3·37	·50	14	20	76·[illegible]	28 & 29	43·5	5
STAFFORDSHIRE.									
Thorganby Villa, Wolverhmtn	G. J. C. Broom, Esq.	4·69	1·50	14	19				
Dudley	Mr. J. Fisher	3·71	·53	20	20	82·0	29 & 30	44·0	5 & 26
Sedgley	Mr. C. Beale	3·20	·62	14	19	72·0	29	45·0	5
Kinver	Rev. W. H. Bolton	4·47	·92	14	17	80·0	29	44·0	26
Walsall	Mr. N. E. Best	3·50	·63	14	22	75·0	28	47·0	10
Grammar School, Burton	C. U. Tripp, Esq.	2·50	·54	19	19	80·0	28	45·0	11
Weston-under-Lyziard R'tory	Hon. and Rev. J. Bridgeman	4·75	1·06	13	22	82·0	29	46·0	6 & 11
Wrottesley	E. Simpson, Esq.	5·28	1·[illegible]0	14	18	76·2	29	45·9	27
Heath House, Cheadle	J. C. Philips, Esq.	3·67	·70	19	19	72·0	28 & 29	43 0	2
Alstonfield Vicarage	Rev. W. H. Purchas	4·42	·77	8	16	76 0	28 & 29	35·9	1
WARWICKSHIRE.									
Coundon, Coventry	Lieut.-Col. R. Caldicott	3·31	·47	8	16	78·0	28	49·0	5
Coventry	J. Gulson, Esq.	3·19	·46	13	16	77·0	30	45·0	6 & 11
Bickenhill Vicarage	J. Ward, Esq.	3·87	·56	13	22	73·0		49·0	
St. Mary's College	Rev. S. J Whitty	3·19	·43	20	20	75·3	29	44·8	11
Henley-in-Arden	T. H. G. Newton, Esq.	3·31	·58	14	17	79·0	29	44·0	6
Rugby School	Rev. T. N. Hutchinson	3·56	·51	19	19	75·8	29	44·0	6
DERBYSHIRE.									
Stoney Middleton	Rev. U. Smith	3·74	·90	20	17	7[illegible]·0	29	35·0	10 & 11
Fernslope, Belper	J. G. Jackson, Esq.	3·41	·50	19	19	77·0	28 & 30	45·0	11
Brampton S. Thomas	Rev. J. M. Mello	3·02	·64	19	14	75 5	28	43·0	13
Linacre Reservoir	C. E. Jones, Esq.	3·0[illegible]	·83	19	18				
Spondon	J. T. Barber, Esq.	2·99	·52	19	20	71·3	28 & 29	42·8	
Duffield	W. Bland, Esq.	2·39	·46	19	19				
NOTTINGHAMSHIRE.									
Hesley Hall	B. J. Whitaker, Esq.	3·66	·71	21	17	79·0	30	43·0	12
Tuxford	J. N. Dufty, Esq.	3·82				89·0	28	45 0	11
Hodsock Priory, Worksop	H. Mellish, Esq.	2·98	·62	21	17	77·8	28	43·1	26
Highfield House, Nottingham	E. J. Lowe, Esq.	3·67	·57	14	19	74·2	18	45·7	11
Park Hill, Nottingham	H. F. Johnson, Esq.	3·46	·45	19	17	75·7	29	48·4	10
LEICESTERSHIRE.									
Loughborough	W. Berridge, Esq.	2·66	·35	8 & 31	20	78·1	29	46·2	11
Ashby Magna	Rev. E. Willes	3·27	·55	13	19	79·0	29	42·0	11
Market Harborough	S. W. Cox, Esq.	4·13	·75	20	23	75·0	30	43·0	6 & 25
Kibworth	T Macaulay, Esq.	3·82	·59	20	22				
Town Museum, Leicester	W. J. Harrison, Esq.	3·72	·75	13	23	75·6	28	46·5	11
Belmont Villas, Leicester	H. Billson, Esq.	3·69	·78	13	18				
Syston	J. Hames, jun., Esq.	2·74	·39	31	23	78·0	29 & 30	45·0	11
Waltham-le-Wold	E. Ball, Esq.	3·93	·58	13	0	78·0	28	43·0	1
Little Dalby Hall	G. Jones, Esq.	3·96	·60	21	21	85·0	29	41·0	11
Foxton Locks	Union Canal Company	2·99	·44	20	19				
Coston Rectory, Melton	Rev. A. M. Rendell	4·25	·77	21	22	74·2	28 & 29	38·7	26
NORTHAMPTONSHIRE.									
Towcester Brewery	J. Webb, Esq.	3·85	·61	20	16				
Castle Ashby	R. G. Scriven, Esq.	3·08	·40	20	19	78·0	29	47·0	5 & 10
Kettering	J. Wallis, Esq.	3·99	·65	20	20	75·0	30	47·0	11
Althorpe	G. S. Groom, Esq.	3·40	·61	20	19	75·0	29	45·0	10
Pitsford	C. A. Markham, Esq.	3·28	·50	20	20	81·0	29 & 30	42·0	25
RUTLAND.									
West Deyne, Uppingham	Rev. G. H. Mullins	3·38	·46	21	19	74·8	28	44·8	11
Northfields, Stamford	W. Hayes, Esq.	2·77	·74	7	17	84·0	29	39·0	12
Ventnor Hospital	W. T. Ryder, Esq.	3·73	1·10	19	12	68·9	29	49·9	11
Altarnun Vicarage	Rev. J. Power	7·77	1·47	1	24	85·0	30	47·0	5, 16, 25

July proved a rainy, ungenial month, with an average temperature of from four to five degrees below the average. Cloudy skies, with south-westerly winds, often strong, prevailed till the last week of the month, when there were a few bright summer-like days. The barometer was unsteady and not high. Severe and general thunderstorms occurred on the 13th and 14th. Hay-cutting not general till the 27th, and all farming operations much hindered and damaged by the weather. From the 11th to the 17th, the wind blew from the east, and fogs are reported from several stations. Solar and lunar halos were seen at Nottingham on the 30th.

Natural History Notes by Observers.—*More Rectory.*—The curlews have been restless during the month, crossing our valley to the neighbouring hills. *Ashby Magna.*—Fruit and flowers, as well as vegetables, very backward. Hay harvest did not begin in this parish till July 15th; much has been well got in the last three days of the month. *Waltham-le-Wold.*—Wheat not in ear till the 20th. Hundreds of acres of oats and barley will not come into ear at all. Bees, both old stocks and new swarms, are starving. *Loughborough.*—Harvest operations fully six weeks late. *Burton-on-Trent.*—1st, wild Yellow Iris, fl.; 4th, Elder, fl., first hay cut; 9th, White Rose, fl.; 7th, Woodbine, fl.; 18th, Barley in ear; hay-making general, but damaged by floods. *Shifnal.*—Apples, of which there was a great prospect, almost all fell off; no butterflies. Peas first gathered 11th, Strawberries 13th. *Stroud.*—List of flowers noticed and time of blossoming:—1st, Butterfly Orchis; 2nd, *Prunella vulgaris*, Dulcamara, *Sedum acre*, *Aconitum Napellus*, Meadow-sweet; 4th, Eyebright, Common Ragwort; 8th, Viper's Bugloss, *Scabiosa columbaria*, *Galium uliginosum*, *Digitalis purpurea*, *Ranunculus Lingua*; 12th, *Epilobium montanum*, *Alisma Plantago*, *Stachys sylvatica*, *Achillea millefolium*, *Medicago lupulina*; 15th, *Juncus uliginosus*, *Centaurea nigra*, *Malva sylvestris*, *Valeriana rubra*; 17th, Great Mullein, *Geranium pratense*, *Lonicera Periclymenum*; 18th, *Chlora perfoliata*; 20th, *Campanula rotundifolia*; 24th, Bee Orchis; 26th, *Malva moschata*, *Reseda Luteola*, *Linaria vulgaris*; 31st, Red Bartsia, Corn Cockle, Wild Basil, Red Pimpernel, Common St. John's Wort. *Nottingham, Highfield House Observatory.*—3rd, Rhodendrons, Ghent Azaleas, Double Scarlet Thorn, Laburnum, Brown Iris, and *Hemerocallis flavus* still in bloom; 6th, Snowball Tree, *Heracleum giganteum*, and Yellow Briar in fl.; 12th, Elder in fl., Strawberries ripe; 20th, *Deutzia scabra* in fl.; 21st, Portugal Laurel in fl.; 27th, *Spiræa ærifolia* in fl., also *Deutzia scabra plena*; 29th, *Spiræa palmata* in fl.; 31st, Roses in full glory, some Rhododendrons yet in fl. *Moseley, near Birmingham.*—August 20th, a large pyramidal Pear Tree is this day in full bloom, as though it were Spring; Roses were more than a month late in blooming; they have continued in great beauty up to now.

Correspondence.

A Long Sleep.—On July 6th, 1875, I found five larvæ of the Puss Moth *(Cerura vinula)* feeding upon willow. These I placed in a breeding box, with their food stuck into damp sand, and after a time they spun their cocoons in the corners and on the sides of the box, and four of them emerged all right in the following May, (1876.) The remaining one I fancied dead, but did not examine the cocoon, and not wanting the box again it was put away in an empty room, and there it remained until August 1st, 1879, when the box was wanted for a purpose which necessitated cleaning it out. In doing this I pulled the five cocoons down, and was much surprised to find the pupa in the one which I had looked upon as dead still alive and really "kicking." On closely examining this cocoon I noticed that the larva had spun it in a horizontal position just below the sand, and in a corner of the box, one end joining the left-hand side, leaving the other end free, from which the moth ought to have emerged had not the larva made a strange mistake by changing to the pupa with its head towards the end joining the wood on the left-hand side of the box, and which it could not possibly penetrate. How long it might have remained alive of course no one can tell; however, on being placed on the mantel-shelf, in a cool room, the moth emerged, after having been in the pupa state for more than four years!—Fred. Enock, 30, Russell Road, London, N.

The Bee-eater *(Merops apiaster)* to which reference is made at pp. 188 and 210, was shot at Mapperley, near Derby, on June 10th, 1879. It was a male bird, in very fine plumage, and was set up by me for the person who shot it, but I afterwards purchased it for the Nottingham Free Museum, to which I am taxidermist. There was another bird shot before the one I had, which I did not see; probably a female. The bird I had was a wild one, and had not been kept in a cage. I shall be very pleased to give any further particulars of it to anyone who may call on me.—L. Lee, Naturalist and Taxidermist, 26, Drury Hill, Nottingham.

Ornithology.—A very fine specimen of the "Honey Buzzard" was shot by Mr. Beech's keeper in the Brandon Woods. It is now at David Smith's. Its crop was found stuffed with caterpillars, grubs, dragon flies, and other insects, upon which this species usually feeds. It rarely takes small birds, or anything larger than caterpillars and insects. It often takes bees, but appears to have no fondness for honey, as its name would imply. A pair of "Hobbies" were also shot at Combe by Lord Craven's keeper a few weeks since. The nest and eggs were also taken from a high tree, in which they had built.—J. Gulson, Coventry.

The Scriptograph.—Directions for making and using:—*Materials for making the pad:* 1oz. gelatine, 6oz. glycerine (common,) 1oz. lump sugar, 4oz. water, $2\frac{1}{2}$oz. barium sulphate. Heat the gelatine, water, and sugar in a water bath, well stir the barium sulphate with the glycerine, and incorporate all together. Pour into a tin mould, 11in. by $7\frac{1}{2}$in. by $\frac{1}{4}$in. deep. To make the ink, rub up the solid aniline violet with gum water, and thin with methylated spirit until it flows freely from the pen. *To use the apparatus:* Write on any paper; when dry, place face downwards on the pad; allow to remain about a minute; then peel the paper off. Then lay on the slab unglazed paper, and smooth with the fingers. Fifty to 100 copies may be taken. When sufficient copies are taken, remove the writing with a wet sponge. When the pad becomes deteriorated, re-melt it. *Additional Notes:* The pad should remain twelve hours after being made before being used, and before being used should be sponged. The mixture should be strained through muslin to remove lumps of barium sulphate. Care should be taken to avoid bubbles, which would cause an uneven surface. If the writing is difficult to remove from the pad, hot water may be used, though this causes the pad to wear away faster. It is not necessary to remove all traces of the writing, as they will diffuse themselves in the course of some hours in the slab. If the original writing still shows a metallic lustre, it may be used to give another negative for printing from.—C. J. Watson.

Gleanings.

The British Association commenced its forty-ninth annual meeting on Wednesday, August 20th, at Sheffield, under the presidency of Prof. G. J. Allman, M.D., LL.D., F.R.S., &c., who delivered the inaugural address, in which, as he himself described it, he gave "in as untechnical a form as possible, some account of the most generalised expression of living matter, and of the results of the more recent researches into its nature and phenomena." Our limited space precludes any attempt at even the briefest outline of this erudite and admirable address, a verbatim report of which is given in *Nature* for August 21st, to which we refer our readers. All we can do is to give very briefly the substance of a few of the introductory sentences.

Sarcode, as Professor Allman in this address pointed out, was the name given more than forty years ago by Dujardin to the structureless, semi-fluid, contractile substance of which the bodies of some of the lowest members of the animal kingdom consist.

Protoplasm.—Hugo von Mohl found a similar substance to sarcode occurring in the cells of plants which he was studying, to which he gave the name protoplasm. Max Schultze demonstrated that the sarcode of animals and the protoplasm of plants were identical. Subsequent researches have confirmed Max Schultze's conclusions, and it has further been rendered certain that protoplasm lies at the base of all the phenomena of life, whether in the animal or the vegetable kingdom. "Thus," says Professor Allman, "has arisen the most important and significant generalisation in the whole domain of biological science."

The Physical Basis of Life, says Huxley, is protoplasm. Wherever there is life, from its lowest to its highest manifestations, there is protoplasm; wherever there is protoplasm, there, too, is life. Co-extensive with the whole of organic nature, it becomes to the biologist what the ether is to the physicist; only that instead of being a hypothetical conception accepted as a reality from its adequacy in the explanation of phenomena, it is a tangible and visible reality, which the chemist may analyse in his laboratory, the biologist scrutinise beneath his microscope and his dissecting needle.

The Chemical Composition of protoplasm is very complex and has not been exactly determined. It may, however, be stated that protoplasm is essentially a combination of albuminoid bodies and that its principal elements are therefore oxygen, carbon, hydrogen, and nitrogen. In its typical state it presents the condition of a semi-fluid substance—a tenacious, glairy liquid, with a consistence somewhat like that of the white of an unboiled egg.

Minute Granules are, under the highest powers of the microscope, frequently found disseminated in protoplasm in countless multitudes. Protoplasm may also be found to be absolutely homogeneous, and whether containing granules or not, it is certain that nothing will be found to which the term *organisation* can be applied.

Bathybius Haeckelii is the name which Huxley gave to a peculiar slimy matter dredged in the North Atlantic by the naturalists of the exploring ship *Porcupine*, from a depth of from 5,000 to 25,000 feet. It is described as exhibiting, when examined on the spot, spontaneous movements, and as being endowed with life. Specimens preserved in spirits were subsequently examined by Huxley, and declared by him to consist of protoplasm, vast masses of which probably extend in a living state over wide areas of sea bottom. Haeckel has since subjected *Bathybius* to careful examination, and he believes he is able to confirm in all points the conclusions of Huxley. The more recent investigations of the *Challenger* Expedition do not support these conclusions, but, as Professor Allman observes, "It is not easy to believe that the very elaborate investigations of Huxley and Haeckel can thus be disposed of."

PROTOBATHYBIUS is the name given by Bessels (one of the explorers of the more recent and ill-fated *Polaris* Expedition) to masses of living undifferentiated protoplasm dredged from the Greenland Seas; but they are in all essential particulars undistinguishable from the *Bathybius* of the *Porcupine* Expedition, and so far Bessels' observations confirm those above recorded.

PROTAMŒBA PRIMITIVA is a name given by Haeckel to "little protoplasmic lumps" found inhabiting the fresh waters in the neighbourhood of Jena. These, when placed under the microscope, were seen to have no constant shape, their outline being in a state of continual change, caused by the protrusion from various parts of their surface of broad lobes and thick finger-like projections (termed Pseudopodia,) which, after remaining visible for a time, would be withdrawn, to make their appearance again on some other part of the surface. They may be compared to minute detached pieces of *Bathybius.*

MONERA is the name given to a group, including several other beings as simple as *Protamœba*, described by various observers, and especially by Haeckel, who has given the name on account of the extreme simplicity of the beings included in it.

AMŒBA, a stage somewhat higher in the development of protoplasmic beings, was the next thing glanced at by Prof. Allman. Widely distributed in the fresh and salt waters of Britain, and probably of almost all parts of the world, *Amœbæ* are small particles of protoplasm closely resembling the *Protamœba* just described. Like it they have no definite shape, and are perpetually changing their form, throwing out and drawing in thick lobes and finger-like pseudopodia, in which their body seems to flow away over the field of the microscope. They are, however, no longer the homogeneous particle of protoplasm which forms the body of *Protamœba.* Towards the centre, a small globular mass of firmer protoplasm has become differentiated from the remainder, and forms what is known as a nucleus, while the protoplasm, forming the extreme outer boundary, differs slightly from the rest, being more transparent, destitute of granules, and apparently somewhat firmer than the interior. There is also a "contractile vacuole," a little rhythmically pulsating cavity of very frequent occurrence among those creatures which lie low down in the scale of life.

CELLS.—Although for 200 years the *Amœba* has been sought for in all likely places, and its Protean changes have never ceased to be a source of amazement, it is only the science of our own days which has revealed its biological importance, and shown that in this little soft, nucleated particle we have a body whose significance for the morphology and physiology of living beings cannot be over-estimated, for in *Amœba* we have the essential characters of a CELL, the morphological unit of organisation, the physiological source of specialised function.

BRITISH ASSOCIATION.—At a recent meeting of the Leicester Corporation it was unanimously resolved, on the motion of Alderman Barfoot, to invite the British Association to hold its annual meeting in Leicester at the earliest possible date. Leicester has never before been able to invite the Association for want of a sufficiently large room in which to hear the President's address; this need has now been supplied by the erection of the Royal Opera House. The invitation was, we understand, very favourably received by the Council of the British Association, so that after Swansea (1880,) with Professor Ramsay as President, and York (1881,) we expect an excellent meeting at Leicester in 1882.

Drift of the West Midlands.—An important paper on this subject by Mr. D. Mackintosh, F.G.S., appears in No. 139 of "The Quarterly Journal of the Geological Society," just published. Three sources of boulders are indicated:—(1) Granite of Criffel, &c., in Kirkcudbrightshire; (2) Eskdale Granite and Felspathic Rocks, from the Lake District; (3) Felstones, &c., from the Arenig Mountains of North Wales. The agency of transport is believed to have been floating ice. On the south-west of the Clent Hills, between Hagley and Bromsgrove, and in less numbers near Birmingham, are many Arenig blocks; between Bridgnorth and Wolverhampton, and on Bushbury Hill enormous numbers of boulders (chiefly Criffel) occur. Here a warm current may have melted the bergs. The "great Cannon Hill Park boulder" at Birmingham, is referred to the Arenig area. In the discussion which followed the reading of the paper, Mr. J. F. Campbell instanced the Straits of Belleisle, almost in the same latitude, as a place where a similar state of things now existed.

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—Geological Section.—July 22nd. Mr. W. Southall mentioned that the Reed Warbler *(Salicaria arundinacea)* had built in the reeds surrounding a pool at the back of his house, in Edgbaston. Mr. J. Morley exhibited some plants sent from Barmouth by Mr. J. W. Cotton. General Meeting.—July 29th. Messrs. Bolton and Levick exhibited a very remarkable animal found in Olton Reservoir by the members at the excursion thither on the previous Saturday, supposed to be the larva of some Entomostracon. Mr. J. Levick also exhibited *Ceratium cornutum*, a very curious Infusorian from the same place; also, *Conochilus volvox* and *Volvox globator*. Mr. J. E. Bagnall exhibited *Marchantia conica*, in fruit, from Sutton; and, on behalf of Mr. T. J. Slatter, *Monotropa hypopitys* and *Geranium pratense*, var. *album*. Mr. W. Graham exhibited a fine specimen of a supposed species of *Cycas* from the coal measures, Rowley. General Meeting.—August 5th. Mr. H. E. Forrest exhibited beautiful living specimens of the two Hydrozoa, *Campanularia verticillata* and *Halecium Halecinum*; also *Chiton cinereus*; all from Penmaenmawr. He also showed portions of the two first in the microscope, with the polyps expanded. Mr. Thos. Bolton exhibited *Doto coronata* and *Nymphon gracile* from the same place. Mr. W. R. Hughes exhibited some curious spawn from a pool near Hamstead, disposed in festooned chains. Mr. H. E. Forrest read a short paper on a supposed new Entomostracon, for which he proposed the name of *Daphnia Bairdii* (see page 217.) Biological Section.—August 12th. Mr. T. Bolton made a communication to the Section respecting a very beautiful and wonderfully-transparent Entomostracon, recently captured by members of the Birmingham Natural History and Microscopical Society at Olton Reservoir, which has been identified by Professor E. Ray Lankester as *Leptodora hyalina* of Lilljeborg, a species hitherto recorded as found in Sweden and Germany only. At the same meeting, Mr. Bolton exhibited the somewhat rare Entomostracon, *Polyphemus pediculus*, which occurs at the present time in enormous quantities, along with *Volvox globator*, in Sutton Park; also, *Ceratium (Peridinium) cornutum*, one of the Cilio-flagellate Infusoria, the elegant Diatom, *Campylodiscus spiralis*, &c. Messrs. Crick, Butterfield, and Caldwell contributed collections of local plants.

CARADOC FIELD CLUB.—Second Field Meeting of the Caradoc Field Club, at Welshpool, on Wednesday, July 30th. Visited Trilobite Dingle, and quarry of basaltic rock near the town. Some of the party walked to exposure of Bala beds at Moel-y-Garth; remainder to the top of Powis Castle Park, returning to Welshpool through the Castle gardens, &c. There was a large attendance of members.

NOTTINGHAM NATURALISTS' SOCIETY.—July 31st was set apart for the annual excursion of this Society, and the district chosen was that of Creswell Crags, to which, by the kind permission of the Duke of Portland, were added the Abbey and grounds of Welbeck. Creswell Crags are situated some half-mile from the village. They consist of a north and south cliff, the rocks in some places reaching sixty feet in height, and forming a picturesque defile in the local ridge of limestone through which flows the river Wollen, recently dammed up as a lake, a stream or shirebrook which parts Nottinghamshire from Derbyshire. At the foot of the northern cliff are two extensive caves, which, along with the one in the southern or Nottinghamshire cliff have recently been explored by the Rev. J. M. Mello, Chesterfield. Mr. L. Lee, honorary secretary of the Society, had arranged for the caverns to be illuminated. The Derbyshire portion of the caves was first examined. The lines of the recent floors were traced, and no small surprise was expressed at the great amount of *debris* which in the course of the explorations had been removed therefrom—*debris* which, as the prospectus of the excursion set out, contained remains of the cave lion, leopard, cave hyæna, machairodus, woolly rhinoceros, mammoth, wolf, grizzly bear, brown bear, bison, reindeer, and the Irish elk. The Nottinghamshire cave was also examined. At the mouth or entrance of this cave, amidst scenery which was classed by some of the members as the grandest they had ever seen, the company were favoured with a discourse upon the physical features of the district by Mr. William Stevenson, in the course of which he pointed out that the Creswell Caves were attributed to aqueous action, and were referred to one or more of the numerous submersions which the country has been subject to in recent geological times. With regard to the animals whose remains were found in the *debris* of these caverns, it was pointed out that the presence of fragments of bones was but poor evidence of the animals themselves inhabiting the caves, as their remains were found in the alluvium of the valleys and in the fractures and minor fissures of the rocks; but the evidence of their inhabiting the district was held to be incontestible. The oldest or extinct species pointed to convulsive actions of nature, in the form of mighty floods, where the bones of the animals themselves were gathered, along with the fragments of local and other rocks, and washed into these fissures or caves in the rocks, the preservation of the same being attributed to the calcareous nature of their surroundings. The lecturer dwelt at some length upon the explorations carried on in the Pleasley Valley by the Nottingham Naturalists' Society in 1865, and the additions thus made to the local museum, especially in the jaw of the *Felis lynx*, a carnivorous animal, no remains of which, with the exception of a solitary tooth in the British Museum, had previously been found in the deposits of this country, and he concluded by describing the Pleasley Caves as being analogous to those in the Creswell neighbourhood. The Society made another visit to the same locality on August 21st.

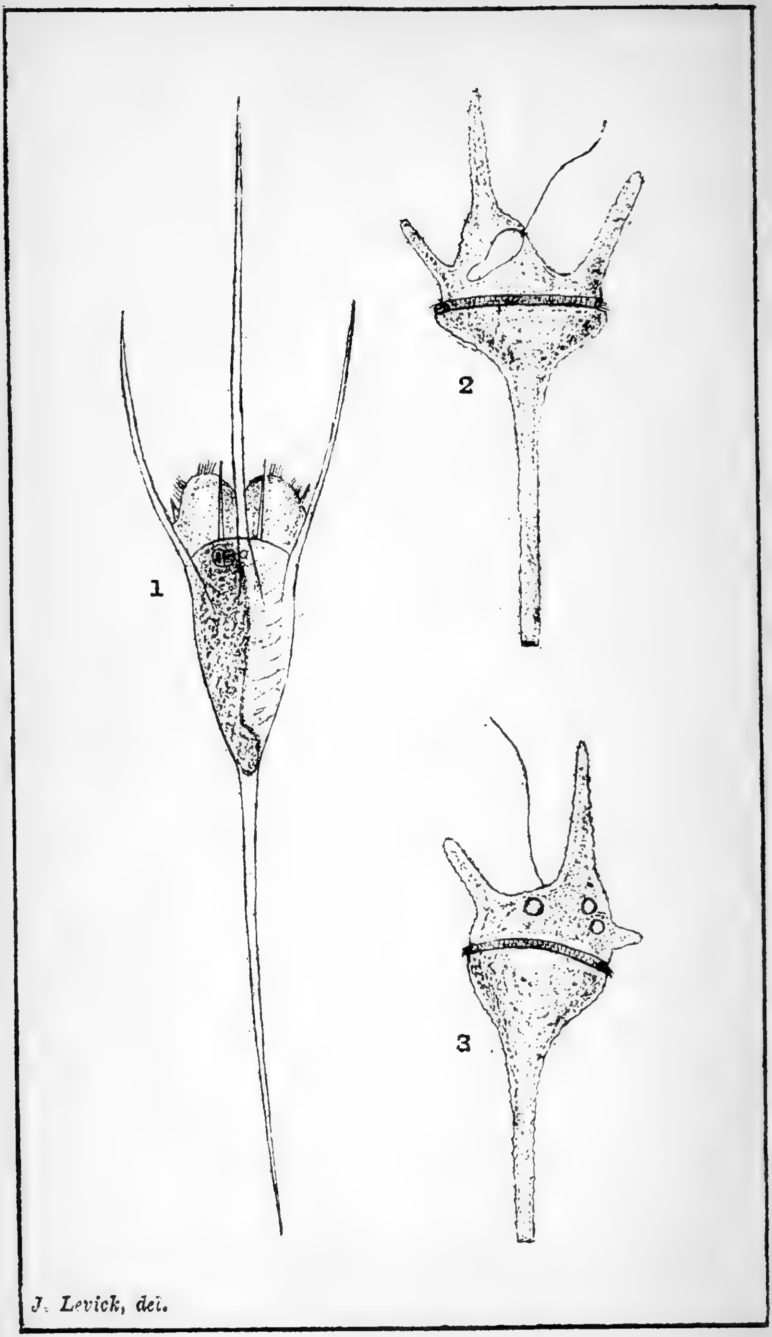
NOTTINGHAM LITERARY AND PHILOSOPHICAL SOCIETY.—Excursions in July and August:—July 10th.—Excursion to Stoke-on-Trent, Trentham, and Longton. August 16th.—The second excursion of the season was to Dale Abbey. A party of members numbering nearly thirty went by train, at 2 30 P.M., to West Hallam, and walked thence to Dale. Heavy rain prevented anything from being done until after tea, when the party, under the guidance of Mr. Scott White, inspected the remains of the Abbey, which have recently been brought to light by the exertions of the Derbyshire Archæological Society, in excavations on the site of the Abbey. In the absence (through illness) of Mr. J. Charles Cox, a paper by Mr. Hope was read by Mr. White. From this it appears that the Abbey was founded in 1160, as a monastery of Austin Canons. About half the area of the Abbey buildings have been laid bare, consisting of a choir, with a double quasi-aisle to the south, central tower, nave, with north aisle, and north and south transepts, with a large chapel on the east of the north transept. After a close inspection of the Abbey, the monuments and encaustic tiles which are preserved in several sheds in the village were examined. For full particulars of these reference should be made to Mr. Hope's paper in the "Journal of the Derbyshire Archæological Society" for this year. The church and hermitage were afterwards visited, and the party returned to Nottingham at a late hour, *viâ* West Hallam.

OSWESTRY AND WELSHPOOL NATURALISTS' FIELD CLUB.—The third excursion for 1879 took place on July 31st. Meeting at Selattyn, the party took the way by the Tower, and along Offa's Dyke to Craignant, and then over the hill by Bronygarth to Brookside, where they were most hospitably entertained by Major Barnes. Some fine specimens of the Frog Orchis *(Habenaria viridis)* were found, and also Sweet Cicely *(Myrrhis odorata.)* The geologists found numerous fossils and fragments of fossils in the blocks of millstone grit on Selattyn Hill, and in the old limestone quarry at Yr Orsedd, by Offa's Dyke, were found some nicely preserved specimens of *Lithostrotion minus*, *L. floriforme*, *Alveolites*, and *Zaphrentis* among the corals, and good specimens of *Productus Youngianus* among the mollusca, together with numerous minute fossils, chiefly spines and stems of Encrinites. After tea Mr. D. C. Davies, F.G.S., gave a short address on the principal objects of interest observed during the day. He explained the order of strata in the Ceiriog Valley, referring particularly to the carboniferous limestone and the millstone grit, along which principally the excursion had been made. The boulders of Scotch granite, seen on the top of Selattyn Hill, were also referred to in connection with the drift deposits. The address, which will probably appear in the proposed new volume of the Proceedings of the Society, concluded with a reference to the increased interest and beauty which a general knowledge of geology attaches to the extensive landscapes the excursionists had that day beheld.

STROUD NATURAL HISTORY AND PHILOSOPHICAL SOCIETY.—August 7th, a short excursion was made (twenty-two members and friends present.) The meeting place was Frocester Court, where the old Tithe Barn of the Abbots of Gloucester was examined, and the fine timber work of the roof much admired. Mr. Chapman courteously received the visitors and admitted them to the Elizabethan Manor-house, built in 1554. Thence the members proceeded to Frocester Hill, where, under the President's guidance, the geologists made an examination of the bed of the Lower Oolite, rich in ammonites and belemnites. The botanists made search in the wooded slopes, and found some fine beds of *Polypodium vulgare*. The next point of interest was the long tumulus near Buckholt, which was uncovered some years since, exposing the various chambers. The construction was explained by Mr. Witchell. The excursionists then had, by Mr. Leigh's kind permission, a very pleasant walk through Woodchester Park, the beautiful scenery of which was much appreciated; on many of the lakes were water lilies in abundance and perfection. The botanists concluded their researches by an unsuccessful quest for clubmoss in the ferny hills, amidst bracken and thistle five feet high. The ramble was followed by tea at Theescombe House, where the members were most hospitably and kindly entertained by Mr. and Mrs. Charles Playne.

WOOLHOPE NATURALISTS' FIELD CLUB.—July 29th.—The third field meeting for the season was at Downton, on which occasion a goodly number of ladies, invited by special tickets, honoured the members with their presence. The day being fine, the drive over the beautiful hill of Mary Knoll was most enjoyable. Immediately under this hill is the wooded valley of Hay Park, where the Earl of Bridgewater's children lost themselves, and gave occasion to Milton to write "Comus." At Aston the members inspected the little Norman church, the Rev. J. H. Clay, the incumbent, explaining its interesting architectural features. At the Hay Mill the party left the carriages and wended their way through the beautiful and romantic scenery in the gorge of the river Teme to Downton, where many varieties of ferns flourish. On the bridge in front of the Castle a halt was made to collect the visitors together. The private grounds and conservatories were then visited, and under a wide-spreading beech tree the President took the chair, and the business of the club was transacted. The President read an interesting paper written by Mr. Timothy Curley on the "Monastic Remains Discovered in the Construction of the Ludlow Cattle Markets," for which a cordial vote of thanks was passed. The beautiful grounds and the chief rooms in the Castle were kindly thrown open to the members and their friends. The return journey was made through Oakley Park (the seat of Lord Windsor) to Ludlow, where a meat tea was provided at the Feathers Hotel. The Museum at Ludlow was visited by some of the members, who expressed themselves highly gratified by the excellent taste displayed in the arrangement of the valuable collection by Mr. Charles Fortey.

Plate VI.



A New Rotifer, &c.

A NEW ROTIFER.

BY J. LEVICK.

In July last a visit was made to Olton Reservoir by a few members of the Birmingham Natural History and Microscopical Society, when I had the good fortune to find that curious Entomostracan, since proved to be *Leptodora hyalina*, a description and figure of which are given at page 225. This species had been discovered before only in Sweden and Germany.

Upon carefully examining the contents of my bottles under the microscope, I noted other rare things, and became very desirous of hunting again in the same locality.

By the kind courtesy of our esteemed member, Mr. C. T. Parsons, I have been able to revisit the pool, which is private property, upon several occasions, and have now the pleasure of recording the discovery of a most strange-looking Rotifer, (Plate VI., Fig. 1,) which is new to this country, and has only most recently been known even to science, and to which I had given the provisional name of *Anuræa tricornuta.*

I sent a sketch and mounted specimens to Dr. C. T. Hudson, to whom I am much indebted for his kind aid, and who expressed his belief that my Rotifer was the same creature as one discovered in Niagara water by Professor D. S. Kellicott, of Buffalo, U.S., who gave a description and figure in the "Journal of the Royal Microscopical Society" of April last, under the proposed name of *Anuræa longispina.*

Notwithstanding that I am unable to make my Rotifer agree with the Professor's details and drawing in some important points, the general characters are so nearly alike that I have no doubt our Rotifers are identical. I must refer your readers to the before-named publication for his account of it, and will here give only such particulars as I have been able to make out in the short time the Rotifer has been under my observation.

As seen in the microscope it is a formidable-looking creature, and may be compared to a three-pronged fork with a handle. Its extreme length is about 1-40th of an inch; it has a hard glassy lorica, which reflects light nearly as brilliantly as does the silicious epiderm of a diatom; it has four spines, three anterior and one posterior, the former roughened or serrated the whole length, the latter only towards the end; the long frontal spine is straight, starting from the upper terminal edge of the carapace, those at the angles curved outwards and downwards; the posterior spine is also slightly curved, all being perfectly rigid, having no hinges or joints.

A reference to my sketch (Plate VI., Fig. 1) will give a better idea of the form of the lorica than I can do in words, but it is described by the Professor as "ovate-cuneate;" it is convex on the dorsal and somewhat

REFERENCES TO PLATE VI.

Fig. 1.—New Rotifer, *Anuræa longispina*, × 240 diameters.
Fig. 2.—*Ceratium longicorne* (?) × 300 diameters ; from Olton.
Fig. 3.—*Ceratium longicorne* (?) × 300 diameters from Sutton Park.

hollowed on the ventral side, the hollow deepening towards the posterior end, where the female carries the egg attached.

It has one round red eye, centrally situate, level with the base of the long frontal spine, and viewed from the ventral side the mastax is seen a little to the left, working away in the usual manner, having I believe four pairs of teeth upon which its prey is continually falling.

Curiously enough in the first specimens gathered the eye-spots were two, nearly close together, both round and red, and of equal size; but in those since taken, evidently in a more advanced stage, many of them carrying the egg, one eye only appears, much larger, but in other respects the same. This phenomenon is new to me in Rotifer life, and I have carefully preserved mounted specimens showing both characteristics. It is common enough in some species for the eyes to disappear altogether; but this is the first instance I have met with in which two small spots, apparently, coalesce and form one larger eye.

The trochal lobes, as shown in the sketch, commencing with the two central short horns, are more protruded than is usual when the creature is swimming, the specimen figured being held under slight pressure; they are furnished with six small tufts of cilia, which under a low power appear almost continuous, and are protected by four short horns, which, unlike the long spines, will bend inwards.

The capacious stomach is of very simple form, looking like a long sack. It occupies about one-half the enclosed space, starting from the gizzard, passing down the left side, and forming a constriction towards the end, and in the specimen now under examination a rhythmical expansion and contraction is continuously taking place.

Professor Kellicott figures a pair of well-defined "wheels" which are not to be seen in my Rotifers, and are probably a mistake.

Like its congeners, it is heavily weighted with its case, and its power of propulsion is comparatively slight. It swims either forwards or backwards at about the same speed, and appears to prefer deep water for its habitat, being most abundant from three to five feet below the surface, in a part of the pool free from plants or mud; it lives but a short time after being gathered.

Its companions at Olton were two other forms of *Anuræa*, viz., *A. aculeata* and *A. stipitata*, with several species of *Peridiniæa*, either with or without horns, the form I have sketched at Fig. 2 being the most abundant. This bizarre-looking creature, about 1-100th of an inch in extreme length, (possibly the *Ceratium longicorne* of Perty,) is new to me in fresh-water life, the horned species of Peridinium being usually found only in salt water; it belongs to that order of ciliated organisms which are besides furnished with one or more flagella, and therefore named cilio-flagellata.

Its congeners are well-known among the marine forms of phosphorescent protozoa, and its outline will be recognised as not unlike some of the species found at Arran last year, when the microscopists of the Marine Excursion party were busy seeking Noctiluca. It is of a yellowish green colour, has a rough and apparently calcareous carapace, which is deeply marked with hexagonal areolæ; a ciliated furrow or groove passes round the widest part, and it is besides furnished with a long flagellum, starting from the base of the central frontal horn, where is to be seen a bright clear space, of an irregular oval shape, probably a vesicle, though I have observed no contraction nor any signs of its purpose. It swims either forwards or backwards, with a rolling motion.

Fig. 3 is a somewhat different form, taken at Sutton Park last June, and figured by my friend Mr. H. E. Forrest, which had, besides a vesicle more centrally situate, three very distinct red spots, which in some analogous species have been variously set down as eyes or eggs, and upon which I am unable to throw any light.

ON THE ROCKS OF BRAZIL WOOD, CHARNWOOD FOREST.

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

This geologically interesting locality has already been briefly described in the pages of this magazine (Vol. II., p. 119,) and the occurrence of garnets in the "gneiss" noted (p. 77.) Quite recently, a microscopical examination of the so-called gneiss convinced one of us that it was an excellent example of contact-metamorphism, similar in character to that observed round the margins of large masses of granite. A visit to the wood was at once made, and the result of a few hours' work was the collection of two heavy bags of specimens, and an interesting addition to the known geological facts of the district.

Brazil Wood lies on the east side of Charnwood Forest, between the villages of Swithland and Mount Sorrel. It is in a valley occupied by the Keuper Red Marls, which cover over the intervening space between the slate quarries of Swithland and the great granitic mass of Buddon Wood and Mount Sorrel. Only in Brazil Wood do we get any indication of the line of junction of the slaty and granitic masses, this line being everywhere else covered over and concealed by the red marls. The wood is about one hour's walk (three miles in a straight line) from Sileby Station, on the Midland main line.

In the field next to the wood on its north-west side there is a small knoll of diorite, which is distant only about 100 yards from the granite, and the latter appears to be connected with the Buddon Wood mass by an exposure at Kinchley Hill, half-way between.

Entering Brazil Wood from the direction of Mount Sorrel, we see on the left hand (north-east portion of wood) a small conical hill of granite, about 750 yards in circumference at the base, and rising from 70ft. to 100ft. above the surface; on the right hand (south-west part of wood) is a smaller knoll of a rock which has hitherto been called "gneiss." On the western side of the granitic mass on the lower edge of a very small quarry, is a dyke of diorite, first noted by the Messrs. Hill and Bonney. ("Quarterly Journal of Geological Society," Vol. XXXIV., p. 223.)

The rock forming the conical hill has the same mineral constitution as that of the larger granitic masses above mentioned, although it differs from them in appearance. It is a rather fine-grained hornblendic granite, having all the constituents well crystallised, and in a remarkably fresh state of preservation. It may be regarded as a good typical example of this variety of granite, and forms a very beautiful preparation for the microscope.

The so-called gneiss is almost wanting in two of the essential characters of that rock; it contains scarcely a trace of felspar, and the foliation is very imperfect. The only recognisable minerals are mica and quartz, and as the mass of the rock is rather fissile in one direction, it might be called a micaceous schist, in order to distinguish it from the typical mica schists, from which it differs in some respects. These rocks will be more fully described hereafter.

The knoll of "gneiss" is separated from the granite by an interval of 35 yards, and this depression is occupied by soil and vegetation, so that the main junction of the two great masses of igneous and aqueous rock cannot be observed. Masses of a dioritic rock have been found on the surface of this interval or passage both by ourselves and Messrs. Hill and Bonney, and the relation of the three sets of rock (viz., the granite, "gneiss," and diorite) to each other has hitherto been a matter on which nothing certain was known.

By observations recently made we are enabled to prove that the granite is clearly intrusive in the "gneiss," and that the latter rock is probably the result of the alteration of clay-slates belonging to the Forest series.

An opening has been made in the "gneiss;" it has been worked back 25 yards from the edge nearest the granite, so as to expose a "face" 50ft. in width and 33ft. in height. It is worked for road metal for the immediate vicinity, and a large heap of broken stone usually lies on the floor of the quarry. On the "face" the remarkable contortions of the rock at once attract attention, those in the south-west corner being very abrupt and "diagrammatic." The mass of the stone is of a dark-purplish hue; the broken surfaces glitter with flakes of mica; it is excessively tough and much jointed, the joints being frequently curved and showing marks of slickensides.

In the north-west corner of the quarry (where excavations have recently been made) we noted a rock of very different character to the "gneiss" above described. Here, underneath a tree, whose roots penetrated its yielding substance, we found a mass of decomposed granite, 5ft. in width. As this passes downwards it sends off narrower veins into the gneiss, which reach nearly to the floor of the quarry; but the main granitic vein turns southwards and enters the face of the quarry, enclosing here a lenticular piece of the metamorphic rock, which measured

3ft. by 2ft. On examining the opposite or south end of the quarry, we here also found veins of granite running up the face and overlying the contortions before mentioned, and further small veins penetrating the rock even in the very centre of the quarry. At some points the line of junction of the two rocks was sharp and distinct, but at others the two appeared to be blended together for at least a few inches. Near the junction innumerable garnets were found to be developed in the gneiss, and a few occur also in the granite. Some of them exceed one-eighth of an inch in diameter, and are finely crystallised.

At the north end of the pit we noticed, embedded as it were in the "gneiss," four distinct patches of a bedded rock, resembling an altered ashy slate. These occurred one above the other at intervals of two or three feet, and had a north-westerly strike. These may be portions of a band of rock interbedded with the gneiss, and "pinched" by it during the contortions which it has undergone. They reminded one of us of the banded ashy Charnwood slates.

Ascending to the top of the knoll of gneiss we find a ridge 30 yards long, running N.N.W. by S.S.E. The northern end has been quarried into, but at the southern extremity we found an exposure of granite which is probably *in situ*, and represents the outcrop of another vein striking through the gneiss. The knoll is thickly covered with vegetation, and many of the rocks are overlaid by a considerable thickness of moss; but we found a little cliff running along the S.W. side, which proved to be composed of a rock having a distinct cleavage, and to have the characters of an altered and slightly indurated clay-slate; it contains numerous small garnets. The cleavage is nearly vertical, and runs N.W. and S.E.; the strike, as far as we could detect, is a few degrees more to the west. This slaty rock is interbedded with a more compact and less cleaved bed.

The discovery of these slaty rocks is another point of interest, as none have been previously observed to the east of the Swithland slates. The strike of the beds and their general appearance renders it almost certain that they belong to the Charnwood series, and we attribute their present crystalline structure to the action of the intrusive granite.

We thus have in this small area an excellent example of the junction of igneous with aqueous rocks, and of the gradual change produced in the latter as they approach the injected mass. It is at present the only good, well-exposed, and readily accessible example with which we are acquainted in this district, for the line of junction in this area seems to be generally also a line of weakness, along which the rocks are shattered, so that they have readily decayed and left a hollow which is usually filled with soil; it is so, indeed, in this case, but the numerous veins sent forth from the granitic mass can here be clearly traced invading and altering the aqueous rock.

These various rocks present several other points of interest, and their microscopical investigation has been undertaken by one of us, the results of whose work will probably appear in a future number.

THE ARTIFICIAL SEA-WATER AT THE ASTON AQUARIUM.*

BY WILLIAM SOUTHALL, F.L.S.

To Philip Henry Gosse, the eminently well-known Naturalist, who, with his pen and pencil, has made so many of us familiar with the wondrous beauty of the inhabitants of the sea, belongs the credit of the introduction of the Marine Aquarium. In the second edition of his excellent book, "The Aquarium," published in 1856, he gave the world the benefit of his thoughts and experiments, by publishing a formula for producing easily and cheaply a supply of artificial sea-water such as had been found sufficient for the purposes of small aquaria. Many other formulæ have since been suggested, and nearly all, like that of Gosse, have been based on the analysis of Brighton sea-water, published by Dr. Schweitzer in the "Philosophical Magazine" for July, 1839. However much such made-up water has answered the purposes required, *theoretically* it has been at fault, inasmuch as in chemical composition it has not been identical with real sea-water, and on this account, perhaps, many Naturalists have been unable to keep certain animals alive in such water, and have affirmed that made-up sea-water is so lacking in certain elements or properties as to be unfit for the maintenance of marine animals in a state of health. Opinions being thus divided, the boldness of the directors of the Aston Lower Grounds Company, in deciding to use none other than artificial sea-water in their magnificent Aquarium, is to be admired; and Naturalists all over the country are looking with interest upon the scheme now carried out for the first time in England on a really great scale. The following tabular statement of the composition of the concocted sea-water may, therefore, be deemed interesting. In the first place, it may be stated that the fine series of tanks and the underground reservoirs are capable of holding, in the aggregate, 300,000 gallons, and sufficient water has been made to fill the whole of the show and reserved tanks, and to nearly fill the reservoirs, enough space only being left to accommodate the contents of a few tanks in case leakages should occur. My firm (Southall Bros. and Barclay) was appointed to manufacture the water, and about fifty tons of chemical substances have been used. Each ingredient was subjected to analysis, and allowance made in every case for water of crystallisation, hygroscopic moisture and impurities, and the various constituents of the well-water used were also allowed for in calculating the working formula. The analysis of Dr. Schweitzer was taken as a basis, supplemented by our own analysis of water recently taken near Brighton, a mile from the shore; and from the latter the data necessary for the required amounts of iodine, &c., were obtained. As a result, the water in use in the Aquarium contains the following

* Read before the Birmingham Natural History and Microscopical Society September 23rd, 1879.

compounds in solution, and in the proportions given, from which it will be seen to completely represent chemically real sea-water:—

	Grains per Gal.		Grains per Gal.
Sodium chloride	1894·1	Magnesium nitrate	0·3
Potassium chloride	53·6	Sodium nitrate	0·2
Magnesium chloride	256·6	Oxide of Iron	0·1
Magnesium bromide	2·0	Silica	1·0
Magnesium sulphate	160·7	Iodide of Sodium	traces.
Calcium sulphate	98·4	Ammoniacal salts and organic matter	slight traces.
Calcium carbonate	5·8		
Magnesium carbonate	1·5		

For the thorough admixture of the water in the various tanks, and the preparation and filtration of solutions, a considerable length of time was required; and it is only at the present date that the water is assuming what may be termed its permanent and representative character. Time will prove how far the sanguine anticipations of its promoters will be realised; so far it is certain that all animals hitherto placed in the tanks, under fair conditions, have done exceedingly well.

A FESTIVAL OF GNATS.

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

On the evening of September 1st, between six and seven, after a fine, sunny day, the sky being clear, and the full moon just rising as the sun went down, there was a grand festival among the gnats. Above the tops of trees and hedgerows in the low meadows north of Leicester these little Diptera were out in immense numbers. I calculated that there might be about three millions of them to a mile of hedgerow. They assembled in groups of various shapes, sometimes a vertical column from 6ft. to 20ft. high, and 1ft. to 3ft. diameter, rose from a tree top like a pillar of smoke. Sometimes a sheet 4ft. or 5ft. high and 10ft. long hung above the hedgerow, but seemed never more than a foot or so in thickness. The following evening, at the same hour, the sky being more clouded, a few gnats only were to be seen; but on the evening of the 6th, with the sky again cloudy, there was a still more remarkable display of gnat life. The little creatures were out again in millions, but this time the vertical column formation was adopted by nearly the whole of them. These columns rose from the hedges on either side of the road, and were visible for half a mile a-head at irregular distances, averaging, perhaps, 12ft. or 15ft. They formed an avenue of such a singular and unusual appearance that everyone who passed along the road paused at intervals to watch and wonder at them. This piece of road is about half a mile long, on the top of an embankment which carries it over the low meadows and the river. At the farther end there are a number of trees, and from the top of nearly every tree three or four of the strange, smoke-like columns could be seen standing up in the air, always straight but not always vertical, some of them being inclined at small angles. It was altogether a very curious sight. It has not occurred again, and I do not remember to have seen anything like it before.

On watching one of the columns closely, it was apparent that all the gnats had their heads one way, facing the breeze, which, however, was a very light one. It was a calm evening; what air-current there was came from the south-east. It seemed to be sufficient occasionally to press back the column a few inches from its normal position, and whenever this happened the whole body of gnats jerked themselves forward again with one perfectly synchronous impulse. How this was accomplished it is difficult to understand. But in fact their whole manœuvres were mysterious, and suggested a variety of questions.

What do these little creatures do during the day, and what do they feed upon?

What was the object of their evening exercises? They were in constant motion, but seemed never to jostle one another.

Why on that particular night did they arrange themselves in vertical columns, with such a general uniformity of shape and size?

How, in their rapid and perpetual motion, were they able to maintain their formation with such precision that at a short distance the columns seemed quite stationary?

How did they contrive to keep such perfect time in their sudden leaps against the wind?

Many of the phenomena of insect life seem to suggest that these little animals have some sense—perhaps several senses—quite unknown to us vertebrates. May there not be other "gateways of knowledge" besides the five by which it enters our fortified brains? Why not an electric sense, which should vibrate to electric currents, as the ear to sound or the eye to light?

AN EXCURSION TO FROGHALL, CALDON LOW, AND ALTON.*

BY JAMES SHIPMAN.

It was seven o'clock in the morning of the 5th of last October, and a somewhat cheerless grey mist hung low overhead, as a small party of the Natural Science Section of the Nottingham Literary and Philosophical Society steamed out of the Midland Station on a visit to the famous ironworks at Froghall, the limestone quarries at Caldon Low, and to lovely Alton—the last geological excursion of the season. Anyone but the most astute meteorologist, and one conversant with the sudden atmospherical changes of the last two years, would have predicted something more substantial than mist. As it was, however, we were all destined to be agreeably surprised by the bright day that was in store for us. The charmingly picturesque valley of the Churnet about Alton, up which we glided as we approached our destination, was not seen to much advantage under the circumstances. But there was still the steep

* Read before the Natural Science Section of the Nottingham Literary and Philosophical Society, Dec. 20th, 1878.

slope of Bunter Pebble Beds on either hand, with strips of the sombre crimson, but mostly mossy and variegated, conglomerate peeping here and there from between the clustering ferns and wild flowers and foliage that almost clothe them; while above, rising abruptly into a perpendicular craggy cliff from the top of the Bunter slopes, could be seen the massive white and pink sandstone of the Lower Keuper, like a thick bed of basalt, capping the hills all round.

We alighted a little after nine at the Froghall Station, where we were met by Mr. Fraser, the manager of the Caldon limeworks, and, having refreshed, we walked on to the wharf, about half a mile distant, along a valley formed by the junction of a small stream descending from the limestone country to the north with the Churnet. We had left the terraced hills of the Triassic Rocks, and were now fairly on the Lower Coal Measures or Gannister Rocks, which in our front, over to the north and west, rose into bold dimpled hills crowned with thick tufts of pine, rather characteristic of the Lower Coal Measures. Beyond lay the picturesque Millstone Grit, rising sharply from the almost featureless Yoredales, while perhaps the Carboniferous Limestone of the Weaver Hills formed the shadows which filled the background. The Cheadle coalfield, across the eastern edge of which our path lay, is about 1,000ft. thick, and forms one of those "basins" into which the Coal Measures of North Staffordshire have been thrown on the west, called the Goyt Trough.

The ironstone, for which the Gannister Rocks at Froghall have long been famous, was stored at the wharf in banks about 20ft. high, broken up into slabs, and separated into different qualities ready for transit to the smelting furnace. The hematite is of the usual dark-brown or blackish colour, being streaked with light-brown along the planes of bedding, giving it somewhat of a stratified appearance, the joints being mostly filled with calcite.* Some geodes in this ironstone yielded very minute six-sided prisms of calcspar. The ironstone is usually found associated with dark, chocolate-coloured shales, and rests on from 1ft. to 14ft. of gray or reddish slaty clay, forming the lowest bed of the Gannister series in this district. It varies in thickness from 1in. to 22in. A remarkable feature connected with this ironstone is that it is only found developed in what seem to have originally been "basins," between saddles or folds of the already crumpled Millstone Grit; for over the more elevated underground ridges of the grit it is found to be represented by a mere trace of reddish ochre. The shales below it present similar phenomena.

Froghall is also the terminus of the tramway from the Caldon Low limestone quarries, and here was the machinery for crushing the stone

* An analysis of this ore, given in "The Iron Ores of North Staffordshire," shows that this hematite consists of:—

Peroxide of iron	52·83	Sulphuric acid	0·28
Protoxide of manganese	0·81	Silica	trace
Lime	14·61	Water	4·75
Magnesia	5·70	Organic matter	1·30
Carbonic acid	18·14		
Phosphoric acid	0·32	Total amount of iron	36·93

into road-metal. The process being similar to that in use in other localities, however, it need not be described. Lying about among the limestone, were some massive geodes, where the prisms of calcite were four or five inches long; and although very interesting as mineralogical specimens, they seemed to be regarded as refuse here. A fine red clay, brought down in large quantities in the trucks from the limestone quarry, was evidently of some commercial value, for the women as well as men connected with the canal boats were actively engaged in taking a cargo of it on board. It somewhat puzzled us to know what formation it could have been derived from. Among other things we learnt here that the limestone, of which there were such stores all round, contained too much iron to be useful for agriculture, but that it made the best of fluxes for smelting.

Taking our seats in a specially prepared tram-wagon, we soon found ourselves gliding, without any visible motive power, up a gentle incline cut through the dark gray shales of the Lower Coal Measures. Meanwhile the curtain of dark clouds and haze which had hitherto given an air of cold solemnity to the excursion now swept swiftly across the sky, and with bright sunshine and the bluest of blue skies overhead, and amid charming scenery, almost romantic, we were presently making our way along one of the spurs of high ground that stretch from the Weaver Hills down to Froghall.

We "pulled up" at Oldridge to examine a curious pillar, or "needle," of what seemed to be the Third Grit (of the Survey) resting on the shoulder of the ridge along which the tramway passed. The ground around was smooth and grass-grown, sloping rather steeply into an east-and-west valley, which widened out to the west. The "needle" itself was about 25ft. high, in some parts being as perpendicular as if it had been chiselled by hand, and about 12ft. in diameter. It consisted of reddish-brown grit with quartz pebbles, and showed distinct oblique lamination, in one face inclined at 45° to south-west. It was difficult, even on the spot, to come to any fair conclusion as to the exact process by which the pillar got formed, for there was no exposure near with which to compare it, and time was too short to examine the hill around. We know, however, that the Third Grit is usually massive and well-jointed, and the fine edges formed by its outcrop are among the most noticeable features in the scenery of this part of Staffordshire. It may be inferred, then, that this columnar mass represents the ruins of an ancient "edge" or cliff, produced partly by the scooping out of the east-and-west valley—the lower part of which is probably in the Yoredale formation—and partly due to the physical structure of the grit of which it is composed. Similar pillars are met with at Belmont Chapel on the north side of the Cheadle coalfield.

Partly owing to faults and partly to the general outcrop of older rocks going west, the sections exposed by the line revealed a complex alternation of Yoredale rocks, Millstone Grit, and Carboniferous Limestone, and at one point we passed through a tunnel in the Yoredale rocks, 500 yards long. We were soon in sight of Caldon Low, a flattened mound of limestone on the western edge of the Weaver Hills, which rose in graceful treeless but grassy swells from the sterile-looking stretch of Yoredale shales. The limestone quarry is about 500 yards long and 140ft. high; and we learnt that there was a similar quarry on the other side of the hill. Gunpowder is preferred here to dynamite for bringing down the rock on account of its greater economy, dynamite being too swift and not lifting so efficiently. We had a good opportunity of observing the action of gunpowder, as several "shots" were fired while we were examining the limestone and the curious veins of calcspar which traverse it in every direction. It had been arranged, however, that an unusually heavy shot should be prepared against our visit; so we devoted the time still required to complete its preparation to examining the crescent-shaped quarry. At the south-eastern horn of the quarry there was what appeared to be a fault, bearing N.N.E., and the space between the walls of the fissure (about 8ft.) was filled with subangular pieces of limestone coated with radiate prisms of calcspar half an inch long, and also contained hematite; the whole being imbedded in red clay cemented by carbonate of lime—the same red clay, in fact, as we had seen earlier in the day at the wharf. Everything being ready for the great shot, we took up position among the rocks at the other end of the cliff, whence the cavern containing the powder could be seen, about 400 yards off. Eighteen hundredweight of powder was used for the charge, and it exploded with a stupendous reverberating roar, lasting about ten seconds, and accompanied by the rattle of thousands of tons of rock as a large area of the cliff crumbled down into the quarry.

Behind the rocks on which we stood was a gap, or "pocket," in the cliff, about 30ft. deep, and as many wide, reminding one of an abandoned lode working. It was an old disused clay pit, and once contained one of those remarkable deposits of white clay and sand which have been observed in several spots on the Weaver Hills, in Wales, and in Ireland.* Mr. Binney, F.R.S., who saw the "pocket" in its best days, says it was filled with bluish-white and pink clay, with various coloured sands, and strings of quartz pebbles, in lenticular alternations, curving inwards towards the middle. The middle of the deposit was occupied by a vertical bed or "pipe" of rounded pieces of grit and white quartz pebbles, mixed with sand, about 5ft. wide; and Mr. Binney regards this as proof that the "whole of the clay and sand now found in the hollow of the limestone was the *débris* of the Millstone Grit formerly lying above them," though he quaintly adds, that "there must have been some strange commotion to account for the position of the pebbles." There was little to be seen of the clay now, however, as the middle of the deposit had been scooped out, and the Drift capping from above had almost completely obscured what remained. One of us here chanced to pick up a boulder of greenstone in the Drift. It most resembled one of the Derbyshire "toadstones," though it could scarcely have become so well rounded during the Glacial Period, and was most likely washed out of the Millstone Grit, during which period it was probably broken off its parent rock, and worn into a boulder. We saw no fossils here.

* See papers by Mr. G. Maw, F.G.S., "Geological Magazine," 1866.

As the afternoon was advancing we left Caldon Low, and with it our estimable *cicerone*, Mr. Fraser, whose courtesy, information, and arrangements left nothing to be desired, and striking across the country to the south-east, presently descended into the embouchure of a ravine in the limestone, with the slopes of Wardlow rising to above 1,000ft. on the left and a much lower ridge on the right. Our path was dotted on either side by old clay pits about 20ft. deep. These showed that the bottom of this valley was filled with deposits of white clay, covered with a thick deposit of red Drift sand and pebbles. The water at the bottom of the pits, however, prevented any examination of their steep sides; and there was no halt till we got to the Ribdin pit, about a mile south of Caldon Low. Here was a very extensive opening, about 40ft. deep, in the white clay deposits, forming the western slope of the valley, where it had widened out somewhat. The section revealed about 30ft. of white and yellow fine tough clay, with irregular patches and broad bands of well rounded quartz pebbles, and large angular blocks of Millstone Grit, Lower Keuper pebbly sandstone, and occasional rounded boulders of chert. Neither contortion nor bedding could be made out; but irregular masses of yellow clay or pink sandy clay reared themselves up in the midst of white clay in the most perplexing manner; yet the deposits had evidently been very slowly accumulated, and were capped with a thick deposit of Drift. Many of the blocks embedded in the clay had so far decomposed as to preserve only their original outline and sandy texture, but were as soft as the clayey matrix; others had altogether melted into the clay and given it a pink tint. Curiously enough there were no traces of limestone among the *débris*. These argillaceous deposits are said to extend more or less over a stretch of nearly two miles from north-west to south-east, but the rock on which they rest could not be seen, though it is mapped as Carboniferous Limestone. They occupy a position about 1,000ft. above the sea. Similar deposits have been met with in North Wales and in Tipperary, at heights of from 800ft. to 1,000ft., mostly in deep cavities in the Carboniferous Limestone, and always below the Drift. They may not all be of the same age, but in nearly every case the same mineral characters are found associated—soft chert breccias, white and buff clays, dark laminated clays, and carbonaceous beds. The cavities in which these deposits occur appear to have been formed after the manner of sand pipes in the Chalk—by the slow dissolution of the limestone, into which the superincumbent beds of grit or sandstone appear to have gradually subsided.

It was difficult to tear ourselves away from so interesting a spot, for there was sufficient here alone to furnish a good day's work. Regaining the main road, however, near Three Lows, we kept the ridge of Yoredale, capped at intervals by Millstone Grit, on to Farley. The scenery was exceedingly pretty all the way, but as we descended into the valley of the Churnet, at Alton, it became magnificent. It was now too late to examine any of the fine exposures of the Lower Keuper at Alton, so that a very agreeable lunch at the "Shrewsbury" terminated a capital day's labours.

THE CRYPTOGAMIC FLORA OF WARWICKSHIRE.

BY JAMES E. BAGNALL.

(Continued from page 224.)

BRUCHIACEÆ.

92.—*Archidium phascoides* Brid. Moist heaths. Edgbaston, (Cameron!) Shores of Coleshill Pool! April, 1868 and 1871. Very rare. April.

93.—*Pleuridium nitidum* Hedw. *Phascum nitidum* Wils., Hobk. Local, but probably frequently overlooked. Moist banks, damp sandy and marly fields. Shirley! on banks near Earlswood Reservoir! field by Powell's Pool, Sutton Park! Autumn, Spring.

94.—*P. subulatum* L. *Phascum subulatum* Wils., Hobk. Banks and fields, frequent; Acocks Green Railway bank! Olton! Packwood! wood near Maxtoke Priory! fields in Tythall Lane, Solihull! Oversley Wood! Sutton Park, 1879! Spring.

95.—*P. alternifolium* B. and S. *Phascum alternifolium* Wils., Hobk. Banks and fallow ground, rare or overlooked. In fields near railway station, Marston Green! Old clay pit, near Erdington railway station on banks! Spring.

LEUCOBRYACEÆ.

96.—*Leucobryum glaucum* L. Moist heathlands and heathy bogs, local. In many parts of Sutton Park! but always barren. Coleshill bog!

POTTIACEÆ.

109.—*Sphærangium muticum* Schreb. *Phascum muticum* Wils., Hobk. Moist banks and fallow fields, local. In sandy fields Coleshill Heath! Tile House Green, near Knowle! Fields by Powell's Pool, Sutton Park! Autumn, Spring.

111.—*Phascum cuspidatum* Schreb. Moist banks and fields, common. Coleshill Heath! Solihull! Canal bank, Acocks Green! Sutton Park! &c. March.

Var. e. curvisetum *Dicks.* Fields, rare. Sparingly in a fallow field above Coleshill Pool, March, 1869!

115.—*Pottia minutula* Schwg. Marly and sandy fields, not rare. Fields near Shirley! Solihull! Acocks Green! Sheldon! Red Hill! Bearley! Hartshill! Astley! Maxtoke! Winter and Spring.

116.—*P. truncata* L. Fallow fields, banks, heathy footways, very frequent. Acocks Green! Sutton Park! Kingswood! Autumn, Spring.

117.—*P. intermedia* Turn. *Pottia truncata*, *b. major* Wils., Hobk. Fields and walls, not rare. Fields near Westwood Coppice, Sutton Park! Acocks Green! Exhall, on marly banks! Bearley! Shirley! Kingswood! marly banks near Henley-in-Arden! stone quarries, Hartshill! wall tops by Arley Hall! Spring. Mr. Mitten considers this to be a variety of *P. lanceolata.* "Journal of Botany," IX., 1871.

118.—[*P. Wilsoni* Hook. Banks in a sandy soil. This species has been found by Mr. E. W. Badger, jun., at Moseley, Worcestershire, on banks, and may probably be found in Warwickshire.]

123.—*P. lanceolata* Dicks. *Anacalypta lanceolata* Wils., Berk., Hobk. Marly banks, wall tops in lias soils, &c. Plentiful on banks Chesterton Wood! Tythall Lane, Solihull! Lias wall tops at Harbury! Kineton! Fenny Compton! Edge Hills! Canal bank near Bearley! growing with *P. intermedia*, at Arley Wood! March.

128.—*Didymodon rubellus* B. and S. Walls and banks, frequent. Shortwood Coppice! walls of Kenilworth Castle! Sutton Park! Canal bridges between Olton and Knowle! Kineton, on lias walls! Arley! Hartshill! Erdington, old clay pits! October.

132.—*D. sinuosus* Wils. *Tortula sinuosa* Hobk. Walls and tree roots, rare. On wall of bridge near Henley-in-Arden! On roots of tree stump just outside Fenny Compton! very abundant on railway bridge in road from Birdingbury to Norton, 1878! Always barren.

137.—*Ditrichum flexicaule* Schwg. *Trichostomum flexicaule* Wils., Hobk. *Leptotrichum flexicaule* Berk. On marly banks, very rare. Abundant on marly bank, at Marl Cliff, just within the county! Barren.

141.—*Trichostomum tophaceum* Brid. Walls and clay banks, local. Dam of Bracebridge Pool, Sutton Park! Erdington, in old clay pits! Canal bridge, near Olton Pool! walls near Arley Wood! Fine form on dripping banks, canal near Rowington! Fruiting in Spirng.

148.—*Tortula rigida* Schultz. On walls in lias districts, rare. Wall tops just past church, at Harbury! wall of farm, Green Lanes, near Wilmecote! Fenny Compton! Kineton! Fruit, Winter.

149.—*T. ambigua* B. and S. On walls and banks. Local in North Warwick, more frequent in South Warwick on lias soils. Walls between Nuneaton and Hartshill! near Arley Wood! Astley! Bearley! Harbury! Fenny Compton! Snowford, near bridge! &c. Fruit, Winter.

150.—*T. aloides* Koch. On clay banks and mud-capped walls, local. Clay banks, Bearley! Red Hill, near Alcester! near Stratford-on-Avon! walls near Nuneaton, with last species! Canal bank, near Olton! Marston Green! &c. Winter.

151.—*T. cavifolia* Schpr. *Pottia cavifolia b. gracilis* Wils. Local. Abundant on walls capped with lias mud. Fenny Compton! Harbury! March.

153.—*T. atro-virens* Sm. *Desmatodon nervosus* Br. and Sch., Wils. *Trichostomum convolutum* Brid., Berk. On marly banks in lias soils. On a marly bank on the Alcester Road, three miles from Stratford-on-Avon, December 1875. I only found a single tuft on this occasion, and have not since been able to find more. It is a remarkable moss to find so far inland. Winter.

154.—[*T. cuneifolia* Dicks. On banks in the coal measures. This species I have found near Halesowen, near Birmingham, on the coal measures fairly abundant. It may probably be found in similar soils in Warwickshire. There is no doubt as to the Halesowen plant. It has been submitted to Dr. Braithwaite, and was also pointed out by me to Dr. Fraser and Rev. J. H. Thompson. As this is a maritime species, its occurrence so far inland is remarkable.] Fruit April.

156.—*T. marginata* B. and S. On sandstone walls and the stonework of bridges, local. Sutton Park! Walls of Rowington Hall! Walls of Meriden Park! Sandstone walls, Guy's Cliff! Allesley! Milverton! May, June.

158.—*T. muralis L.* On walls. Very common in all districts I have visited.

Var. b. incana. A very hoary form, more rare than type; growing on the mortar of brick walls, canal bridges, near Bearley! Hatton! Wilmecote! Abundant on wall at Guy's Cliff! March, April.

Var. c. æstiva *Schultz.* On damp sandstone walls. On stone coping near Powell's Pool, Sutton Park! stonework of dam, Bracebridge Pool, Sutton Park!

Var. d. rupestris *Schultz*. On old walls and marly banks, more local than type. Canal bridge, near Shrewley Common! wall of farm near Rose Hall, Alcester! near Grafton, on banks! stone walls near Fillongley!

159.—*T. unguiculata* Dill. Walls, banks, fields, &c., in most soils, very frequent and very variable. Marston Green, &c.!

Var. b. cuspidata *Schultz*. On mortar coping walls near Hartshill! on lias banks near Wixford! December.

160.—*T. fallax* Hedw. Banks in marly and sandy soils, local. Shustoke, on railway bank! Marston Green, on railway bridge! Erdington, in old clay pits! Sutton Park! November.

163.—*T. rigidula* Dicks. Wall tops; more frequently in lias districts. Wall of churchyard, Ufton, near Southam! Harbury! near Henley-in-Arden! November.

164.—*T. spadicea* Mitt. *Trichostomum rigidulum* Wils., Berk. Banks and damp walls, local. Bearley! Red Hill, on lias soil on footways! Ballards Green, by Arley Wood! bridge near Henley-in-Arden! Always barren in these districts.

165.—*T. cylindrica* Tayl. *T. insulana* De Not. *T. vinealis b. flaccida* Wils. On banks, &c., rather local. Near Claverdon, on the way for High Cross! Sutton Park, Bracebridge Pool, and Druids Well!

166.—*T. vinealis* Brid. Banks and walls, rare. Wall of Milverton churchyard!

167.—*T. Hornschuchiana* Schultz. On the mortar and walls and on the ground in marly soils, local. Canal bridge, Shirley Heath! Bearley! lane near Fillongley! Yarningale Common! Ballards Green! Very rarely fruiting. Spring.

168.—*T. revoluta* Schwg. On the mortar of walls, not rare. Near Solihull! Fillongley! Shirley Heath! Bearley! Binton! Sutton Park! Shrewley Common! All in fruit. May.

169.—*T. convoluta* Hedw. On walls and waysides, local. Sutton Park! abundant on heathy places by Whitacre Railway Station! wall of cottage near Meriden Shafts! Railway bank, near Gravelly Hill! May, June.

171.—*T. tortuosa* L. On old walls, very rare. Somewhat sparingly on a canal bridge near Olton! I have not seen it elsewhere in the county, but have noticed it in the above station for ten years.

175.—*T. Brebissoni* Brid. *Tortula mucronata* Brid., Berk., Hobk. *Cinclidotus riparius, b. terrestris* B. and S., Wils. On roots of trees near rivers, rare. Banks of the Avon, near Bidford! in fine fruit on banks of Alne, near Aston Cantlow! on old bridge, near Holywell! near Henley-in-Arden! Fruit May.

176.—*T. subulata* L. On sandy banks, walls, and tree roots occcasionally. Near Oakley Wood! Copt Heath! Harbury! on walls Guy's Cliff! Packwood! Kingswood, Fillongley! May, June.

177.—*T. lævipila* Brid. On trees, sometimes on stone walls, not rare. Copt Heath! Rowington! Ufton! Edge Hills! Harbury! Binton! Oakley! Offchurch and Birdingbury! Milverton! Quarries near Warwick! May, June.

178.—*T. latifolia* B. and S. On roots of trees and woodwork near streams, rare. Wooden bridge and alders by stream near Holywell! on willow trunks, banks of Avon, near Bidford. Bridle road from Chadshunt to Drayton Bassett! Always barren.

179.—*T. ruralis* L. Thatched roofs, walls, &c., rare in North Warwick, frequent in South Warwick. Temple Grafton! near Oakley Wood on trees! wall by Chesterton Windmill! near Hartshill! Maxtoke Shustoke! Coleshill! Spring.

180.—*T. intermedia* Brid. *Tortula ruralis, b. minor* Wils. Wall tops and lias banks. Banks near Temple Grafton! walls Edge Hills Binton! Harborough Magna! Fillongley! Harbury in fruit! May.

181.—*T. papillosa* Wils. On trees and old pales, local. Old pales Olton Canal! foot-bridge near Holywell! on elms near Alcester Lodge! on ash trees Marl Cliff! abundant on elms between Alcester and Stratford! near Birdingbury! Marston Green! Always barren.

185.—*Ceratodon purpureus* L. Heaths, banks, walls, &c., very common in all the districts I have visited. May.

[TO BE CONTINUED.]

METEOROLOGY OF THE MIDLANDS.

THE WEATHER OF AUGUST, 1879.

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

Still another wet unsummerlike month! The frequent and heavy rains were only diversified by severe thunderstorms, and, with a maximum temperature hardly ever rising above 70°, it was difficult to realise that we were in what should be the hottest period of the year. The storms on the 2nd and 16th were very remarkable. The former gives us the maximum rainfall for the East Midland stations, and the latter for the West Midlands; at the Southern stations the 19th was the day of heaviest fall. About the storm of the 16th Mr. Davis, of Orleton, writes, "Another great storm of lightning and thunder set in on the afternoon of the 16th, and continued till after midnight, with great darkness and heavy rain till 8 P.M. on the 17th, producing great floods." The average temperature for the Midlands was 57°. The hay harvest was much interfered with, and along the Soar Valley (Leicestershire) a great quantity of mown hay was washed away by floods; the corn harvest had not commenced at the end of the month.

NATURAL HISTORY NOTES BY OBSERVERS.—*Alstonfield Vicarage.*—Haymaking still unfinished; many fields of grass still uncut. Oats showing little prospect of ripening. Swallow tribe are leaving unusually early; the Swifts left on the 11th, although a pair of these birds were seen flying rapidly to the southward over this house on the evening of the 23rd. The greater portion of the swallows seem to have retired from this part soon after the swifts. A few swallows and some house martins still remain here. The Painted Lady butterfly has been seen several times this season. *Shifnal.*—One Humming Bird Sphinx seen on 5th; several Painted Lady butterflies on and after 14th; a few Tortoiseshell, but not one Peacock. Gooseberry bushes stripped by the caterpillar; slugs and grubs still most destructive. Caterpillars of the Mullein moth (*Cucullia verbasci*) found feeding on *Verbascum virgatum*. *Spondon.*—*Lilium candidum*, which generally blooms towards end of June, only commenced flowering on August 3. Until the last week of August but few butterflies have been seen; now *Pontia brassicæ* is becoming plentiful. No wasps seen since very early spring. *Stroud.*—List of flowers and date of blossoming: 1st, *Linaria minor;* 4th, *Mentha sativa;* 7th, *Geranium dissectum*, Moneywort, *Potentilla reptans*, *Teucrium Scorodonia*, *Convolvulus arvensis*, *Circæa lutetiana*, *Sagittaria sagittifolia*, *Campanula glomerata*, *Sambucus Ebulus*, Goat's Beard, Bird's Nest, *Hypericum pulchrum*, *Epilobium angustifolium*, *Lithospermum officinale*, *Humulus*

Lupulus, Tamus communis, Erythræa Centaurium, Agrimonia Eupatoria, Filago Gallica, Nymphæa alba; 14th, Burdock, *Chrysanthemum inodorum, Sedum dasyphyllum*; 21st, *Convolvulus sepium, Lythrum Salicaria. Altarnun.*—The third very wet month in succession. As disastrous as 1860 for hay, corn, and "turf" (peat) harvests. A little corn cut in the last week; oats promising well; wheat and barley poor. No turf cut yet, and much hay still on the fields. Trees browning very early, especially sycamores.

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.	6·56	2·32	16	19	77·1	12	41·4	24
Stroud	S. J. Coley, Esq	5·39	1·62	17	18	73·0	13	46·0	30
SHROPSHIRE.									
Haughton Hall, Shifnal	Rev. J. Brooke	6·16	1·36	17	18	74·0	11 & 12	39·5	19
Whitchurch	A. B. George, Esq	8·48	3·42	17	19				
Woolstaston	Rev. E. D. Carr	6·23	1·05	16	22	72·0	28	43·0	9
Leaton Vicarage	E. V. Pigott, Esq	6·21	1·88	16	20	75·0	12	39·1	10
More Rectory, Bishop's Castle	Rev. A. Male	6·38	1·80	16	22	76·0	12	40·0	24
Larden Hall	Miss F. R. Boughton	5·59	1·53	16	20				
Bishop's Castle	E. Griffiths, Esq.	5·38	1·50	16	20	76·0	12 & 15	41·0	10
Cardington	Rev. Wm. Elliott	6·08	1·76	16	20				
HEREFORDSHIRE.									
Stoke Bliss	Rev. G. E. Alexander	7·04	2·00	16	17	75·0	12	41·0	31
WORCESTERSHIRE.									
Orleton, Tenbury	T. H. Davis, Esq	6·21	1·88	16	21	77·7	12	43·3	
West Malvern	A. H. Hartland, Esq.	6·85	2·02	16	21	80·5	12	43·5	30
Pedmore	E. B. Marten, Esq.	6·55	1·69	16	19	80·0	12	43·0	30
Longlands, Stourbridge	J. Jeffries Esq.	6·05	1·92	16	17	80·0	11	36·0	31
Dennis, Stourbridge	Mr. C. Webb	5·63	1·80	16	18	76·5	12	35·0	31
STAFFORDSHIRE.									
Thorganby Villa, Wolverhmtn	G. J. C. Broom, Esq.	5·31	1·35	17	20				
Dudley	Mr. J. Fisher	6·40	1·59	17	22	80·0	12	40·0	31
Sedgley	Mr. C. Beale	4·93	1·13	17	23	73·0	12	44·0	30 & 31
Kinver	Rev. W. H. Bolton	5·91	1·29	16	18	79·0	11	36·0	31
Walsall	Mr. N. E. Best	5·61	1·38	17	22	73·0	12	42·0	31
Grammar School, Burton	C. U. Tripp, Esq.	5·00	1·50	2	19	79·0	13	40·0	10 & 30
Weston-under-Lyziard R'tory	Hon. and Rev. J. Bridgeman	6·59	1·74	16	22	76·0	11	43·0	30 & 31
Wrottesley	E. Simpson, Esq.	5·36	1·56	16	17	76·8	13	43·0	31
Heath House, Cheadle	J. C. Philips, Esq.	7·26	1·61	17	19	74·0	12	44·0	30 & 31
Alstonfield Vicarage	Rev. W. H. Purchas	7·40	1·06	17	13	72·4	12		
WARWICKSHIRE.									
Coundon, Coventry	Lieut.-Col. R. Caldicott	5·20	1·17	2	19	76·0	12	42·0	31
Coventry	J. Gulson, Esq.	5·18	1·15	17	20	75·0	11	40·0	31
Bickenhill Vicarage	J. Ward, Esq.	5·59	1·15	17	19	72·0		43·0	
St. Mary's College	Rev. S. J. Whitty	5·47	1·46	2	19	75·8	12	44·2	30
Henley-in-Arden	T. H. G. Newton, Esq.	7·98	1·50	16	20	78·0	11 & 12	42·0	24
DERBYSHIRE.									
Stoney Middleton	Rev. U. Smith	5·53	·90	27	18	74·0	12	33·0	1
Fernslope, Belper	J. G. Jackson, Esq.	5·45	1·19	2	20	74·0	12	45·0	8, 10, 30
Linacre Reservoir	C. E. Jones, Esq.	4·23	·68	16	19				
Spondon	J. T. Barber, Esq.	5·46	1·12	3	21	70·1	12	35·0	31
Duffield	W. Bland, Esq.	6·24	1·39	2	18				
NOTTINGHAMSHIRE.									
Hesley Hall	B. J. Whitaker, Esq.	4·22	·80	3	21	77·0	12	43·0	9
Tuxford	J. N. Dufty, Esq.	2·79				70·0	4	41·0	31
Hodsock Priory, Worksop	H. Mellish, Esq.	3·53	·77	2	20	74·9	12	42·1	10
LEICESTERSHIRE.									
Loughborough	W. Berridge, Esq.	3·59	1·02	2	16	78·0	11	42·1	10
Ashby Magna	Rev. E. Willes	4·63	1·25	2	20	77·0	11	42·0	10
Market Harborough	S. W. Cox, Esq.	3·49	·92	2		72·0	15	34·0	31
Kibworth	T. Macaulay, Esq.	4·11	·81	2	20				
Town Museum, Leicester	W. J. Harrison, Esq.	4·01	1·16	2	19	75·2		43·5	8
Belmont Villas, Leicester	H. Billson, Esq.	3·92							
Syston	J. Hames, jun., Esq.	3·31	·94	2	19	84·0	13	43·0	10
Waltham-le-Wold	E. Ball, Esq.	3·95	1·86	2	16	74·0	11	43·0	8
Little Dalby Hall	G. Jones, Esq.	3·79	1·50	2	21	85·0	12	42·0	10
Coston Rectory, Melton	Rev. A. M. Rendell	3·67	1·30	2	21	72·0	12	37·5	8
NORTHAMPTONSHIRE.									
Towcester Brewery	J. Webb, Esq.	3·69	·87	19	16				
Castle Ashby	R. G. Scriven, Esq.	3·63	1·01	19	16	75·0	12 & 15	42·0	31
Kettering	J. Wallis, Esq.	2·95	·83	19	13	74·0	13	50·0	10, 30, 31
Althorpe	G. S. Groom, Esq.	3·38	·87	2	15	72·0	11	36·0	31
Pitsford	C. A. Markham, Esq.	4·21	1·00	2	16	80·0	12	42·0	9
RUTLAND.									
West Deyne, Uppingham	Rev. G. H. Mullins	2·87	·82	2	16	77·2	12	43·8	10
Northfields, Stamford	W. Hayes, Esq.	3·31	·74	16	15	80·0	15	36·0	10
Ratcliffe Observatory	H. R. Bellamy, Esq.	5·05	1·29	19	17	75·7	12	40·8	31
Ventnor Hospital	W. T. Ryder, Esq.	5·58	1·23	19	10	69·2	10	52·1	30
Altarnun Vicarage	Rev. J. Power, M.A.	8·00	·90	20	23	79·0	12	41·0	30

Correspondence.

Injurious Insects.—The whole of the gooseberry and currant bushes in this neighbourhood are entirely denuded of leaves by the larvæ of a sawfly. They are here in countless thousands. The bushes are dreadful objects, not a vestige of green left on them, but plenty of fruit. Other pests are abundant, but partial; but the gooseberry grubs are everywhere. —V. R. Perkins, Wotton-under-Edge, Gloucestershire, August 8th, 1879. (From the "Entomologist.")

Unsymmetrical Insects.—About five or six years ago, some friends of mine were butterfly catching on Boxley Warren, about 2½ miles from Maidstone, when they netted a specimen of the Common Blue *(Polyommatus alexis.)* The two wings on the one side of the body were of the usual bright blue of the male, while strangely enough the other two wings were brown, edged with red spots, exactly like those of the female. This insect, though sadly battered and in a bad state of preservation, is still in the collection of a friend of mine, of this town. There are, I believe, other instances of similar "unsymmetrical" insects on record.—Fred F. Grensted, Maidstone.

Bee-eater, &c.—In my late communication to you respecting the Bee-eater shot near Derby, I said that there were two shot. Since I wrote the second one has been purchased by a gentleman near Mansfield, and sent to me to be re-stuffed. It is now at my place, and I shall be willing to show it to anyone who may call. It may interest some of your ornithological readers to know that I have in my possession a young specimen of the Shag or Green Cormorant, *(Carbo cristatus,)* shot on the top of a factory in the middle of Nottingham, and also that two other specimens, both young, were caught alive in an adjoining street, and that a fourth was shot about two miles from where the others were got.—L. Lee, Naturalist, 26, Drury Hill, Nottingham.

Leptodora Hyalina.—This interesting and singular Entomostracan, whose capture in this country for the first time was recorded at page 225, has since been found in considerable abundance at Edgbaston Pool, near Birmingham, a fact which leads to the hope that it may be found in other localities. As Leptodora is making some little stir among the savans, and had the honour of being introduced to the British Association as a "distinguished stranger," it is only fair to say that its first captor was Mr. John Levick, one of the curators of the Birmingham Natural History and Microscopical Society, to whose ingenious devices for obtaining specimens, and keenness in detecting them, the members of the Society and others are indebted for this and many other interesting "finds."—Walter Graham.

Ornithological Notes.—We had several pairs of Wild Ducks breeding here this season. I was told of six nests in one double hedge. They were late, some of the nests having eggs in them the second week in May. The bulk of the Swifts departed on August 12th—two days later than last year. I saw a solitary one on the 22nd, but none since. I have heard several Nightjars this season; usually they are rare. Snipe arrived very early. I saw five on August 8th. Towards the end of that month about a score were seen, and on September 6th I saw over a hundred get up from one reed-covered meadow. Three procured were probably immature birds, being darker coloured than winter-killed specimens. On the same day I saw a Green Sandpiper on the banks of our stream—the Sorebrook. The Snipe were quite as numerous a few days ago. In changing to winter plumage the chin of the Pied Wagtail seems to be affected first. One I shot on the 7th inst. had the back very little changed, throat spotted with black, and chin quite white. Two observed on the 18th had the back lighter, and throat pure white. Our taxidermist showed me a specimen of the Grey Phalarope, killed on the Cherwell, in this parish, a few years ago. The occurrence of this little Arctic bird so far inland is, I think, noteworthy. It, however, I believe, visits our coasts every autumn on its migration. We have a great dearth of Blackbirds, Song Thrushes, and Robins, especially the last. Before the winter they were very plentiful, but one may now go for weeks and not see a Robin—the frost killed them off.—O. V. Aplin, Bodicote, Oxon, September 19th, 1879.

Remarkable Rainfall.—On the 2nd August there was a remarkable rainfall on the Clent Hills and at Halesowen, being 2·75in. at the latter place. This caused a flood on the Stour remarkable alike for its height and suddenness. It was almost all the red water coloured by the Permian clays of Clent Hills, as the branches of the river coming from the Dudley area were not much swollen. On the 16th the rainfall was more general, and measured nearly three inches over a large area, while near Hartlebury it was more than seven inches, and was thought to be a water-spout. From appearances observed over that district by residents at Wollaston, near Stourbridge, this certainly seems to have been the case, as a very dark black cloud was observed to descend quickly in a funnel-shaped mass to the earth, the lower end waving about in a singular manner. The havoc on the railway near Kidderminster, and the bursting of Stone and Spennels Pools, cutting up a turnpike road with a deep trench across it, showed plainly a most unusual and concentrated rainfall. One garden and orchard, rather hemmed in by a railway and natural embankments, was filled up, the water remaining for days half-way up the lower storey of the house and up to the lower branches of the trees, as there was no outlet for it.—E. B. Marten, Pedmore, near Stourbridge.

Remarkable Egg.—On collecting the eggs from my hen roost on 2nd September last, I found in one of the nests an egg with a perfect shell, but of a very small size, scarcely, if at all, larger than a robin's or house sparrow's egg. The surface was very rough, being dotted over irregularly with projecting lumps of calcareous matter. I tried to blow it with my mouth, in the manner common to school boys, but could not force through the hole a drop of anything, and on rubbing the pin on my finger could find no trace of moisture. I dropped it into a glass of water, when it sank like a stone, without even a bubble of air escaping through the holes. I then cut it open with my knife, and found it filled with a globule of extremely tenacious glairy albumen, without a vestige of yolk. I have the impression that when an ovary is removed from a hen it is usually found to contain a large number of immature eggs, varying in size from a small pea to the full size of the yolk of a perfect egg, and that the substance forming such immature eggs is the yolk. Further that the white of the egg is formed over and around the yolk after it has become detached from the ovary and during its passage through the oviduct, and that finally the shell membrane and shell are deposited over all. Such being the normal order of development, is it not remarkable that a globular lump of albuminous substance, resembling as closely as possible one of the little transparent jelly fish frequently found on the sands at Scarborough, and not surrounding a yolk, should become coated with membrane and shell, and be laid in the usual nest as if it had been a perfect egg? When a hen lays an egg without a shell she usually avoids the nest and drops the egg anywhere, but in this case she was evidently prompted to seek the nest, as though she were going to lay a proper egg. I may say that I have a mixed lot of fowls, but I believe this egg was laid by a white Brahma.—Chas. L. Rothera, Beeston, Notts.

Gleanings.

An Exhibition of Apples and Pears has been arranged for by the Pomona Committee of the Woolhope Club, to be held at Hereford on October 29th and 30th. The Hon. Secs., Messrs. J. R. Symonds and H. C. Moore, will forward schedule of prizes on application to them, at the Free Library, Hereford.

Gilchrist Lectures.—Through the exertions of the Rev. J. Page Hopps, a course of six lectures, in connection with the Gilchrist Trust, will be delivered in the Temperance Hall, Leicester, on Wednesday evenings, commencing October 1st. The lecturers announced are Profs. Martin Duncan and Williamson, Dr. Carpenter, and Mr. Proctor. The charge for admission is one penny to each lecture.

Phosphorescent Sea-weed.—During a recent stay at Barmouth I found on a dark night a mass of sea-weed, recently left by the receding tide, which was most beautifully phosphorescent. On taking up a piece of the weed and rubbing my hand gently along it the phosphorescence became still more luminous, and the luminosity remained for fully half an hour. The smell of phosphorus was also most perceptible. On getting to my lodgings I found the weed covered with Sertulariæ, and I imagine the light-giving *Noctiluca miliaris* had adhered in great numbers to the horny dwellings of the hydrozoa, though I was not able to find it.—E.

Mr. Bolton's Studio.—At the Sheffield meeting of the British Association, Sir J. Lubbock, Bart., M.P., F.R.S., read a paper on the rare and interesting species of Entomostraca, *Leptodora hyalina*, new to this country, which had been recently found near Birmingham. He said he had received the specimens from Mr. Bolton, of Birmingham, and took the opportunity of acknowledging the valuable aid that Mr. Bolton was rendering to microscopic enquiries by sending numerous specimens by post by means of his excellent plan of little tubes, giving great pleasure to his corresdondents, and important aid in spreading the knowledge of many rare and beautiful objects. Professor E. Ray Lankester, F.R.S., speaking upon Sir John Lubbock's paper, said he was very glad to add his testimony to the value and excellence of the work Mr. Bolton was doing in the supply of living microscopic objects. He sent regularly by post to his subscribers, for a very moderate subscription, a numerous supply of living objects in little tubes; and their value and interest were much increased by lithographed descriptions and drawings of the objects that were sent with them. He hoped this excellent plan would receive the support of microscopists generally, to enable Mr. Bolton to keep up so desirable a work. He also remarked that through Mr. Bolton's agency he had seen many interesting objects which otherwise he would not have seen. Mr. Bolton informs us that since his last report (page 213) he has sent out to his subscribers, in addition to the two new Entomostraca figured last month, (Plates IV. and V.,) some marine Infusoria, *Kondylostoma patens; Vaucheria*, one of the fresh-water confervoid Algæ, in an early stage; the interesting clustered Rotifers, *Conochilus volvox* and *Lacinularia socialis;* the Pitcher Rotifer, *Brachionus urceolaris*, and the large Entomostracan *Sida crystallina*—all accompanied by drawings and descriptions. Mr. Bolton has found *Lacinularia socialis* and *Cristatella mucedo* lately in great abundance.

George Henry Lewes Studentship.—This Studentship has been founded, in memory of Mr. George Henry Lewes, for the purpose of enabling the holder for the time being to devote himself wholly to the prosecution of original research in physiology. The Studentship, the value of which is slightly under £200 per annum, paid quarterly in advance, is tenable for three years, during which time the student is required to carry on, under the guidance of a director, physiological investigations to the complete exclusion of all other professional occupations. No person will be elected as a "George Henry Lewes Student" who does not satisfy the trustees and director first as to the promise of success in physiological enquiry, and second as to the need of pecuniary assistance. Otherwise all persons of both sexes are eligible. Applications, together with such information concerning ability and circumstances, as the candidate may think proper, should be sent to the present director, Dr. Michael Foster, New Museums, Cambridge, not later than October 15th, 1879. The appointment will be made and duly advertised as soon as possible after that date.

American Predictions of Coming Storms.—Much curiosity has been excited as to the method by which notices of storms travelling eastward over the Atlantic have been telegraphed from New York to the London office of that enterprising paper, the *New York Herald*. Eminent meteorologists have pointed out that it is long odds against a storm leaving the American coast at any date preserving its character and direction unchanged across the 3,000 miles of ocean which it would have to traverse before reaching this country. But it seems to have been forgotten that swift ocean steamers are continually proceeding from Europe to America, arriving at New York a little before an ordinary cyclone, which they met with say in the mid-Atlantic, could reach England. These steamers are probably boarded immediately on their arrival in America by the agents of the *Herald*, their logs overhauled, any storms through which they passed are examined in connection with those which have left the American shores some days previously, and from the information so gained telegrams are prepared and sent off. There can be no doubt but that if it were possible to maintain some five or six ocean stations—lightships of some kind—at distances of from 100 to 500 miles west of Ireland, and in telegraphic communication with our coast, our Weather Office could accurately foretell every storm approaching us from that direction. Whether it will be possible to fix and maintain such stations is a question for our inventors.

Mr. Marsden's Natural History Agency.—No branch of Natural History has made greater advances within the past few years than that which deals with the relationships of the faunæ of different countries, and the attendant phenomena of variation or similitude. The studies of Ornithology and Entomology specially lend themselves to this branch of enquiry, and as a consequence of the greater attention paid by critical students to this subject there has sprung up a considerable branch of business devoted to the sale or exchange of rare and foreign birds and their eggs; and insects and their larvæ. The advantages of a well-conducted agency of this nature must often have been experienced by those who may have had occasion to work out special groups, or to institute comparisons of allied forms of birds or insects. We have recently had an opportunity of visiting Mr. H. W. Marsden, of Gloucester, who has for many years conducted such an agency with a gradually-increasing amount of success and a proportionately-enlarging sphere of usefulness. We have been much interested in his extensive stock of rare birds, eggs, and insects from all parts of the world, but more especially from those regions which Mr. Sclater has named the *Palæarctic*, embracing Europe and Amurland. Mr. Marsden spares no pains to secure examples of newly-discovered species. His correspondents include dealers, amateur collectors, and men of science in every part of Europe and America; and a new species, which may turn up in Lapland or in Syria, soon finds its way to his cabinets. It is only by extending such a business to its widest limits that low prices and the highest facilities of exchange are secured. So far as we can judge from an experience of many continental houses, Mr. Marsden offers his *clientéle* exceptional advantages. Our space does not permit of our mentioning other objects which form part of his business, but we can cordially recommend any one interested to pay him a visit.

Reports of Societies.

BIRMINGHAM AND MIDLAND INSTITUTE SCIENTIFIC SOCIETY. —August 4th, Excursion to Habberley Valley, &c.—August 23rd, Excursion to Maxstoke.—September 10th, seventh Annual Meeting was held in the Council House. There was a large attendance of members. The President (Mr. R. Birbeck) in the chair. The report gave an encouraging account of the present state of the society, the number of members being 134. During the past year fifteen papers have been read, and eight excursions made to places of interest. By subscription and a grant to the committee a first-class binocular microscope had been purchased for the society. The Librarian reported that fifty vols. had been added to the library, and 760 books issued during the year. The report was unanimously adopted, and a vote of thanks passed to the officers and committee for their services during the year. The following elections were then made:—Mr. C. J. Watson, president; Mr. R. Hipkiss, vice-president; Mr. C. R. Robinson, treasurer; Mr. G. Patchet, librarian; Mr. W. H. Cox, hon. sec. At the conclusion of the formal business, the retiring President, Mr. Robert Birbeck, gave a short history of the society from its commencement in 1872 to the present time. The society, he said, had now completed the seventh year of its existence. Its formation was initiated by Mr. C. J. Woodward, and a preliminary meeting was held in October, 1872, attended by about six students in the science classes, and the result was the establishment of a society which had been of inestimable advantage to Institute students, especially where valuable works on science were needed for reference. About 60 papers had been read before the society during the period mentioned, and these had been listened to by large numbers of members. About forty excursions had been organized and successfully carried out, and the library of the society, which at first only mustered about 33 books, has now the very best works on scientific subjects which are in existence, and numbers 393 volumes. In its second year the society organized a movement amongst the students of the Institute for the purpose of augmenting the Institute Building Fund, and the sum realised was £173 13s., and during the year just ended an effort was made by the members, under the guidance and management of the society, to assist the fund being raised for the restoration of the Free Libraries, when the very handsome sum of £205 was collected. In addition to this the Society had just purchased a very excellent microscope for the use of its members. The Society had been prosperous, for its managers had kept steadily in view the prime object of its founders, the assisting by every reasonable means of Institute students, and when the inexpensive character of the society is considered—only 3s. a member per session—it must be a cause for surprise and regret that its numbers—now 140—are not doubled. Why should not the society gather to itself the members of the literature and language classes, and its library become proportionately enhanced in its range, and thus become what some at least wish it to be a truly representative society of the Institute students? May the present committee have this under serious consideration, and see if something cannot be done soon to bring about so desirable a state of things. At the conclusion of the address, a hearty vote of thanks was passed to Mr. Birbeck.—September 17th, the President exhibited a collection of minerals and fossils from Castleton, Derbyshire.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—MICROSCOPICAL GENERAL MEETING.—August 19th. Mr. T. Bolton exhibited an alga, supposed to be a young state of *Enteromorpha intestinalis* which had appeared in one of his aquaria. Mr. J. Levick exhibited *Lacinularia socialis* and *Plumatella repens*, from Barnt Green; Mr. W. H. Wilkinson *Parnassia palustris* and *Pyrola rotundifolia*, from Southport; Mr. J. W. Cotton sent for exhibition a specimen in spirits of *Loligo vulgaris*, the Squid, from Barmouth; Mr. W. Graham exhibited *Argulus foliaceus*, from Spurrier's Pool. GEOLOGICAL SECTION.—August 26th. Mr. W. Southall exhibited a number of plants from the West of England, including *Bartsia viscosa*, *Brassica nigra*, (wild,) *Verbascum virgatum* and *V. nigrum*, *Scirpus maritimus*, *Radiola millegrana*, *Arenaria rubra*, and *Glaux maritima;* Mr. W. B. Grove two of the beautiful caterpillars of the Vapourer moth, *(Orgyia antiqua;)* Mr. W. H. Wilkinson specimens of several species of *Libellula*; Messrs. Caldwell and Butterfield specimens of *Bromus asper*, *Corydalis lutea*, &c.; Mr. C. J. Watson microscopic sections of a boulder from the drift at the Pleck cutting, near Walsall. He also exhibited the printing apparatus called the Scriptograph, (see page 235.) GENERAL MEETING.—September 2nd. Mr. W. B. Grove contributed *Raphidia viridis* from Sutton Park, and an embryo snail, showing pulsation of the heart, and ciliary action on the foot. Mr. H. E. Forrest exhibited a goldfish from the aquarium at the Aston Lower Grounds, having two tails, united together along their upper edges in the shape of an inverted V; Mr. Montagu Browne the femur and part of the tibia of the extinct *Dinornis* of New Zealand; Mr. J. Levick a supposed new species of Rotifer. BIOLOGICAL SECTION.—September 9th. Mr. W. Graham announced that the rare Entomostracan *Leptodora hyalina*, recently found by members of this society at Olton, and not before recognised in England, had been again taken in enormous quantity in Edgbaston Pool, on occasion of the visit of the members, by dipping to a depth of about four feet from the surface. He also exhibited a new form of portable microscope, manufactured by Mr. Parkes, of this town, and possessing the essential points of a good instrument at a very moderate price; also, a compressorium of improved construction, ensuring actual parallelism of the two surfaces. Mr. Bolton contributed *Ophrydium sessile*, *Leptodora hyalina*, *Hyalodaphnia Kahlbergensis*, *Alcyonella fungosa*, *Plumatella repens*, and *Spirogyra Mülleri*, all from Edgbaston Pool.

NOTTINGHAM NATURALISTS' SOCIETY.—September 3rd. A special general meeting was held to consider several subjects of special interest to the society.—September 17th. There was a discussion on the origin, extent, and chemical composition of the Magnesian Limestone. The debate was commenced by the Hon. Sec., who gave a description of the Permian rocks generally, particularly with regard to the character of the red sandstones and marls, of which a great variety were exhibited from the cutting of the Bennely and Bulwell Railway, together with about 100 specimens of fossil teeth from the caves of Cresswell Crags. Votes of thanks were awarded to the Hon. Sec. for his address, and to Mr. Bull for his assistance in procuring the rock specimens.

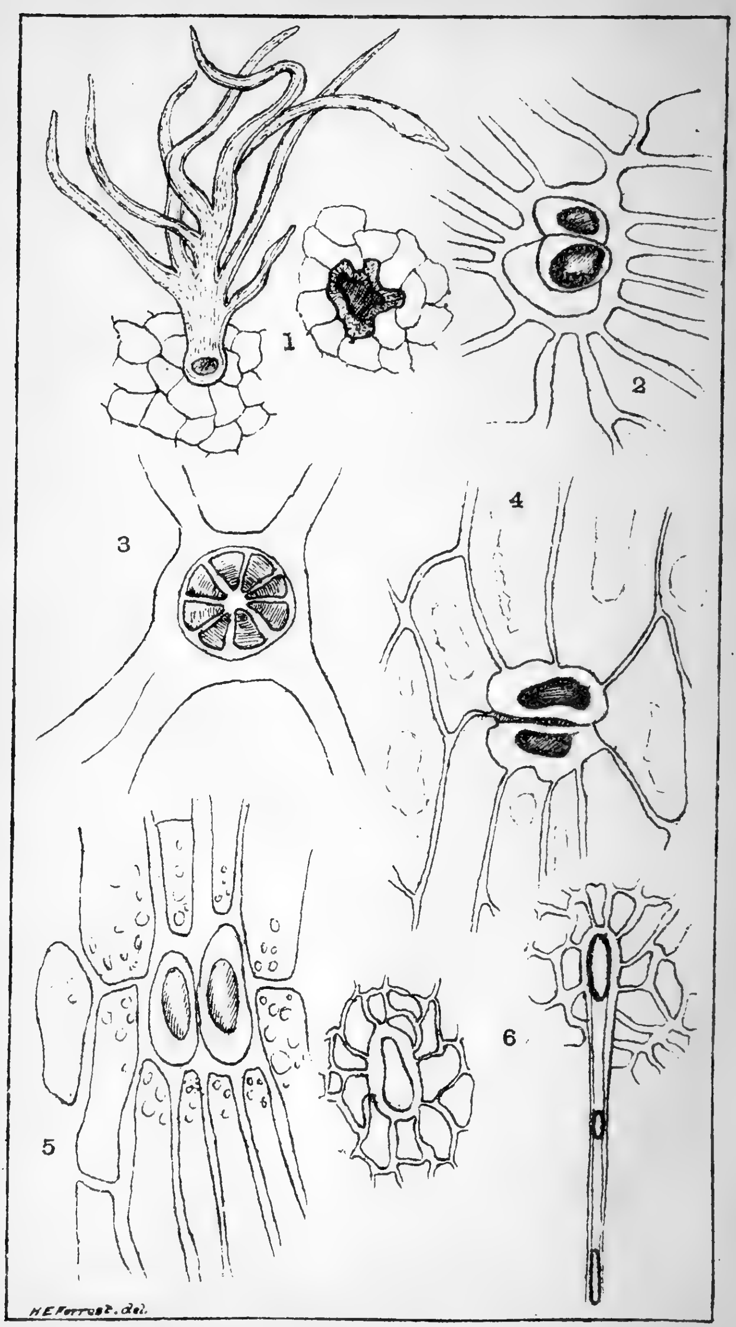
OSWESTRY AND WELSHPOOL NATURALISTS' FIELD CLUB AND ARCHÆOLOGICAL SOCIETY.—The fourth excursion took place on Thursday, September 4th. The day was fortunately fine. The members and friends met at Whitchurch, and walked first to Pan Castle, a flat-topped mound of some size, and nearly square, with a moat round it. It was probably a fortified place of considerable strength; the country on one side being low and marshy may have formerly been under water, or could possibly be submerged; while on the other side, where the ground is higher, there is a deep ditch cut, at a little distance from the mound, probably used as a hiding place for the defending garrison. From Pan Castle the route lay by Iscoed Park and Wolvesacre Hall, (where there is a portion of an old moat,) and then along the Wiches Brook, which divides Flintshire from Cheshire, past one of the Salt Springs. It is a round pit, two or three yards across, and close to the brook side, into which the overflow runs. The water of the spring is very salt indeed, and the edge is white in places with a thin incrustation of salt. It is not used now. The party then left the Wiches Valley, and proceeded along a Roman road to Malpas, said to have received its name in ancient times from its bad roads. There they did justice to an excellent tea at the Wyvern Hotel, and then visited the church. It is a handsome Perpendicular structure, much needing restoration, with some very fine and beautifully preserved monuments with recumbent figures in alabaster in each of the chancel aisles. The chief botanical finds were *Parnassia palustris* (Grass of Parnassus) and *Mimulus luteus*, growing in a bog between Whitchurch and Malpas. A resolution of congratulation to the President of the Society, the Bishop of Bedford, on his advancement to the Episcopal dignity, was passed, with deep regret at his retirement from the Presidentship.

WOOLHOPE NATURALISTS' FIELD CLUB.—August 29th. The fourth field meeting of this club was held on the Radnorshire Hills, near Hay. Mr. E. H. Cheese, of Hay, kindly undertook to pioneer the party, and from his local knowledge was enabled to afford much information to the club. After crossing the Wye by the fine iron bridge at Hay, and passing the picturesque village of Clyro, the party arrived at Court Evan Gwyn, where the remains of an old border fortalice were examined. Thence, ascending the steep sides of Clyro Hill, a magnificent view was obtained of the surrounding country. The plain of Herefordshire, bounded by the Malvern and Clee Hills on one side, and the valley of the Wye lying beneath, with its grand background of the Black Mountains and the Brecon Beacons on the other hand, formed a panorama that will not readily be forgotten, and was thoroughly appreciated by the party, one of whom exclaimed, "Call this Italy, and the whole world would come to see it!" A descent was made into the valley where the well-known bog of Rhos Goch lies. After visiting the site of another stronghold of by-gone days the party separated—some going to explore the bog, and the others up a steep hill to Bryngwyn Church. Here, at this quaint old Welsh church, the party were courteously received by the incumbent, the Rev. J. Hughes. The church has been recently restored. There is an interesting old cross in the church-yard, and what appears to be the cover of a stone coffin or tomb let into the wall of the porch; a very old yew is standing near the cross. A gold coin, supposed to be a Burgundian noble of the fourteenth century, was found in the earth of the floor of this church when it was being repaired; the coin belongs to Mr. F. Banks, who had kindly sent it for exhibition; it is in fine preservation, and was an object of great interest to the members. The route afterwards lay along the valley to Painscastle. A halt of a couple of hours was made here, and the site of the old castle was visited. Several very interesting botanical specimens were found at Rhos Goch Bog, including *Triglochin palustre*, *Utricularia vulgaris*, *Lastrea Thelypteris*, and the Royal fern, *Osmunda regalis*. After a delightful drive over the Begwyn Hills, the party arrived at Hay, where they dined at the Crown Hotel. Subsequently, after the ordinary business of the Club had been transacted, Mr. Cheese read an interesting paper on Painscastle. A botanical paper was read by Dr. Holmes, of Leominster, on "The Uses of some Wild Plants."

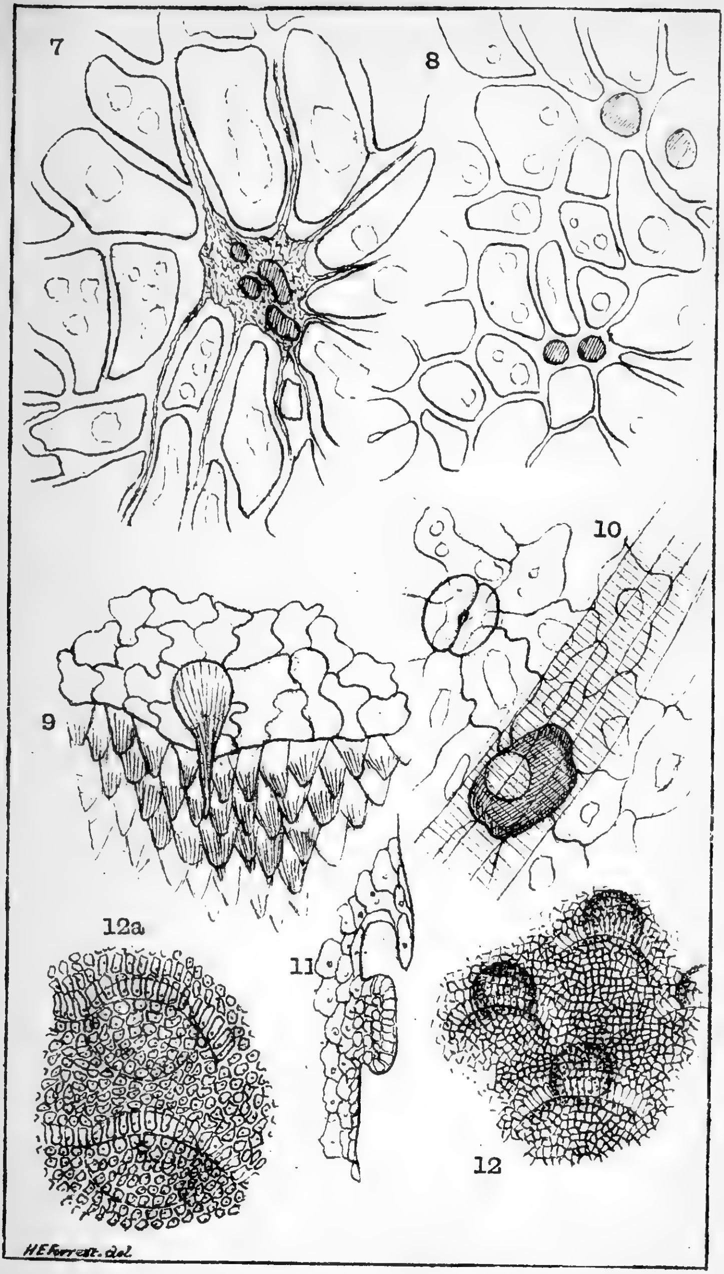
EXCHANGE.

ANSWER TO CORRESPONDENT.

H. F. Devis.—Your plant is one of the sub-species of *Fumaria capreolata*—I think the more rare sub-species, *Fumaria muralis* (Sonder.) It is difficult to decide these plants from dried specimens.—J. E. B.



Structures of Pitcher Plants, &c.



Structures of Pitcher Plants, &c.

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.

The following notes comprise a series of jottings on the structures of these interesting plants, made whilst I was investigating, at the suggestion of Mr. Darwin, their digestive powers. Some of the observations are, I know, not new, and others I am equally certain will not be admitted without further corroboration. They were made at a time when leisure was more abundant to me than it is now, and I may therefore be excused if I say that I am not likely to travel over the ground again, and shall therefore leave any corrections which may be necessary to be made by future observers.

Mr. Darwin was the first to use the term "quadrifid" to describe certain structures inside the pitcher, which I think he shows are associated with the process of absorption. The term is a very useful one, and I have adopted it, and modifications of it, to describe certain epithelial structures which are of very frequent and constant occurrence in pitcher plants. They consist merely of modified epithelial cells, the walls of which are lined with a thin layer of protoplasm and divided into arms, so that the cell is composed of a set of branching tubes, conducting to one stem, in which is placed the cell nucleus. The number of arms is very various, and therefore I generally speak of these bodies as multifids. They are most numerous, and are most fully developed on the outsides of pitchers covered by the lid from the access of rain, and they are especially large and numerous on those parts of the pitcher where water is most apt to lodge. Thus, in a pitcher of a young plant of *Nepenthes Rafflesiana* they are largest at the point where the stem bends at the base of the pitcher, and in the curvature; the spot where of course water would be longest in evaporating from the surface of the pitcher. Over the general surface of the pitcher they are much smaller, and indeed are mostly to be found only as aborted buds. (Plate VII., Fig. 1.)

In the reversed coriaceous pitchers of an old plant *(N. Rafflesiana)* they are often to be found only as buds slightly raised above the general

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REFERENCES TO PLATE VII.

Fig. 1.—Multifid and bud from *Nepenthes Rafflesiana.*
Fig. 2.—Included gland, *Drosera rotundifolia.*
Fig. 3.— „ „ *Pinguicula alpina.*
Fig. 4.— „ „ *Sarracenia flava.*
Fig. 5.—Ostiole from pedicel of *Drosera* gland.
Fig. 6.—Tubular trichome from fourth zone of young pitcher of *Sarracenia purpurea.*

REFERENCES TO PLATE VIII.

Fig. 7.—Glandulous lacuna infested with fungous growth, *Sarracenia rubra.*
Fig. 8.—Nucleated lacunar expansion from lip of *Darlingtonia.*
Fig. 9.—First and second zones of *Sarracenia purpurea,* showing sudden transition.
Fig. 10.—Nectaries of *Darlingtonia.*
Fig. 11.—Secreting gland of *Nepenthes distillatoria,* in section, showing the hood.
Fig. 12.—Ditto, at upper part of glandular zone.
Fig. 12A.—Ditto, at lower part of glandular zone.

epithelial surface, and not dipping under it. Their contents consist of light brown protoplasm lining the walls, somewhat viscid, and within that a more fluid and slightly darker substance. When a piece of the pitcher on which they are situated is snipped off they rapidly shrivel, and the arms separate. But if a drop of water be placed on the fragment and then gently shaken off it will be found that while it does not adhere to the general surface, some of it has been retained by the arms, which have gathered together, just like the hairs of a brush wetted with water, and in a few minutes they become quite plump.

When this experiment was performed with water containing phosphate of ammonia (after Darwin's plan, but not with such extremely dilute solutions,) the protoplasm was found in some instances, but not in all, to become turbid and to separate into ill-defined masses, and the nucleus went through slow changes in outline. Decaying or digested animal matter did not, in any of my experiments, produce these changes. The distribution of these structures, which will be given more in detail when speaking of individual pitcher plants, and the result of my experiments induce me to believe that they are absorbents of water and such nutrient material as may be dissolved in water without special preparation.

In certain pitchers the multifid buds, instead of appearing wholly above the epithelial surface, are seen to dip partially under it, and this may be seen in favourable instances to advance till the epithelium almost meets over the top of the bud. In this case the protoplasm of the bud may be seen marked by distinct divisions, varying in number from two to nine, the latter being the largest number which I have seen. These divisions of the cell seem to send up processes which appear at the surfaces between the interstices of the epithelium, and such modifications are generally associated with a peculiar system of intercellular canals to be afterwards described. This involution of multifid buds is seen in many surfaces, but it is especially associated with the absorption of decayed or digested animal matter. When the epithelium completely covers these structures I propose to call them included glands, for similar, if not absolutely identical glands, are found in the tissues of many plants, some of which are already known as digesters, (Drosera, Fig. 2, Pinguicula, Fig. 3,) whilst others are not suspected to have such functions.

Dr. John Lindley described these structures in Nepenthes as long ago as 1848, and Mr. A. W. Bennet has also described them in Drosera and Pinguicula under the term *ganglia*, but without entering into any explanation of their function. ("Popular Science Review," Oct., 1875.) In very many cases where they are included they may be seen to occupy lacunar enlargements in the system of intercellular canals, and even where no such canals can be seen they occupy the spaces between the large cells of the parenchyma (as in Pinguicula) in a position where their aid would be almost as effectual. In some cases, as in the lids of some Sarraceniæ (rubra and flava, see Fig. 4) and in the pedicels of Droseraceæ, they have intimate relations with the intercellular canals without being included by the epithelium, and then I give to them the name of *ostioles*. On the pedicels of the Droseraceæ they are seen to be papillary in some instances. (Fig. 5.) These ostioles never have air bubbles in them as the stomata invariably have, unless they have been removed by maltreatment; and they are smaller than stomata, being ·035mm. in their largest measurement, whilst the latter are almost uniformly ·05. Cells do not radiate from stomata as they do from ostioles. Their relations to other parts, their special distribution, and the fact that I have seen their contents undergo changes when the fragment of leaf has been bathed in a solution of phosphate of ammonia, and once in the case of *Drosera intermedia*, when the leaf was bathed in a solution of peptone, the result of digestion in a Nepenthes pitcher, make me certain that their function is the absorption of the food of the plant.

Another variety of epithelial absorbent is the tubular trichome found in certain pitchers. It is always associated with a system of intercellular canals, and seems really to be developed from the protoplasm contained in these canals more than from a cell, the cell wall apparently going to constitute the lining membrane of the tube, its protoplasm disappearing. At the upper side of the margin of the base of the trichome its protoplasm can be seen to be continuous with that of the intercellular canals; and in the growth of the hairs this can be seen to be deepening in colour and increasing in quantity at the lower part, so as to form the process of the trichome. This observation can be best made at the lower part of the fourth zone of a young pitcher of *S. purpurea* (Fig. 6.) At the free extremity of these tubular trichomes there must be a true stoma, though I cannot pretend to have seen it. But I have seen a bubble of air enter at the extremity of the tubule, and I have traced its slow passage, coincident with the shrivelling of the fragment examined; and the air bubbles may be made to alternate with short columns of water by alternately wetting and drying the surface.

The systems of intercellular canals to which I have referred are best seen on such surfaces as absorb digested food. Thus on the inner surface of a Nephenthes pitcher examination by high powers will demonstrate these canals beyond dispute. They are walled and contain protoplasm, for its columns may be seen broken at irregular spots. They are undoubtedly absorbents, for I have repeatedly satisfied myself that they were larger in pitchers which had been fed, had digested and were absorbing their food, than they were in virgin or starved pitchers of the same plant; and the fact that the tubular trichomes of Sarracenia are developed from the protoplasm contained in these canals is a further argument in favour of this view. The most complete proof of the actual existence of these canals is to be obtained from diseased epithelial surfaces where fungous growth is found to be extending into them from an ostiole and distending them. In several pitchers of *S. flava* and also of *S. rubra*, I have found the ostioles so infected that their characteristic protoplasm had been destroyed, but their canals were so dilated that the connecting systems between the ostioles could easily be traced and canals could also be seen dipping deeply down into the parenchyma of the lid. The appearances seen strongly reminded me of the effects of a poisoned wound of the finger upon the superficial lymphatics of the forearm. (Plate VIII., Fig. 7.)

In the lip of Darlingtonia I have seen them with nucleated lacunar expansions (Fig. 8) quite identical with similar appearances which I have already described in the human umbilical cord, (Proceedings Roy. Soc., No. 163, 1875.) In many cases, however, they do not possess distinct walls, but seem to be mere tubular interspaces between cells.

The last structure found in pitcher plants to which I shall make special reference is the secreting gland. These are limited to the Cephalotus and Nepenthes. In the former they are buried in a pit excavated in the parenchyma and lined by epithelium. They are constructed of modified epithelium, arranged very much like the elements of the glands of the Drosera and Dionæa as described by Darwin. They are probably also absorbents, their two actions alternating; but of this I have no evidence save the analogy with the glands of Drosera.

[TO BE CONTINUED.]

SCIENTIFIC NAMES.—II. PRONUNCIATION.

BY W. B. GROVE, B.A.

(Continued from Vol. I., p. 152.)

The rules concerning the pronunciation of words come under two heads, (1) as to the sound of single letters, (2) as to the syllable upon which the accent falls. Upon the second head, in the case of Latin, at least, there is very little difference of opinion, but with regard to the first the ideas of many persons are in a transition state. The old-established idea was that each nation should follow the precedent of *its own* language in determining the sound of the various letters in Latin words. But, though this was the theory, the practice, at least among ourselves, was very different, and the accepted model was a combination of diverse styles, together with a little of no style at all.

In the case of scientific nomenclature the confusion is worse confounded on account of the medley of sources from which it is derived. Sometimes when a native name of a plant or animal formed part of the scientific name, or when some discoverer with an appellation full of unclassical consonants and diphthongs was to be immortalised, an attempt was made to diminish the incongruity by Latinising the word on the same principle on which the Romans themselves converted the words which they adopted from other nations, as when they changed Caradoc into Caractacus. But this is seldom done now, and the practice sometimes leaves the original form of the altered name uncertain, and thereby fails after all to immortalise anybody in particular. No apology is now thought needful for placing a word which is pure Greek side by side with one which is pure Javanese, *e.g.*, *Strychnos Tieuté*, a tree which grows in Java. The old principles will no longer suffice, and any change will most likely be in the direction in which opinion now seems to be tending, viz., that, when we borrow the words of a foreign nation, we must borrow the pronunciation too, however unlike that may be to our own. This is done to some extent already, and if we once adopt the principle we shall have no tenable ground left for refusing to apply it to the classical tongues. I will proceed to indicate the chief points in the "old" pronunciation of Latin. Besides giving a number of the ordinary rules, I have also endeavoured to investigate the truth about some cases in which I believe the common practice or belief to be faulty.

One most important point to be remembered is that *every vowel must be pronounced;* there are no silent vowels—thus, *vulgare* has three syllables, *Cardamine* and *Trichomanes* four each. The final syllables of such words have the sound of the final syllables of the words *duty* and *duties.* It is sometimes indicated in books by accenting the letter, thus *é* or *è* or (less properly) *ë.* Another point is that each of the vowels can be either long or short; this is called its "quantity," and is marked in all the dictionaries, in every case where it is required, by the signs ¯ for long and ˘ for short. The usual sounds of the vowels are given in the following pairs of words:—

Băn, bāne; mĕt, mēte; pĭn, pīne; cŏn, cōne; tŭn, tūne; cy̆st, cȳme.

It is a general rule that one vowel immediately preceding another is short; in this case the quantity need not be marked. Thus Glădiŏlus will be found marked as given; the *i* is short by position, as it is called, before the *o*, and the word if fully marked would appear as Glădĭŏlŭs. From this rule we must except all cases where the vowel preceding represents either of the Greek long vowels *ē* and *ō*, or diphthongs, which are necessarily long. So the *o* in Polyzōa is long, and the *i* in Conium, (Gr. *koneion*, "hemlock,") as also in many other words in *-ium*, which custom, however, seems to permit us to pronounce short.

When it is said that all vowels must be pronounced separately, of course the case of two vowels forming a diphthong is excepted. The chief diphthongs occurring in true Latin words are these five:—æ, œ, (both pronounced like *e* in *mēte*,) au, ei, and eu, (pronounced as in *laud*, *height*, and *Europe;*) in Greek there are the additional ones *αι* and *οι*, represented by the first two of the above five, (with a few exceptions, as in *dioicus* and *Aira*,) and *ου* represented by *u*. (See "Midland Naturalist," Vol. I., p. 152.) Consequently, whenever in words formed from true classical sources we have any two vowels coming together which are not among the above-mentioned five, we may generally conclude that they do not form a diphthong, and must be pronounced separately. For example, Eözoön, Aïzoön, Hypecoüm, bromoïdes, each of which consists of four syllables; aïzoïdes, conoïdeüs, pyrenaïcum, each five; and hiëracioïdes, seven. Sometimes, even the five combinations first mentioned are not diphthongs, *especially when they come at the end of a word*—as Hippophaë, Hierochloë, Isoëtes, Silaüs, Nereïs, Rheüm, Heracleüm, gramineüs, &c. It should be noticed that *u*, standing between *s*, *q*, or *g*, and a vowel, is pronounced like *w* in English; thus *suecicus* begins like *sweet*, and so with Suæda, Quercus, Lingua, &c.

The consonants, in the old style, are pronounced almost exactly as in English, even to the extent of giving *ti*, *si*, and *ci*, in such words as

Spartium, Blasia, and Vicia, the peculiar sounds which occur in the respective English words, nation, occasion, and vicious; this, however, is not always done, and I shall have more to say on this point hereafter, as also on the habit of not pronouncing the initial consonant in such words as Pteris and Psamma. *Ch* is always hard, as in monarch, *e.g.*, Chara, Chelidonium, Colchicum, and *j* must be sounded like *y* in a few words, viz., Leucojum, Thuja, Najas, Epigejos, majalis, &c. The *j* here, in fact, is only a misleading way of writing *i*, as may be proved by the derivation; *e.g.*, *Convallaria majalis* is the lily "of May," *maialis*. These words are sometimes written Leucoïum, Thuya, &c., and it would be better to do so always. It will be seen hereafter that the sound which we are compelled to give to *j* in these cases is that which, in the "new" style, is given to it in every case.

In determining upon which syllable the accent should fall, we are to consider whether the last syllable but one (called the *penult* or *penultimate*) is long or short.

(1) If the penult is long, the accent falls on it, as in Myosu′rus, Sola′num, Eri′ca, Anemo′ne, Œnothe′ra, Trienta′lis, Ibe′ris, Isa′tis, Caki′le, Rese′da, Jasio′ne, Potamoge′ton, Sila′üs, Conochi′lus; this rule must always be strictly observed. Some of the words given above and others (of which *Cotyle′don Umbili′cus* is especially a trap for the unwary) are habitually mispronounced, but though we may and indeed must now say Ane′mone as an English word, we ought to speak of *Anemo′ne nemoro′sa* as a botanical name. It is worth notice that in a passage of one of our poets, the word has its original accent:—

> "Let me the blue-bell'd hyacinth behold,
> The silver anemone of the wood,
> And golden primrose intermingled well."
>
> *Hurdis*, (*1763—1801.*)

But in most cases the persistent tendency of the English people to throw the accent as far back as possible has effected a change:—

> "And then fades silently
> One frail and fair anemone."
>
> *Shelley*, (*1792—1822.*)

(2) When the penult is short, it used to be taught in our schools that the accent must always be placed on the last syllable but two, (called the antepenult,) as in Vi′cia, Cle′mătis, O′xălis, Co′mărum, Hippo′phăë, &c. This arbitrarily assumes that the accent can never fall farther back than the third syllable from the end—a limitation for which no reason can be assigned. It is better, in a certain class of words, to adopt a practice which is now gaining ground, and is embodied in the following rule:—

(3) In such words as Glădĭŏlŭs, place the accent not on the *i*, Gladi′olus, but on the *a*, Gla′diolus, and so in all cases where a short penultimate vowel is immediately preceded by a short vowel, *e.g.* Co′dĭŏlum, Ca′lcĕŏlus, A′rgĭŏlus, He′pĭălus, Rho′dĭŏla, Lu′tĕŏla, gra′vĕŏlens, A′mblўŏdon, Bra′chўŏdus, Cra′nĭădæ, Trigo′nĭădæ. We thereby avoid lengthening a vowel which, from its position before another, is short. But the conventional mode of accenting the *i*, *e*, or *y* is so well established that few have as yet adopted the rational method here advocated.

This is the whole secret of placing the accent correctly, and it is seen that accuracy depends upon our knowing whether the last syllable but one is long or short. Of course if the word has only two syllables there is no choice, as in Rhe′um, Thu′ya; and it only remains to indicate, as far as possible, the cases in which rules can be given for words of more than two syllables.

(1) It has been said that a vowel immediately preceding another is short; a few exceptions have been already mentioned incidentally, as Coni′um, Sila′üs, Aïzo′ön, and there is also the large class of generic names ending in *-ea* and *-eum*, as Ostre′a, Prote′a, Centaure′a, Staphyle′a, Heracle′um. A small number of these, which are simply adjectives, are accented on the antepenult, as Aza′lea, Casta′nea, and the same must be done with all other adjectives ending similarly, such as lu′tĕa, purpu′rĕa, crusta′cĕa, the *-ea* in which has quite a different origin; through ignorance of this some persons affect the barbarous pronunciation lute′a, purpure′a, etc.

(2) There are a number of terminations in which the penultimate is generally long:—

-īdes, *-īda*, (meaning "like,") as deltoïdes, *i.e.*, delto-īdes, Molluscoïda; compare Petaloïdeæ, Crinoïdea, Nematoïdeum (see "Midland Naturalist," Vol. I., p. 150.) Though in all such words the *o* and *i* should be pronounced separately, in truly naturalised words they form a diphthong of course, as anthropoid, colloid, cycloid, &c.

-ālis, as Trienta′lis; exc. O′xălis, Cory′dălis, Cau′călis.

-chīlus, "a lip," as Conochi′lus, Cetochi′lus.

-īnus, *-ēnus*, *-ānus*, etc., as alpi′nus, Elati′ne, Paludi′na, veluti′num, Lapsa′na, Dicra′num, Ole′nus, Sile′ne; exc. Fra′xĭnus, Ri′cĭnus, Car′pĭnus, Pla′tănus, Ba′lănus, Ra′phănus, Caly′mĕne, Stropho′mĕna, and all those ending in *-crĭnus*, as Penta′crinus.

-īgo, *-āgo*, *-ūgo*, as Verti′go, Planta′go, Asper′ugo.

-ītes, etc., as Phragmi′tes, Limeni′tis, piperi′ta, Ananchy′tes.

-nēma, "a thread," as Trichone′ma, Hyalone′ma.

-ōtus, etc., "an ear," as Stephano′tus, Dio′tis.

-ūrus, "a tail," as Lagu′rus, Podu′ra, Hippu′ris.

There is also the termination *-oda*. When preceded by *p* the *o* is short, as will be seen below; but, in most other cases, it is the same ending as occurs in the Greek word *dendrōdes*, "like a tree," and must be pronounced similarly. Thus the Ostraco′da are the (bivalve) "shell-like" group of the crustacea. So Cesto′da, Nemato′da, Tortrico′des, &c. This ending should be *-odea* in the plural, and some authors write it so, as Ostraco′dea, etc.

(3) The chief terminations in which the penult is generally short are:—

-ĭdes, *-ĭdæ*, *-iădæ*, etc., as Pota′mides, E′quidæ, Cra′niadæ. It will be seen that the first of these—*ĭdes*—may be invariably distinguished from the termination *-īdes*, and those related to it, by the absence of the inserted *o*, which occurs in all such words as hypnoïdes, and here it may be noticed that the absence of this *o* is a sufficient reason why the derivation given in all botanical books that I have seen for Ceratidium,

Oïdium, antheridium, pistillidium, gonidium, etc., is incorrect. On referring to any work which professes to give the origin of these words, it will be found somewhat like this:—Gonidium, from *gonos*, seed, and *eidos*, form. But in that case it must be gono-idium, as I have explained *ante* Vol. I., p. 150. The fact is that these words are diminutives, an antheridium meaning strictly "a little anther," oïdium "a little egg," and so on. In the same way the name of a genus of spiders, Theridion, though stated by Staveley to mean "resembling a beast of prey," really means "a little beast of prey," as may easily be seen by comparing it with the actual Greek words *kunidion*, "a little dog," and *thuridion*, "a little door."

-ŏlus, *-ŭlus*, etc., as Sa′molus, Gla′diolus, Py′rola, Mi′mulus, I′nula; exc. Iu′lus. These are generally diminutives, thus Gladiolus means "a little sword."

-ĭcus, *-ăcus*, etc., as Lu′mbricus, Beto′nica, Sta′tice, Doro′nicum, Di′psacus, A′phaca, Tara′xacum; exc. Urti′ca, Myri′ca, Eri′ca, Verbena′ca, Pastina′ca; Hypericum should also be accented on the penult, it is said, but on rather doubtful grounds, and custom renders Hype′ricum preferable.

-stŏma, *-stŏmum*, "a mouth," as Cyclo′stoma, A′stomum.

-gŏnus, etc., "an angle," as Poly′gonum.

-ptĕron, *-ptĕryx*, etc., "a wing," as Di′ptera, Micro′pteryx, Thely′pteris, Proto′pterus.

-pŏda, etc., "a foot," as Cephalo′poda, Cope′poda, Macro′podus.

-ŏdon, *-ŏdus*, "a tooth," as Leo′ntodon, Cera′todon, The′codus.

-trĭchum, etc., "a hair," as Lepto′trichum, Calli′triche.

In addition to these it must be remembered that the inserted *i* or *o* in compound words is short; this, however, only becomes important when the last component consists of only one syllable. There are many words ending in *-pus*, "a foot," which come under this head, and are frequently mispronounced, as Ly′copus, Orni′thopus, Lo′phopus, Ma′cropus, Coro′nopus, Campy′lopus, Cy′stopus.

Sometimes a difficulty is found about placing the accent in "complimentary" names, and here a little latitude is undoubtedly permissible. But perhaps the practice which has the most authority in its favour is that which places the accent generally on the penult, as in Watso′ni, Graha′mi, Rober′ti, Colema′nni, but on the antepenult in all which end in *-eri* or *-ii*, as Fo′rsteri, Bre′weri, Ga′llii, Eichho′rnii. In the latter case the *ii* is pronounced *ĕ-eye*, not *eye-eye*. In complimentary generic names the accent is placed on the syllable preceding the termination, *-a*, *-ea*, or *-ia*, as Liste′ra, Grevi′llea, Hooke′ria. In order to tell how to accent such words as Lastrea, Saussurea, we must first know their origin. If they are formed on the analogy of Ostre′a, Centaure′a, the *e*, which represents a Greek diphthong, must be long; but if the *e* merely represents an unaccented part of the name of some naturalist, to whom the genus is dedicated, as Greville, Saussure, etc., it would necessarily be short, being used instead of the more usual *i* in order to retain the form of the word. Thus Brownia and Brownea would commemorate respectively Brown and Browne, but there would be no ground for making a distinction in the pronunciation.

[TO BE CONTINUED.]

SUBURBAN GARDENING.

BY EDWARD W. BADGER, F.R.H.S.

INTRODUCTORY.

Of all the varied pursuits which have given pleasure to mankind, or filled up leisure hours agreeably, none have been more warmly or deservedly praised than Gardening. No part of John Milton's glorious poem is more generally appreciated than his glowing descriptions of our first parents' delightful occupations as they tended the plants which adorned the Garden of Eden; and this, apart from the literary beauty of the poem, is no doubt to be accounted for by the universality of the delight which mankind has in tilling the soil, and cultivating fruits and flowers. What greater pleasure can be afforded a child than giving it a tiny garden of its own? Many a wearied man of business finds his most cherished recreation in the quietude of his garden. No occupation is more suitable to the later years of life than the gentler pursuits of horticulture; and even when age or infirmity debars from active participation in the work, the results of others' labours are capable of affording the purest of pleasures. Strange as it is, still it is too true that we English people, with all our love for gardens and gardening, are individually but indifferent gardeners.

At the request of some of our readers, I have decided to prepare some papers on Gardening, and, in doing so, shall endeavour to combine practical directions with such references to the principles on which they are based as will I hope assist occupiers of small gardens to make good use of them. I hope it will not be considered out of place for these articles to appear in the "Midland Naturalist." I think I shall be able to show that gardening is a pursuit well adapted for our working naturalists who are fortunate enough to have a plot of ground attached to their houses, and I am quite sure a man will be a better gardener for being a naturalist too. I hope to be able to prove that "rule of thumb" gardening processes are less educative, less pleasant, and less profitable, than those which are based on a knowledge of the "why" and "wherefore" of what is done or needs doing.

Suburban gardening is always more difficult than gardening in spots where the air is uncontaminated by smoke and impure exhalations, such as prevail in and about populous places. Small gardens surrounded by high walls, where sun and air penetrate but feebly, demand much skill for their successful management, for they are necessarily heavily burdened with disadvantages as compared with plots of the same size fully open to light and air. Then, as a rule, the smaller the plot the more it gets crowded, so eager is the anxious occupier "to make the best" of his limited area; this adds another difficulty, and, in the outset, I would desire to point out that the bulk of garden plants, whether such as are grown for their flowers, or such as are grown for food, are almost invariably allowed too little room for their complete development.

Dwellers near our manufacturing towns whose success in business enables them to live away from their places of business, surrounded by plots of ground capable of unlimited adornment, are as a body aspirants after successful gardening. But their failures, even when cost is no consideration, are far more frequent than their successes. Money is often lavished in vain, because of the lack of needful guidance. The ordinary villa garden is almost always at the mercy of the ignorant jobbing gardener, whose sole purpose in life seems to be to make his employer spend money in vain. He is always striving after the (to him) impossible, for he knows nothing, or next to nothing, of what he pretends to have mastered; and a glorious pursuit, capable at once of being a refreshment and delight, is often, from "lack of knowledge," barren and resultless, except in disappointments.

No one unfamiliar with the routine mismanagement of villa gardens can have the least idea of the waste of resources every day going on in all parts of the country. It seems the lot of those who have such gardens, and who, themselves knowing nothing of gardening operations, rely for the culture of their precious plots on totally unqualified men, to labour and spend money in vain. The sums spent unproductively in this way are enormous. The most feasible remedy for this state of things would be for our suburban residents to strive after a personal knowledge of the principles of successful gardening. This is the plan which will soonest yield satisfactory results. If each for himself will only master the details of successful practice they will as a body very soon find their own reward, and the ignorant persons they employ to "do their gardens" will no longer be able to trade on their employers' want of knowledge, but must be content to "do as they are told."

AUTUMN CULTIVATION.

The year of gardening operations commences as soon as the summer crops are gathered and the ground is unoccupied. It is a great mistake to leave the remains of crops to "cumber the ground." They should be cleared off as soon as possible, and either placed on the rubbish heap to decay, or, which is preferable, particularly where the garden is small and the house near at hand, they should be partially charred, and the ashes added to the compost heap. There is another method of dealing with them, and that is to bury them deeply in trenches. In one way or other they should be got rid of as soon as possible for the sake of health, tidiness, and economy. The exact time for doing this will vary as the summer is prolonged or short; but at the earliest time when crops no longer remain to be gathered the ground should be prepared for those which are to ollow.

The work of preparation may be divided into two parts: (1) cultivation whereby the surface soil and that immediately below it are loosened and their positions altered, the whole being afterwards thrown up in rough ridges so as to expose the largest amount of surface to atmospheric influences; and (2) the addition of fertilisers, usually in the form of stable or mixed farm-yard manure; or in some other way replacing what crops have withdrawn from the soil.

In many gardens, the usual plan is merely to dig the ground one spade's depth. This, though generally done, is far less effective than trenching, which almost always is a more satisfactory method. Some portion, at least, of every garden should be trenched annually. The reasons for doing this are many. In the operation of trenching, the surface soil, which is more or less exhausted, and usually stored with oxygen, gets placed lower down, and undergoes a period of rest, at the same time that it will slowly part with its store of oxygen; the lower soil is brought to the surface, and being invariably enriched with a reserve of fertilising substances, these are rendered available for the support of a crop. By exposing soil to atmospheric influences it is acted upon in a variety of ways. It is sweetened, the particles of which it consists are separated, and so acted upon by oxidation and other processes that some portions which hitherto have lain dormant are rendered fit for ready absorption by the roots of plants, and their growth and development are thereby materially assisted. The mechanical effect of trenching is also of great value, for water is admitted more freely, and when the ground is properly drained, by nature or artificially, as every well-ordered garden should be, whereever the water passes through there air will follow, and the importance of this to the development of healthy and productive crops cannot be overestimated. Then again, crops grown on deeply-stirred soil are able to withstand the vicissitudes of our varying summers far more easily than on soils stirred only to a shallower depth; in rainy ones the roots are less injured by wet, and in dry ones they are least affected by a protracted drought.

There are various methods whereby land may be prepared for succeeding crops, but those known as trenching and bastard trenching are the only ones which the amateur need be familiar with.

TRENCHING.

For deep soils, trenching is the best method. Trenching is a term used to describe the digging of ground twenty to thirty inches deep. It is performed as under:—From one end of the plot to be dug take out a trench two feet wide and two spades deep, wheeling the soil to the other end of the plot. Next loosen the bottom of the trench with a fork in order to assist in deepening the soil available for the roots to ramify through. Mark off the ground into widths of two feet. Then commencing at the width nearest the already opened trench, fill into it the surface soil or "top spits" of the two feet space next to it; then throw the bottom spits of trench No. 2 over the top spits placed at the bottom of trench No. 1, in such a way that when finished a ridge like this Λ shall be left. Having loosened the bottom of trench No. 2 with the fork, fill it up with soil from No. 3 in the same way as No. 1, and so proceed until the plot is finished. Manure should be dug in during this operation in greater or less quantities according as the ground is poor or rich.

BASTARD TRENCHING.

When the soil is shallow—that is, when not more than a single spade's depth is of good quality—a method called bastard trenching should be used. The plan is this:—Mark off the plot into two feet widths. Dig out the first of these one spade's depth, and wheel the soil to the other end. Loosen the bottom of trench No. 1 as deep as possible with a fork, and mix with the soil a sufficient quantity of manure and vegetable refuse, and throw on this the surface soil from the next two feet space, mixing manure as may be needed. Leave the surface in a ridge and as rough as possible. Treat No. 2 in the same way, and each of the other two feet widths in succession.

Ground prepared in either of these ways in the autumn will be in admirable condition for seed sowing next spring. If the ground is too sandy or too clayey, the occasion of the annual trenching may be taken advantage of to make such additions to it as may alter its texture. In the former case marl should be added; in the latter lime or sandy soil, though, if manure be applied at the autumn digging, the application of lime had better, in most cases, be deferred till spring, some little time before seed sowing. Whenever land is dressed with lime, particularly for the purpose of altering its texture, it should be dug in at once, so that the atmosphere may not rob it of its energy.

MANURES.

Every crop, especially every heavy crop, withdraws from the ground fertilising elements. However rich soil is naturally, its stores are yearly diminished if it is persistently cropped, and if materials replacing what has been withdrawn are withheld. The constant replacement of what is withdrawn, in some form or other, is therefore necessary to maintain the crop-producing powers of a garden. If a nice adjustment of supplies to withdrawals be always maintained, the normal capacity of production will, of course, be preserved. It must be obvious to all who think about the subject that the ordinary methods of manuring are more or less haphazard, but experience has proved that manure consisting of the products of the stable, cow-house, and piggery, in sufficient quantity, is all-sufficing for most garden crops. In our gardens we grow peas, beans, cabbages, and other vegetables, and each takes away from the land *something*. The skilful cultivator tries to ascertain what this something is, and to replace it at the first opportunity. If the crops grown in a given space were allowed to decay there the soil would receive back all that had been taken from it with something added; but our garden crops are more profitably consumed as food, and the withdrawn substances replaced in another form at once convenient and effectual.

The Rev. Henry Moule, vicar of Fordington, impressed by a sense of the importance of maintaining the fertility of land at the least possible cost, as well as by other considerations, has for years advocated the return of human excreta, mixed with dry earth, as the most effectual and least expensive method, at the same time that it afforded a solution of one of the most pressing problems of the time. Where his plan can be properly carried out, no one, we think, can question its value. In the country it can often be carried out easily and economically; but at present, for want of perfect self-acting apparatus, and the difficulty of obtaining a sufficient supply of dry earth at nominal cost and trouble, we fear the difficulties are too great to prevent its general adoption where its value would be greatest—in our large towns and their suburbs. Wherever the nightsoil can be systematically mixed with *dry* earth, easily moved, stored under a shed, and frequently turned over for a few months before being applied to the land, Mr. Moule's system can be employed with great advantage, and what too often proves a fearful nuisance may be disposed of and utilised as a valuable enricher of the land.

Farm-yard manure, where obtainable, when well mixed and saturated with the drainage from cow-sheds and stables, is one of the best forms in which to apply food to the soil for the production of most of our garden crops. Garden refuse, pea and bean haulm, the remains of all crops, in a state of partial decomposition, may be dug into the ground with advantage. Clippings of hedges, prunings of trees, &c., partially charred, should also be employed as fertilisers. There is scarcely an article of any kind made of organic matter which is not available to swell and add valuable substances to the compost heap.

Artificial manures suitable for the various sorts and conditions of land, replacing what has been withdrawn by the last crop, or supplying what will be required by the next, are readily obtainable anywhere. The requirements of the cultivator and the condition of the land must of course settle what kind of artificial manure can be used most judiciously.

Speaking generally, the best time to apply manure of a permanent kind is when the ground is being prepared in the autumn. By being well incorporated with the soil it will be slowly acted upon by it, and will impart some of its more soluble parts to the soil in immediate contact with it, which will then be in the fittest condition to afford supplies of food to the roots of plants in the spring, when it is most needed, that is, when active growth commences.

On light sandy soils an application of marl, rich in carbonate of lime, &c., is more than equivalent to an ordinary manuring, for it is much more durable in its effects, and supplies ingredients of great value to plants in which the soil is naturally deficient. If marl be easily obtainable enough may be added, with advantage, to so change the texture of a light soil as to incline it towards stiffness. It must, however, be remembered that marls differ very much in quality. In some samples only five or six per cent. of carbonate of lime is present; others contain as much as eighty per cent. Marls also differ as to the proportions they contain of phosphate of lime and potash, and the quantity and composition of the silicates. A rough and ready method for ascertaining whether lime is present is to place a small piece of marl in some good vinegar; if active effervescence ensues, the presence of lime is indicated. If effervescence does not take place lime is absent, or present in too small quantity for the marl to be worth applying.

Where garden ground approaches in character to clay great benefit will be secured by burning a quantity of it annually, and afterwards applying it as a manure. Burning clay causes the particles to lose their adhesiveness, and if this burnt earth be added to a stiff soil in sufficient quantity it will give a new character to it by rendering it more permeable by water and air, and the roots of plants will be found to ramify through it more easily. Hedge clippings, &c., may be utilised to burn heaps of clay soil, and will contribute to the enrichment of the heaps. Sir Oswald Mosley made a number of experiments with burnt clay, and found its value very great indeed. I quote the following remarks from his pen. He says:—"My gardener sowed two beds of onion seeds. The beds were each eighteen yards by twelve; one was manured with good stable dung, the other with a mixture of burnt clay and vegetable ashes. The produce of the first did not exceed five bushels of an inferior size. The latter was twenty bushels of onions as large as those imported from Portugal. The latter also kept best. An application of the same burnt mixture has been applied with equal success in my fruit garden. I am so fully persuaded of the excellence of this kind of manure that I intend to adopt it generally on my farm." The burning of soils appears to increase the amount of soluble potash in them. In an experiment made by Dr. Voelcker, he found that unburnt clay contained 0·269 per cent. of this ingredient, whilst after burning it contained 0·941 per cent. of potash soluble in acidulated water. Soda, too, when present in soils, has its soluble parts increased by burning. On the other hand the proportion of soluble phosphoric acid and of ammonia are diminished by the process, which is rather against it. But then it must be remembered that burnt earth acquires a greater aptitude for absorbing ammonia from the atmosphere. On the whole, the use of burnt clay is strongly to be recommended. In burning clay care must be taken not to employ too much heat. The clay must never be so far baked as to be coverted into a brick-like substance, but only so much that the lumps of burned clay will readily crumble with a little pressure.

[TO BE CONTINUED.]

THE CRYPTOGAMIC FLORA OF WARWICKSHIRE.

BY JAMES E. BAGNALL.

(Continued from page 256.)

CALYMPERACEÆ.

189.—[*Encalypta vulgaris* Hedw. Banks. This species I have found on sandy banks near the Lickey Hills, in Worcestershire. It may probably be found on similar habitats in Warwickshire.]

192.—*E. streptocarpa* Schwg. On the mortar of old walls, rare. On a small bridge at Earlswood, near Reservoir! on stone walls near New Fillongley Hall! Always barren.

GRIMMIACEÆ.

194.—*Grimmia apocarpa* L. *Schistidium apocarpum* B. and S., Wils., Berk. On walls, frequent. Olton Canal bridge! Elmdon! Binton! Coleshill! Shrewley Common! Pinley!

Var. b. gracilis *N. and H.* On stone walls near Fillongley!

Var. c. rivularis *N. and H.* On stones in stream. Out of large pool at Arbury! Spring.

197.—*G. crinita* Brid. On the mortar of old walls, very rare. On an old bridge near Hatton! This interesting moss was new to our

British flora when found by myself in June, 1872. It was then fairly abundant; unfortunately the next year the bridge was partly pulled down for repairs, and nearly the whole of this moss was thereby exterminated. I was pleased to notice in 1876 that it had begun to make headway again. I believe this is at present the only British station. It is ably described by Dr. Braithwaite, in "Journal of Botany," July, 1872. July.

199.—*G. pulvinata* Dill. Wall tops, very common in all the districts. Spring.

206.—*G. trichophylla* Grev. Wall tops, rare. Wall of Lapworth Churchyard! on Radford Canal bridge, near Leamington! Not found in fruit.

221.—[*Racomitrium aciculare* L. Stone walls. This species I find abundantly on walls of new red sandstone near Halesowen. It may probably be found on like habitats in this county.]

224.—*R. heterostichum* Hedw. Stone walls, rare. Pinley, near Coventry (T. Kirk)! This I also find near Halesowen. Spring.

225.—[*R. fasciculare* and *R. lanuginosum* I also find on stone walls near Halesowen. Probably both may also be found in Warwickshire.]

228.—*R. canescens* Hedw. *Trichostomum canescens* Purt. "Shores of Coleshill Pool" (Bree) (Purt., Vol. III., p. 85.) Heathy waysides, local. Near Berkswell Railway Station on main road to Kenilworth! near Four Ashes Lane leading to Monkspath! Lane from Solihull to Sharman's Cross! Always barren.

230.—*Ptychomitrium polyphyllum* Dicks. Stone walls, rare. Near Binley, Coventry (T. Kirk)! [Abundant on stone walls near Halesowen.] Fruit March.

233.—*Zygodon viridissimus* Dicks. On roots of trees, local in northern part of the county. Copt Heath! near Oakley Wood! between Stratford and Redhill! Lane to Harbury Railway Station, abundant! Bridle road from Drayton Bassett to Chadshunt! Frequent between Offchurch and Long Itchington! Bishops Tachbrook! Barren.

241.—*Ulota crispa* Hedw. *Orthotrichum crispum* Hedw., Wils., Hobk. On trees, rare. "Allesley, Bree," (Purt.) Coppice in Whew-porridge Lane, near Solihull! Shelly Coppice! June.

242.—*U. intermedia* Schpr. On trees, rare. Chalcot Wood, near Umberslade!

247.—*Orthotrichum saxatile* Brid. *O. anomalum* Hedw., Wils., Berk. Local, on stone walls. Bridge near Henley! near Wilmecote! near Holywell! Binton! Harbury! Kineton, Edge Hills! Spring.

252.—*O. obtusifolium* Schrad. On ash trees, very rare. Abundant on a small ash tree near Binton, 1876-78! I have carefully examined every other tree in this district that I could have access to without being able to find this moss again.

253.—*O. affine* Schrad. On trees, &c., frequent, more especially in South Warwickshire. Olton! Copt Heath! Rowington! Chesterton Wood! Wolstone Heath! Edge Hills! &c. June.

260.—*O. tenellum* Bruch. On trees, rare. Between Stratford and Red Hill! near Offchurch! June.

[O. stramineum *Hornsch.* Is very likely to be found on trees in the lias districts; at present I have not found it.]

262.—*O. diaphanum* Schrad. On trees, walls, and stones, frequent. Castle Bromwich! Alcester! Morton Morrell! Wolstone Heath! Sherbourn! Hampton Lucy! &c. May, June.

264.—*O. Lyelii* H. and T. On trees, ash, and elm, local. Near Solihull! Chadshunt! Copt Heath! Wormleighton! Ladbrook! Offchurch! &c. Never noticed in fruit.

265.—*O. leiocarpum* B. and S. On Ontario poplars, rare. Near Rowington Village! May.

267.—*O. rivulare* Turn. "On stones and a water wheel at Bidford Grange —Bree." (Purt., Vol. III., p. 388.)

FUNARIACEÆ.

279.—*Ephemerum serratum* Schreb. *Phascum serratum* Wils., Hobk. In fallow fields, local or overlooked. Sutton Park! Acocks Green! near Solihull! Olton! wood near Maxtoke! Coleshill Heath! March, April.

283.—*Physcomitrella patens* Hedw. Damp marly places. Damp marly bank near Fillongley Hall! Autumn.

285.—*Physcomitrium pyriforme* L. *Gymnostomum pyriforme* Purt. "Bank bounding mill pool at Oversley," (Purt.) On moist banks, &c., local. Sutton Park! Aston! Water Orton! Dukesbridge! April.

288.—*Funaria fascicularis* Dicks. *Physcomitrium fasciculare* Wils., Hobk. *Entosthodon fascicularis* Berk. Heathy waysides and fallow fields, rare. Coleshill Heath! fields near Maxtoke Priory! in a field near Ufton Church, 1872! Sutton Park! April.

290.—*F. hygrometrica* L. Walls, heathy waysides, &c., very frequent. Occurring in all the districts. May, November.

BARTRAMIACEÆ.

292.—*Amblyodon dealbatus* Dicks. On damp turfy heaths, near pools, very rare. Sutton Park! April.

299.—*Bartramia pomiformis* L. On dry shady banks, local. "Lane from Spernall Ash to Middletown" (Purt.) Sutton Park! Middleton Heath! Curdworth! Marston Green! April.

307.—*Philonotis fontana* L. *Bartramia fontana* L., Purt., Wils., Berk. Marshes, rare in fruit. "Cookhill," (Purt.) Near Windley, Keepers', and Bracebridge Pools, Sutton Park! waysides near Four Ashes! April.

[TO BE CONTINUED.]

A TUBE-DWELLING STENTOR.

BY J. LEVICK.

I have been much puzzled for some time past by a curious tube-dwelling Infusorian, which I have found occasionally upon the weeds brought from Barnt Green, (a locality to which we are indebted for so many interesting and beautiful forms of fresh-water life,) and until recently have been quite unable to make out what the creature could be, the specimens being so small and deeply embedded in foreign matter that only a glimpse of the tube and ciliated disc could be obtained.

I had nearly come to the conclusion that my new find was one of the species of *Freia*, possibly *F. elegans*, to which it appeared to bear great resemblance, notwithstanding the difficulty that that genus of Infusoria is described as marine only.

After frequent search, however, I was rewarded by finding a much larger specimen, having an extreme length of about 1-22 of an inch, and I now find it to be a Stentor, with the ciliated disc most curiously shaped, its general outline being not unlike that of the human ear, especially as seen in one position.

The disc instead of being nearly round and at right angles to the body, as in *S. Mülleri* or *S. polymorphus*, stands upright with a frontal lip-like continuation in opposition, forming a cavity which might make a suitable seat for a *Trachelius ovum* or other similarly shaped Infusorian, and looks under the microscope like the old-fashioned bonnet, known as the coal-scuttle pattern.

The body is trumpet-shaped and without cilia, the whole surface being furnished with long contractile hairs or bristles, like the rays of an Actinophrys, which are ranged at equal distances, and, as it turns about in its tube, give it quite a *chevaux de frise*-like character.

The disc has, besides a row of these setæ round its margin, a fine wreath of cilia, and behind a funnel-shaped mouth, also ciliated to its termination, is seen a large contractile vesicle, a moniliform nucleus being, in my specimen, just traceable.

Its colour is dirty white, and it dwells in a roughly constructed tube, formed by a sticky secretion, and, the particles of rejected matter, which are continuously falling upon its disc, diatoms, fragments of algæ, and anything else coming in its way being utilised for the purpose of building up its tube, it has the ragged appearance often seen in the cases of some of the caddis worms.

These particles are precipitated by the action of the cilia, and trickle down its side, making their way through the setæ so closely to its surface as to appear almost as though enclosed within the animal, the tube being perceptibly augmented even whilst under observation, and certainly giving the idea that it is under the control of the creature, whether they are thus guided to its base or driven off, a point I have felt pretty sure about in other Stentors, which, I believe, accomplish this by reversing the action of the cilia on the body, at one time working them upwards, and at another downwards.

It is not social in its habits, as Ehrenberg styles its congeners, which often form a white gelatinous mass, and live in groups, but is isolated, and most easily distinguished from other Stentors. I have not yet recognised it in its free state, and, judging from the smallness of the specimens found, it would appear to form the tube at the beginning of its career.

Turning to the Transactions of the Royal Microscopical Society for April, 1870, I find a new tube-dwelling Stentor described and figured by Dr. Charles A. Barrett, under the provisional name of *Stentor Barrettii*, which, I have no doubt, is identical with mine, though his has a well-formed smooth tube.

This is the second, if not the third, addition to the ever charming family of Stentors, for which we are indebted to the before-named locality—Barnt Green.

METEOROLOGY OF THE MIDLANDS.
THE WEATHER OF SEPTEMBER, 1879.

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.	3·26	·72	7	16	66·7	3	35·6	1
Stroud	S. J. Coley, Esq	2·82	·62	24	16	67·0	3	39·0	1 & 25
SHROPSHIRE.									
Haughton Hall, Shifnal	Rev. J. Brooke	2·69	·60	24	17	67·0	6	33·0	30
Woolstaston	Rev. E. D. Carr	3·93	1·06	7	20	67 5	3 & 6	37·5	25
Leaton Vicarage	Rev. E. V. Pigott	2·87	·69	7	17	69·0	3	33·0	30
More Rectory, Bishop's Castle	Rev. A. Male	3·31	·93	7	22	72·0	6	30·0	30
Larden Hall	Miss F. R. Boughton	3·08	·67	7	19				
Bishop's Castle	E. Griffiths, Esq.	3·25			16	71·0		35·0	30
Cardington	Rev. Wm. Elliott	3·6[illegible]	·94	7	17				
HEREFORDSHIRE.									
Stoke Bliss	Rev. G. E. Alexander	4·23	1·56	30	17	66·0	3	46·0	7 & 9
WORCESTERSHIRE.									
Orleton, Tenbury	T. H. Davis, Esq	3·25	·44	13	18	77·3	6	33·0	30
West Malvern	A. H. Hartland, Esq.	3·14	·67	23	15	71·0	3	37·0	24
Pedmore	E. B. Marten, Esq.	3·60	·59	28	18	67·0	4 & 17	37·0	24
Longlands, Stourbridge	J. Jeffries Esq	3·63	·56	24 & 28	17	70·0	2, 6, 7	34 0	24 & 29
Dennis, Stourbridge	Mr. C. Webb	3·45	·73	24	14	72·0	3	36·0	24
STAFFORDSHIRE.									
Thorganby Villa, Wolverhmtn	G. J. C. Broom, Esq.	2·8[illegible]	·59	28	19				
Dudley	Mr. J. Fisher	3·17	·52	24	20	78·0	28	34·0	24
Sedgley	Mr. C. Beale	3·03	·58	28	19	65·0	3	38·0	24
Kinver	Rev. W. H. Bolton	3·09	·5[illegible]	28	20	67·0	6 & 7	32·[illegible]	24
Walsall	Mr. N. E. Best	3·27	·52	24	20	65 0	3	38·0	24
Grammar School, Burton	C. U. Tripp, Esq.	2·90	·60	28	17	74·0	4	35·0	30
Weston-under-Lyziard R'tory	Hon. and Rev. J. Bridgeman	2·77	·53	24	18	70·0	3 & 6	33·0	30
Wrottesley	E. Simpson, Esq.	2·81	·58	28	16	68·2	4	37·4	30
Heath House, Cheadle	J. C. Philips, Esq.	2 71	·48	28	13	68·0	3	38·0	30
Alstonfield Vicarage	Rev. W. H. Purchas	3·71	·61	8	14	67·8	3	31·5	30
WARWICKSHIRE.									
Coundon, Coventry	Lieut.-Col. R. Caldicott	3·14	·56	28	15	66·0	2 & 7	42·0	24
Coventry	J. Gulson, Esq.	3·32	·62	23	18	68 0	7 & 8	38·0	1 & 30
Bickenhill Vicarage	J. Ward, Esq.	3·39	·59	24	14	63·0		37·0	
St. Mary's College	Rev. S. J Whitty	3·15	·54	28	18	71·0	3	36·6	30
Henley-in-Arden	T. H. G. Newton, Esq.	3 27	·60	23	13	70·0	3	36 0	1
Rugby School	Rev. T. N. Hutchinson	2·96	·62	23	16	69·8	3	37·2	30
DERBYSHIRE.									
Stoney Middleton	Rev. U. Smith	2·90	·57	8	12	67·0	4	29·0	29
Fernslope, Belper	J. G. Jackson, Esq.	3·21	·60	28	15	67·0	7	34·0	30
Linacre Reservoir	C. E. Jones, Esq.	2·39	·36	8	15				
Spondon	J. T. Barber, Esq.	3·11	·58	28	16	65·0		30·0	1
Duffield	W. Bland, Esq.	2·88	·44	13	15				
NOTTINGHAMSHIRE.									
Hesley Hall	B. J. Whitaker, Esq.	1·64	·41	14	10	71·0	4	30·0	30
Hodsock Priory, Worksop	H. Mellish, Esq.	2·06	·41	13	15	71·0	3	30·8	30
Park Hill, Nottingham	H. F. Johnson, Esq.	3·39	·92	24	15	67·5	7	39·0	26
LEICESTERSHIRE.									
Loughborough	W. Berridge, Esq.	3·39	·68	24	15	70·9	3	32·7	30
Ashby Magna	Rev. E. Willes	3·41	69	23	17	70·0	6	33·0	30
Market Harborough	S. W. Cox, Esq.	2·87	·80	23		64·0	1 & 15	31·0	30
Kibworth	T Macaulay, Esq.	3·14	·61	23	19				
Town Museum, Leicester	W. J. Harrison, Esq.	3·33	·68	14	15	69·1	3	35·2	30
Belmont Villas, Leicester	H. Billson, Esq.	3·29	·65	13	16	69·0	3	34·8	30
Syston	J. Hames, jun., Esq.	3·12	·59	13	16	72·0	4	35·0	30
Waltham-le-Wold	E. Ball, Esq.	3·47	·60	24	14	68·0	7	36·0	24
Little Dalby Hall	G. Jones, Esq.	3·23	·50	13	15	75,0	4	32·0	30
Coston Rectory, Melton	Rev. A. M. Rendell	3·29	·61	13	17	68·0	3	29·3	27
NORTHAMPTONSHIRE.									
Towcester Brewery	J. Webb, Esq.	2·95	·52	23	13				
Castle Ashby	R. G. Scriven, Esq.	2·72	·65	28	18			39·0	29
Kettering	J. Wallis, Esq.	2·54	·61	23	17	67·0	8	42·0	25
Althorpe	G. S. Groom, Esq.	2·90	·72	28	15	65·0	7	33·0	29
Pitsford	C. A. Markham, Esq.	2·67	·70	28	14	73·0	3	33·0	29
RUTLAND.									
West Deyne, Uppingham	Rev. G. H. Mullins	2·95	·80	23	17	68·3	3	36·9	25
Northfields, Stamford	W. Hayes, Esq.	2·58	·58	23	14	60·0	1	33·0	15
Ratcliffe Observatory	H. E. Bellamy, Esq.	2·89	·56	28	15	68·0	3	40·3	24
Ventnor Hospital	W. T. Ryder, Esq.	3·46	·92	23	6	68·6	6	43·2	25
Altarnun Vicarage	Rev. J. Power, M.A.	5·17	1 00	9	16	76·0	7	35·0	1 & 30

The first week of September turned out dry and fairly fine, and there was another interval of similar weather between the 14th and 20th; with these exceptions, however, rain fell almost daily, and in sufficient quantities to cause the total fall at most stations to exceed the average by from ten to twenty per cent. The 13th, 23rd, 24th, and 28th were the days of maximum fall, the heaviest record for one day, however, being 1·56 inches, on the 30th, at Stoke Bliss. There was much fog and haze, with heavy dews, in the latter half of the month. The barometer, on the whole, ranged high, but was unsteady. Westerly winds prevailed, with little sun. Owing to the continuance of unfavourable weather, the harvest was everywhere late. Although much corn was cut by the end of the month, it lay sodden in the fields. We have to go back to 1860 to find a similar record.

Natural History Notes by Observers.—*Haughton Hall, Shifnal.*—A very few wasps have at length appeared; Peaches attempted to ripen by the 30th; Figs hopeless; no Mushrooms. *More Rectory.*—The fruit crop is generally dwarfed in size and poor, excepting the nuts; Whinberries, however, have been abundant on the hills. I have not seen or heard of a Mushroom. *Cheltenham.*—Peaches and Nectarines on open south brick wall just ripe by the 27th; Brimstone Butterflies emerged from chrysalis on the 20th. *Uppingham.*—Crops and fruit very backward. There is a heavy crop of Plums, which, however, is only half ripe. Other fruit very bad. *Burton-upon-Trent.*—Horse-chestnut, Lime, and Birch began to shed their leaves on the 25th. *Spondon.*—*Œnothera Lamarckiana*, which usually blooms in June, did not commence flowering till this month, although close to a hothouse and facing south. *Altarnun.*—All hope of a peat harvest has been given up; scarcely any Partridges in N. Cornwall, except old ones; the young birds were drowned.

Correspondence.

Fossiliferous Bunter Pebbles in the Drift.—Well-rounded quartzite pebbles derived from the Bunter conglomerate occur in great numbers in the Chalky Boulder Clay of Leicestershire. Whilst examining this deposit in Mr. Townsend's brick-yard at Countesthorpe, about five miles south of Leicester, I broke open a liver-coloured quartzite pebble which contained a good specimen of *Orthis redux*, a well-known Lower Silurian fossil. In the "Geological Magazine" for 1878 (p. 239) I see Mr. Jennings records the same fossil in a precisely similar matrix from the vicinity of Nottingham.—W. J. Harrison.

Leptodora hyalina.—In reading over Mr. Graham's interesting paper on this remarkable animal, (page 225,) I could not help noticing one passage, which is most certainly incorrect. It runs as follows:—"Leptodora belongs to Baird's Legion Branchiopoda, Order II., Cladocera, Family I., Daphniadæ." Now this is obviously wrong, for Leptodora does *not* belong to the Cladocera, much less to the Daphniadæ. If Mr. Graham will turn to the definition of the order Cladocera in Baird's Entomostraca he will find that one of the most essential characters is that the limbs are all enclosed within the carapace. In Leptodora the limbs are all entirely free, and the carapace is almost atrophied. "How can these contrarities agree?" There is no need to say more than that if we attempt to reconcile it with the characters of the family Daphniadæ we fail utterly. Will Mr. Graham kindly let us know to what order and family Leptodora *does* belong? The so-called auditory organs are evidently antennæ. They are what Baird calls the superior antennæ, and in the male are long and spear-like. The long swimming limbs are the inferior antennæ, and the limbs marked d 1 to d 6 (Plate V.) are all true legs; d 6 is not an antenna.—Enquirer.

Daphnia Bairdii.—Since I wrote my paper on this new Entomostracon, (see page 217,) I have been informed that the animal had been previously found near Berlin, and described by Schödler in his work entitled "Die Branchiopoden der Umgegend von Berlin," (Berlin, 1858,) under the name of *Hyalodaphnia Kahlbergensis*. There is no doubt, however, that it is a true Daphnia; and since it agrees in every particular with the characters of that genus given by Baird, I see no reason why it should be placed in a separate one. Schödler's specific name must, of course, take precedence of mine, by reason of its priority, and the name should then be *Daphnia Kahlbergensis*. I have the pleasure to record that this species has been found not only in Olton Reservoir, but also in Edgbaston Pool and Spurrier's Pool, and we may, therefore, hope to keep it amongst us not as an "illustrious stranger," but as a familiar friend.—H. E. Forrest.

Scarlet Runners.—I have noticed but few rows of this useful vegetable during the present year which have borne anything like a moderate crop of pods. I presume it is primarily due to the abnormal character of the year, in the course of which we have had such a large number of wet days. This insalubrious weather also accounts for the absence of bees, which are necessary for the fecundation of scarlet runner bean flowers. The following extract from Dr. Darwin's "Cross and Self Fertilisation," p. 150, will, perhaps, prove interesting. He says: "The flowers of *Phaseolus multiflorus* are so constructed that hive and humble bees, which visit them incessantly, almost always alight on the left wing petal, as they can best suck the nectar from this side. Their weight and movements depress the petal, and this causes the stigma to protrude from the spirally wound keel, and a brush of hairs round the stigma pushes out the pollen before it. The pollen adheres to the head or proboscis of the bee which is at work, and is thus placed either on the stigma of the same flower or is carried to another flower. This plant grows well and flowers in Nicaragua, but as none of the native bees visit the flowers not a single pod is ever produced." Mr. Belt mentions a case ("Nature," 1875, p. 26) of a late crop of *P. multiflorus*, near London, which was rendered barren by the humble bees cutting, as they frequently do, holes at the bases of the flowers instead of entering them in the proper manner.—E. W. B.

Reports of Societies.

BIRMINGHAM AND MIDLAND INSTITUTE SCIENTIFIC SOCIETY.—September 24th. Mr. A. J. Shilton gave a very interesting paper upon "Illuminating Gas."—October 8th. Mr. C. B. Caswell, F.C.S., read a paper upon "Alkalimetry."—October 18th. The members visited the new railway now being made between Halesowen and Northfield.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—Microscopical General Meeting.—September 16th.—Mr. T. Bolton exhibited a living specimen of *Ophiocoma neglecta*, the gray Brittle-star, from Llandudno. Mr. Wright Wilson exhibited a section of diseased liver stained with an aniline dye, which acted differently on the healthy and diseased parts so as to produce two colours. He also made some remarks on *Calveria hystrix*, a species of Sea Urchin found by Sir Wyville Thompson, at a depth of 445 fathoms, and presented to the Society the part of the Transactions of the Royal Society which contains figures and descriptions of the only perfect specimen yet found. Mr. J. Levick exhibited a new rotifer, *Anuræa longispina*, (see page 241.)—Geological Section.—September 23rd.—Mr. R. M. Lloyd mentioned the difficulty he had found in keeping alive the new Entomostracon, *Leptodora*, and exhibited a cast shell of crab from his aquarium. Mr. Badger exhibited a very abnormally tasselled form of *Pteris serrulata*, grown by Mr. Chas. Williams, of Moseley Lodge, and read a letter about it from Mr. Thomas Moore, F.L.S. Mr. W. Southall read a paper on the making of the artificial sea-water for the Aston Aquarium. (See page 246.)—GENERAL MEETINGS.—September 30.—Mr. W. G. Blatch exhibited larvæ of *Vanessa Cardui*, remarkable only for their occurrence so late in the season; beautiful cocoon of a spider, *Ciniflo ferox*, in the shape of an egg, suspended by a silken cord; and a rare beetle, *Amara patricia*, new to the Midlands, found at Cannock Chase. Mr. W. B. Grove exhibited *Schizogonium murale*, from a wall at King's Norton. Mr. J. Levick read the paper on "A New Rotifer and Infusorian" printed at page 241. Mr. W. Graham gave an interesting account of a marine and dredging expedition organised by the Aberdeen University. Mr. H. E. Forrest reported that he had found *Ophrydium versatile*, a remarkable Infusorian, at Shrewsbury.—October 7th.—Mr. T. Bolton exhibited living male and female of *Leptodora hyalina*. Mr. J. Levick read some notes upon a curious Stentor, which he had found at Barnt Green. (See page 280 for description.) Mr. Montagu Browne, F.Z.S., read a paper "On the Desirability of Establishing a Museum in Birmingham, with some remarks on the Collection at Aston Hall." He characterised the latter as a collection of caricatures of nature, huddled together without even a pretence of scientific arrangement or correct nomenclature, and propounded the following scheme for the establishment of a scientific museum, centrally situated, and equally instructive to the student and the mere sightseer. That two moderate-sized rooms should be obtained, in one of which should be collected specimens illustrating the fauna, flora, geology, and mineralogy of Great Britain, with especial regard to local natural history. That these should be mounted with characteristic surroundings (*i.e.*, rock birds on rocks, waders in marshy ground, &c.) In the second room might be arranged groups of animals, &c., such as were likely to be of use for educational purposes. He said that if the two rooms were provided and fittings obtained by public subscription, the objects would be speedily forthcoming; indeed, that he himself was prepared and willing to present them with a large number of British birds. At the conclusion of the paper, a discussion took place; in which Messrs. E. W. Badger, W. R. Hughes, W. Wright Wilson, H. E. Forrest, R. W. Chace, and J. Levick took part, all the speakers substantially supporting Mr. Browne's suggestions.—BIOLOGICAL SECTION.—October 14th.—Mr. J. Bagnall exhibited *Medicago denticulata*, *M. maculata*, *Lolium temulentum*, and *Bromus patulus*, from a farmyard at Kenilworth; he considered all of them to be casuals introduced with foreign seed. *Riccia glauca* and *Anthoceros punctatus*, Hepaticæ from a marly field at Leek Wootton. The peculiar distinctions in fruiting characters were pointed out and microscopical preparations of them were exhibited. Mr. J. G. Cotton exhibited Eye of Trilobite, *Asaphus caudatus*, from the Wren's Nest, Dudley. Mr. J. Bagnall then read his report of the Botanical Section of the Falmouth Excursion, in which he stated that upwards of 400 species of flowering plants, grasses, and ferns had been recorded or collected during the excursion, the greater part of which were found in the Falmouth district, (Falmouth to Helford, a distance of about six miles,) most attention having been given to this neighbourhood. Each day's excursion and proceedings were then duly recorded, and the most noticeable plants found during the excursion were exhibited. An account was also given of the excursion to Land's End and Lizard Point, and the rare plants taken on that occasion were exhibited. The geographical range in Great Britain of each plant exhibited was given, and an analysis of the whole flora of the district worked, so far as represented in the list made during the excursion, was given, as follows:—220 belong to what Hewett C. Watson calls the British type of distribution, or to that intermediate type which he designates British-English, *i.e.*, species widely spread through South, Middle, and North Britain; 150 to what Hewett C. Watson calls English type, or to that intermediate type which he calls English-British, *i.e.*, species chiefly seen in South or South Middle Britain; seventy to what he calls the Atlantic type or species, chiefly seen in West England; twenty to the Germanic type or species, chiefly seen in East England; four are what he designates local species, and are confined to single or few counties. The paper was illustrated by sixty-eight specimens of the plants collected.

BIRMINGHAM PHILOSOPHICAL SOCIETY.—The annual meeting of the members of this society was held on Thursday, October 10th, in the Board Room of King Edward's Grammar School, Birmingham. Dr. Heslop (the president) presided. The Rev. H. W. Crosskey (one of the hon. secs.) read the annual report, which stated that the number of members was 118. During the year there had been three withdrawals and twenty-four new elections. Dr. Heslop was re-elected President. The other officers having been elected, Dr. Heslop delivered the annual address. He proposed to ask their attention that evening to the life and poems of Lucretius. The sum of Lucretian philosophy was that all things sprang spontaneously from matter, and that out of the concourse of atoms, their varied motions and combinations, all the phenomena of nature arose; that the mind, soul, and body came into existence, developed, and died together; that the sum of things was fixed; that by infinite adaptations ever going on some things disappeared, or rather were restored again into the primal elements, while other things came into existence and maintained themselves; that there might be gods dwelling in the upper ether, but that providence was not their function, the universe being self-dependent. Finally, that the laws of nature were eternal and inviolable, the monsters and chimæras of mythology being idle tales, and that the punishments fabled to be in store for us in a place of torment "do all exist for us in this life." Lucretius had no conception, or but the dimmest conception, of those forces which play so great a part in modern science, much less of their relations to each other. He ascribed far too serious a part to the fear of death as a motive influence on man's mind; and he seemed to be unaware, as many modern writers on the same subject seem to be unaware, that the views of death held by persons in their health and strength are very different from those held by the same persons when afflicted by pain, disease, or moral suffering. Especially Lucretius exaggerated fear of the gods and of death as the chief basis of the religious emotions. He was apparently unconscious that these emotions are intertwined with our nature under all conditions of human life, altogether irrespective of the origin to which he ascribed them. The most ardent faith in the existence of a supreme First Cause, and of our dependence on that Being, was able to exist in the same breast which knew no fear of death. The greatest fault of Lucretius was his confidence in his theories, as offering complete solutions of the problems of life and nature. When he left the mysteries of matter, motion, and death, Lucretius planted his foot on surer ground. There they were free to admire a descriptive power, an insight into nature, a vigorous handling of man, life, and society, not equalled by any ancient author excepting Homer. Lucretius loved to think of nature as free from the dominion of her proud lords; he loved to think of men as free from degrading superstitions. Yet even he was obliged to admit that the first beginnings of things swerved, though ever so little, from their lines of motion, and so made the phenomena of the world possible. He admitted that varied deities dwelt in the bright ether, above the gliding signs of Heaven, though he refused to believe in their power or their desire to influence the course of nature. He saw as intensely as the most orthodox believer, that when men deviated from justice, gave themselves up to ambition, or yielded to their passions, the conscience was able to punish them with a severity equal to that inflicted on the fabled tenants of Tartarus; yet he did not admit that this inner monitor reposed on any external sanctions. This, then, was the compromise effected, doubtless after painful struggles and much thought, in the mind of Lucretius between the popular religion of his day and his knowledge of the facts of life and nature. It was not for them to say whether his standpoint was correct—whether the reconciliation he arrived at between the sensuous and the supersensuous was a logical reconciliation. If it was correct for him, they were precluded from denying its validity. The conscience of each investigator was his only court of appeal. If a man's conscience was to be his guide and his strength, it could only be strong and helpful when it was kept in constant work. It was probable that the exercise of external authority over it might yield a crop of hypocrisy; it was impossible that it could give a stock of strength. Here, to dominate was sooner or later to drown. An eminent scholar, educated in the school in which they were assembled, lately told a notable congregation in Westminster Abbey that "every fact which is added to our knowledge of man or of the world illuminates our knowledge of God." This was a reflection which he gladly left in their minds as he took leave of Lucretius.—On the motion of the Rev. A. R. Vardy, seconded by the Rev. H. W. Crosskey, a hearty vote of thanks was accorded Dr. Heslop for his address.

BURTON NATURAL HISTORY AND ARCHÆOLOGICAL SOCIETY.—September 27th.—An afternoon trip to Egginton and Etwall completed the excursion programme for 1879. Mr. R. Thornewill acted as the leader, and the party numbered about forty persons. Arriving at Egginton Junction, the party proceeded to the church. The members duly examined the objects of interest in the church, and the leader discoursed upon its history and architectural features. The building is supposed to have been erected about the year 1300. After visiting the gardens at the hall, the party went to Etwall. In the churchyard there is a fine old yew tree and some beautiful elms, and in the adjoining vicarage grounds are two magnificent specimens of the latter, known to have been planted in the year 1701. Two gravestones were pointed out as having been erected at the heads of their intended graves by two eccentric parishioners some years before their decease. Each stone had a full inscription engraved, leaving space for the dates and ages. Both persons are now buried, one very recently, and in the other case the final particulars are not yet inserted. On visiting the church the register was first inspected. Commencing as far back as 1558 there are many entries of quaint interest. The most curious feature, however, is the register of burials under the Woollen Act, 1678 to 1681—an Act passed to compel all persons to be buried wrapped in woollen, in consequence of the depressed state of the woollen trade. In each case the relatives of a deceased person had to make an affidavit before a magistrate that the Act had been complied with, and there was a penalty of £4 for setting at nought this ultra-protectionist enactment. The church belongs chiefly to the "Perpendicular" period. There is a stone lectern, and in the south windows are some remains of fourteenth century glass, representing the three persons of the Trinity, and St. Helen, the patron saint of the church. There are brasses to the memory of the Port family in excellent condition, bearing date 1557; also a fine raised stone tomb, beneath which lie the remains of Sir John Port, the founder of Etwall Hospital and Repton School, also his first and second wives. The party adjourned to the Hawk and Buckle Inn, had a capital tea, and then a formal meeting was held, at which new members were nominated. The *Burton Chronicle* makes the following remarks on the work of this active society:—"It may be remarked that the Natural History and Archæological Society has thus far achieved an undoubted success in its operations. There is probably no other organisation in the neighbourhood that is fulfilling so useful a mission. Pleasure and profit are combined in a pre-eminent degree. The summer excursions make one familiar with objects of interest in the neighbourhood, which might otherwise have remained unnoticed and unknown to very many. It is something to visit old churches, and halls, and battlefields, and so call up the times and the circumstances in which our ancestors lived, and so compare the past with the present; it is something to search deeply into the hidden mysteries of nature and read the testimony of rocks, the language of flowers and plants, and discover more fully the Divine handiwork in the world of animal and insect life; it is a further advantage to leave for a time one's daily round of labour and step out from the narrow world of ordinary life into a larger and freer atmosphere. Nor are the winter operations of the society of less importance, for in the evening meetings there are presented for consideration subjects of the deepest import concerning various branches of science in the province of the society's work. There are a few people who affect to ridicule such researches and speak somewhat scornfully of beetle and butterfly collectors. Let them do so if they will, and so close their eyes to nature's marvels and their ears to the many Divine voices around them. A reverent naturalist prefers to say—

> To me the meanest flower that grows may give
> Thoughts that do lie too deep for tears.

The same sentiment is equally true of God's creatures, even the smallest, and the history and habits of any one of them fill a page in that glorious book of nature, which is, as Lord Bacon has well said, simply 'the word of God revealed in facts,' and these facts are interesting and profitable to the intelligent and thoughtful of every class of the community."

CARADOC FIELD CLUB.—September 25th.—A special meeting for the study of cryptogamic botany was held at the Wrekin. The morning was very inclement, cold, and wet, and heavy rain continued during the greater part of the day. Consequently only some six or seven members assembled at Wellington station, where they were met by Dr. Callaway, Rev. W. Houghton, and Mr. R. Anslow. The weather prevented much search for the special objects of the meeting, and the day was spent in examining the geology of the hill, on which Dr. Callaway's recent labours have thrown so much new light. After the annual dinner at the George Hotel, Shrewsbury, papers were read by the Rev. W. Houghton "On the Common Liverwort," and by Mr. T. P. Blunt, "On some relations of Light to Vegetation."

CHELTENHAM NATURAL SCIENCE SOCIETY. — At the annual meeting held on Thursday, the 2nd October, Dr. T. Wright, F.R.S., was re-elected president. The first ordinary general meeting was held on Thursday, October 16th, when, after the usual business routine, the President gave a short address, stating the use the Society had already been to the town of Cheltenham, noted the progress it was making, and urged on his hearers to take up some special subject of natural history. He ended by giving an outline of the proposed arrangements for the formation of a library in connection with the Society, and then introduced Col. Basevi, who read a paper on the "Structure of Mosses," which was well illustrated by diagrams and over 200 mounted specimens of mosses from various parts of the world. Col. Basevi exhibited under the microscope various slides showing parts of the structure of mosses. Some of the objects, showing the fructification, had been, he stated, kindly given to him by the Rev. J. E. Vize, of Forden.

NOTTINGHAM NATURALISTS' SOCIETY.—October 1st. Mr. B. S. Dodd read a paper on sponges. He pointed out the special arrangement of the sponge to bring about a current by inhalant and exhalant apertures, the inhalant being called pores, the exhalant oscula. The mode of reproduction was illustrated by diagrams showing the peculiar arrangement of a gemmule of the fresh-water sponge *(Spongilla)*. Specimens of horny and siliceous sponges were exhibited, and likewise an oyster-shell perforated by the boring sponge *(Cliona)*. Various orders of the second sub-kingdom, Cœlenterata, were referred to, but especially the order Hydrida, of which *Hydra viridis* was taken as a type. Medusæ were in some instances shown to be reproductive buds of one or other species of Hydrozoa. A discussion followed.—October 15th. Mr. A. H. Simpson gave a lecture on water, showing how, by electricity, it was resolved into its two gases, the oxygen appearing at the positive pole, hydrogen at the negative one, and concluded the experiment by showing how it was reproduced from the same elements by an electric current. The power of water, as water and as steam, was explained, and how its evaporation and collection in the clouds was the cause of rain. Its expansion on being converted into ice and the advantages resulting therefrom, both physically and economically, were next noticed. Various experiments with each of its two constituent gases were performed, to the surprise and amusement of the audience. The construction of the lime-light was fully explained, by which a number of views of the Falls of Niagara, representing winter and summer, were shown on a screen.

OSWESTRY AND WELSHPOOL NATURALISTS' FIELD CLUB AND ARCHÆOLOGICAL SOCIETY.—The last excursion for 1879 took place on Tuesday, September 30th. The meeting place was Newtown, famous for its trade in Welsh flannel, a prettily situated town on the banks of the Severn. After a visit to the ruins of the old church, the route lay over some very hilly country to the village of Kerry. Here there is an interesting old church, in which is a monumental tablet to Giraldus Cambrensis, the antiquarian. Close to the Vicarage there is a fine camp, and two tumuli in a field just outside the village. The whole neighbourhood abounds in entrenchments, ditches, camps, tumuli, and other similar relics of antiquity. The scenery about Kerry is very picturesque. There is a branch line from Abermule Station on the Cambrian Railway to Kerry, by which the party returned to Oswestry.

THE DIPHTHERIA FUNGUS.*

BY THE REV. J. E. VIZE, M.A.

I wish to direct attention to a fungus doing its deadly work not in the vegetable but in the animal kingdom, namely, diphtheria, which certainly is fungoid, and belongs to an ally of *Peronospora*, namely *Oidium*, under the order Mucedines. It might possibly be thought strange that I, a parish priest, should be arrogant enough to refer to a subject which certainly would far more readily and easily be treated by some one in the medical profession. But sometimes this disease comes so near to one whose work is not medical that we must attend to it whether we like it or not. Such has been my duty lately, for my parish has had diphtheria in it since last October, and the National Schools have been closed for several weeks and are likely to be for some time. There have been several deaths amongst the children, although the great majority of the attacks have been light. Those light attacks seem to be really the most subtle and dangerous, because the sufferers are not isolated and are therefore liable to spread the disease. It should not be forgotten that, generally speaking, the first outbreaks are light; and why? Speaking not from a medical but from a botanical point of view, the answer is very easy. The fresher the spore, (the seed,) the more vigorous it is. Hence, if an attack comes from an enfeebled spore, the virulence of the growth is quite weak compared with that from a spore recently communicated from a patient.

When the medical officer, Dr. Thursfield, called upon me to urge the closing of the schools, we became mutually interested in the diphtheria question, and the doctor urged me very strongly to investigate the diphtheria *Oidium*. It was arranged that some of the diphtheria fungus should be sent to me, and this was done with every possible measure of precaution to avoid the risk of contagion. Having received the fungus, I mounted some for microscopical examination, and then found that the specimens showed unmistakably an *Oidium* growth. In the manipulation of the slides every precaution was taken to prevent the escape of even a fragment of the fungus. And here I would point out the great importance of precautionary measures whenever diphtheria breaks out. I would particularly urge the burying or burning of all linen used by an infected person; for a frightful source of the spread of diphtheria is the use of pocket handkerchiefs, &c., which, even after washing in cold water, might still contain the spores of *Oidium*—and these are the germs of the diphtheria fungus. As a rule these germs are only the elementary states of higher fungi; for various species of *Oidium* develop into different kinds of blight. It was to find out the more highly developed fungus of the *Oidium* of diphtheria that I have run the risk of having it sent to me; and if I or my co-workers could discover this, we

* Part of a lecture delivered at Chester, January 30th, 1879.

should be doing good service. The spores are so minute that $6\frac{1}{4}$ millions of them would lie upon a square inch of writing paper.

By some it is supposed that diphtheria is caught from cows suffering from "garget," and is communicated with the milk; to such I would say —examine under the microscope the milk from a cow thus diseased, and if there be any spores in it just like the *Oidium*, then you have safe ground on which to go. My own notion is that "garget" has little or nothing to do with diphtheria; but, if it has, then it would seem likely that the spores of *Oidium* were eaten by cows in herbage near the mouths of bad drains or such like spots, and so passed through their system and into the milk. I believe that the cows may be left out of the investigation, and that in certain seasons there will be outbreaks of the illness because those seasons are, from atmospheric conditions or other causes, favourable to the more abundant growth of the *Oidium* in drains. When that takes place the spores escape into the air, and are carried about in all directions; but are not (even when they reach the throat injurious to anyone unless the throat is ripe for their development. One prolific source of the disease is bad drainage. A surveyor examining a sewer from which diphtheria had broken out was seized with the disease and suffered severely. The *Oidium* was in that sewer, and most likely had produced its resting-spore, according to the gradation of seasons. In the drains you may look for it; destroy it you never will; but you may possibly check its severity. No one ever caught the illness yet without the *Oidium* or a riper stage of the fungus being present. No sore throat can produce an attack of diphtheria unless the fungus is there. Some people seem to think that these growths come of themselves, but it is utterly impossible that they can. Do trees or flowers spring up spontaneously? or is spontaneous generation the source of animal life? All would deny this. But it may be asked—How is it that, if these fungus-spores abound in the air, they are so eccentric in their choice of throats in which to grow? The reply is very simple. Hundreds of acorns fall in the autumn from one tree, and how is it that so few ever grow? The fact is, they do not meet with a spot just suitable for germinating, and cannot grow. So with the diphtheria fungus; many thousands of people may inhale the spores, but their throats may not offer the conditions necessary for growth.

Then, again, with regard to the development of the disease. There might be several children attacked in one house, some get well easily, others with difficulty, others die. How is this? The solution might be, and probably is, that their throats were more or less ready for the growth of the *Oidium*. According to the state of the throat, so the disease is intensified or not. It is very singular that the fungus is so apt to attack children, as compared with adults; the Medical Officer of my own parish has recorded that 71 deaths out of every 100 are those of children between one and ten years. The feeding grounds, the dens of infection, are schools (especially National Schools) and workhouses, because therein children congregate so much.

There is one point in which some of you may perhaps be able to help me. The diphtheria fungus grows in the mucus of the throat, at the top or some distance down the trachea. Existing in so moist a habitat, how is it that it is so contagious? I can understand the spreading of the spores by carelessness in the use of pocket handkerchiefs and the like; but I cannot understand how a child's breath or a corpse can carry the spores about, unless when there is an absence of moisture altogether and the spores escape when dry, after evaporation has taken place.

I hope that none will carry away the idea that fungi are, as a rule, so hurtful in their work as might be supposed from what I have said of this one form. They are often mighty instruments in arresting disease and death, although they sometimes destroy life. Nevertheless the rule is certainly not to hasten death, but to keep health. Animal life could not be prolonged to anything like the proper extent if it were not for the despised moulds, which teach us that purity is a grand reality, for what would the half-drained sewers and damp places be if the *Oidium* of diphtheria did not in its growth imbibe for its own existence the poisonous gases which otherwise would be insufferable? We are thus taught lessons which it will be to our cost if we do not follow. We are taught that animal and vegetable refuse must not lightly be permitted to accumulate; the sooner it is applied to its real use, namely, the enriching of the soil, the better. Soil deodorises, economises, and profits by these refuse materials; they are the very things which the earth requires.

ENTOMOLOGICAL RAMBLES IN THE MIDLANDS.

II.—CANNOCK CHASE.

BY W. G. BLATCH.

(Continued from page 196.)

Next in order of importance to Bewdley Forest as a resort for Midland Entomologists must be reckoned that extremely interesting district known as "Cannock Chase." Situated almost in the heart of Staffordshire, and covering a very considerable portion of the extensive area lying between Lichfield, Penkridge, Stafford, and Rugeley—easily accessible, withal, from any of those stations—the "Chase" ought to be better known to local Naturalists than it seems to be. Those who have visited it need no recommendation of its attractions, but to those who at present are strangers to that region I would say: "Go, take a half-holiday as soon as you can, and spend it there." But as, I suppose, for the purposes of these papers, I am, for the time being, "Guide, philosopher, and friend," I must not only point to the goal, but lead the way. We will, therefore, if you please, consider ourselves as fairly started on our second Ramble. As he "who hesitates is lost," we will not bewilder ourselves by discussing the various routes by which our chosen ground can be explored, but at once decide to attack it from Rugeley.

This will be attended by the additional advantage of admitting of friends from other districts joining our party at the Trent Valley Junction. Crossing the Trent and passing through a part of the town, we are soon in the open country, the wide stretch of undulating heather-clad ground before us indicating unmistakably that we are on the very threshold of Cannock Chase. As we press on, eager and hopeful, we are struck by the peculiar features of the spot, forming as they do a perfect contrast to the scene of our first Ramble. Instead of dense woods hemming us in on every side, we have before us an extensive moorland tract, covered with heather and bracken and a thick carpet of bilberry, cowberry, and crowberry, the only woodland features being, now and then, a straggling thicket of haggard, storm-torn birches, and, in the distance, a long, narrow strip of coppice, known as the "Huntington Belt." Boggy ground is not uncommon, whilst here and there we come upon a bright sparkling streamlet dancing merrily along its pebbly course.

At Bewdley, we were so hemmed in by copse on copse, piled in massive and silent grandeur around and above as far as the eye could scan, that frequently the absence of "air in motion" affected us in a way and to an extent scarcely credible. In the midst of our sport, almost gasping in the stagnant, humid air, a feeling of solemnity has suddenly sprung up in our minds, as if the guardian spirit of the region had, in passing, touched us with his invisible form, and evolved sensations of mystery and awe from the depths within. Here, on the contrary, where sportive breezes seem perpetually to play, languor is unknown, and we tread the springy soil with a buoyancy and freedom almost ethereal.

But not only do we notice a change of soil and landscape, even the insects are, for the most part, of types divergent from those to be found at Bewdley. This is, of course, only what might be expected from the totally different conditions under which they exist. Our method of procedure must also be altered to suit our new surroundings. The umbrella (for beating into) and the sweeping-net are useless encumbrances here, but the digger and knee-pad are absolute necessities. The digger (a strong fern trowel is best) will save the fingers in turning over stones and refuse, the knee-pad (of stout leather) will save the operator from headache and backache, and will prevent the knees and trousers being cut by sharp pebbles. As was the case in describing our Bewdley Ramble, we have not time to do more than merely hint at the charms of the "chase" to sightseers, but must limit ourselves strictly to the entomological features of the locality. The novelty of the "first view" having worn off, and having satisfied ourselves that our *instrumenta belli* are effective, we proceed to explore this "fresh field," in the hope that the result will prove it to be another "happy hunting ground." At first we see only a few common species of moths and beetles, the Heath Moth, *Fidonia atomaria*, being, from its abundance, a perfect nuisance, and the dull, puffy *Adimonia suturalis* dropping in hundreds from the heather at the slightest touch. Look into this drain-hole by the roadside, and see how thickly these beetles, alive and dead, strew the bottom. They have, evidently, fallen over the sides, and are too lazy, or too stupid, to make their escape. Under a solitary oak tree are some insects flying in a curious manner; we catch a few and find them to be the "Rusty Gun-barrel," *Athous hæmorrhoidalis*, a beetle of the Skip-jack tribe. The "Fox" and the "Emperor" moths are dashing about with their usual swiftness and irregularity, as if madly and vainly trying to escape from demons of the air that confront them at every turn. About those bright green patches, indicative of the triumph of the bilberry over its less vigorous plant rivals, swarms of green Hair-streak Butterflies, *Thecla rubi*, flash about in the sunshine; and it is amusing to watch their evolutions and to note how, in certain lights, they become quite invisible. This butterfly is a perfect mimic. With its wings open it resembles the darker foliage and the russet soil; with its wings closed it cannot be distinguished from the green leaves of the bilberry, upon which it delights to settle, and you would certainly pass it by, only that it betrays itself by flying up as you approach. But here is work for the digger, to turn over these stones strewed about the turf. What numbers of *Bradycellus cognatus* and the pretty little *B. similis!* Here are also, though less commonly, their congeners, *B. distinctus*, *B. verbasci*, and *B. harpalinus*. What is this beetle, looking somewhat like a giant *Dyschirius?* It is shiny, bronze-black, beautifully rounded in outline, its thorax being almost globular, and its abdomen oval, and looks altogether like an insect of "high degree." Its name is *Miscodera arctica*, and this is a new locality for it, the most southern one yet discovered. Another prize. This time it is *Cymindis vaporariorum*, like the preceding a mountain species and rather rare, taking its day-rest under a paltry piece of old shoe leather! Thus we find another species new to the district, and at the same time learn an important lesson in beetle knowledge, viz., that under the smallest and most unlikely bit of rubbish may lurk an insect prize! "It never rains but it pours." Here is another red-letter capture, and a beauty it is too. How it gleams in the sunshine, its changeful tints resembling the effects of shot-silk, only that they are more gorgeous. What long deep lines mark the base of the thorax, and altogether what a lovely outline it bears! It can be nothing else but the very desirable *Pterostichus lepidus*. Satisfied of this, we eagerly hunt for more, and find them, too, both males and females, the latter having their elytra duller and more softly silky, the thorax showing a brighter coppery appearance.

The generally common species of *Pterostichus* seem to be entirely absent, even the ubiquitous *P. cupreus* not showing up; but here are a pair of *P. versicolor*, which we of course capture. This insect is regarded by some Coleopterists as being a variety only of *P. cupreus*, but having examined a considerable number of specimens in which the diagnostic characters appear distinct and constant, I have no doubt about its being a good species. The genus *Calathus* is well represented, the following species being found freely:—*C. cisteloides*, *C. flavipes*, *C. melanocephalus*, with its variety, *nubigena*, and *C. piceus*. Considerable dexterity is required for the capture of these beetles, (especially the shiny and quick *C. flavipes*,) which "screw" themselves into the soil before you have time to see fairly what they are.

This seems to be a rich field for *Geodephaga*. Besides those already named, we have secured a fine series of the beautiful though common *Cicindela campestris*, including some striking varieties, bronze instead of green, and having small black specks on the elytra in place of yellow spots. *Dyschirius globosus*, *Patrobus excavatus*, *Taphria nivalis*, and *Olisthopus rotundatus* occur in abundance, as also do many species of *Amaræ* and *Harpali*. Of *Amara fulva* we pick up two, and are fortunate enough to secure three examples of the rare *A. patricia*. Amongst the small pebbles in the roadway *Bembidium lampros* (the variety *velox* occurring sparingly,) *B. brunnipes*, and *B. femoratum* abound. Upon lifting a larger stone we are gladdened with the sight of two beautiful beetles and a rare moth, the former being *Corymbites æneus*, male and female, one a dark bronze, the other a deep blue, and the latter the Glaucous Shears Moth, *Hadena glauca*.

Pressing on over the moor in the direction of the Huntington Belt, we reach "Deakins' Grave," 760ft. above sea level. Here we pick up the variety *griseus* of *Harpalus ruficornis*, and a dead and damaged specimen of *Nebria Gyllenhalli*, two northern insects; more *Miscodera* and *Pterostichus lepidus* turn up; also a very fine example of *Calathus nubigena*.

But we must push on through the heather towards Hednesford. As we go we start up great numbers of the very beautiful little moth *Anarta myrtilli*, together with hosts of "Crambs" and other moths.

The pool seems full of water beetles, and on the margin we find many species of *Geodephaga* and *Brachelytra*. At one end, on the leaves of *Polygonum amphibium*, are to be seen hundreds of specimens of *Galeruca nymphea* in all stages of development, and under a dead dog occurs a fine fresh specimen of *Silpha opaca*.

Our way now takes us over a not very interesting part of the Chase towards Norton Bog and Reservoir. The walk pulls the "kinks" out of our legs, and on arriving at the Reservoir we are prepared for more work. Close to the margin of the water is a mass of rubbish washed up by the "waves;" we turn it over, and are rewarded by seeing *Carabus nitens*, perhaps the most strikingly coloured of all the British *Carabidæ*. It is accompanied by *C. granulatus* and several *Anchomeni*, including the handsome but common *A. marginatus*. Amongst the gravel we take quite a host of *Bembidia*, this being apparently the favourite locality on the Chase for the very interesting little beetles comprised in this genus. The following species of *Bembidium* fall victims to our prowess: *rufescens*, *obtusum*, *biguttatum*, *æneum*, *guttula Mannerheimi*, *quadrimaculatum*, *quadriguttatum*, *articulatum*, *lampros*, *nigricorne*, *bipunctatum*, *decorum*, *monticola*, *brunnipes*, *tibiale*, *atrocæruleum*, *femoratum*, *littorale*, *flammulatum*, and *punctulatum*, not by any means a bad day's sport in themselves, even had we "bottled" nothing else. But there are a few more things yet to be added to our list. By digging in the marly bank we turn out two or three specimens of the ludicrously awkward *Nebria livida*, very interesting as occurring in the Midlands, the headquarters of this beetle being on the coasts of Yorkshire, Norfolk, &c.

A short distance furthur on our diggers bring from their hiding-places three beautiful specimens of the rather rare *Trechus brunneus*.

Our time has now nearly run out and we must think of returning. Before leaving this spot, however, we turn over one of the drowned dogs lying about, and pick out a supply of the Histers and other Clavicorns that have taken possession of his carcase. But though there are plenty of beetles we are soon glad to retreat, the "high" state of our quarry being too much for at least one of our five senses. We therefore hasten towards Brownhills Railway Station, with the view of catching the next train homeward. On the way we capture *Carabus arvensis* running on the heath, *C. catenulatus* under a stone, and a single specimen of a pine-feeding weevil—*Hylobius abietis*—which seems to be altogether out of his reckoning here. This beetle suggests a topic for conversation, and our journey home is bereft of much of its tediousness by an animated discussion on the migrations (both local and general) of insects. Our second Ramble thus ends as happily as did the first, and our party separates with evident signs of unabated energy, indicated by the eager enquiry, "Where shall we go next, and when?"

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 268.)

SARRACENIÆ.

Of this family Dr. Hooker makes two groups, in the first of which the lid does not cover the mouth of the pitcher, whilst in the second the lid does not admit rain to the pitcher. These groups are united by the fact that in some of the first the lid covers the mouth of the pitcher in the young state of the plant, but does not do so when the plant is old.

In *S. purpurea* the lid never covers the pitcher, and to this plant I first directed my attention, for it seemed to me that it would prove to be in organisation the least removed from a mere water pitcher. I examined many specimens of this plant, some grown under glass in this country, and some brought living from its native soil. My observations on the structure may be summed up in the description of a mature pitcher of a native-grown plant, nine centimetres in length. The outer surface was scattered with stomata and multifid buds. From the margin of the lip down the inner surface of the true pitcher, for a distance varying between two and three centimetres, the epithelium is of peculiar shape, known as sinuous. On this zone stomata are very abundant. There are numerous stiff hairs, not tubular, but made up of long rod-like cells. (Plate VIII., Fig. 9.) These setæ are all pointed downwards, towards the cavity of the pitcher, and must, evidently, be of service in preventing the egress of insects who may wish to travel outwards. It would be very interesting to know what special appliances enable

Xanthoptera semicrocea and *Sarcophaga sarraceniæ*, said by Professor Riley to be the only two insects which can escape from the pitchers of the Sarracenia, to overcome this formidable *chevaux de frise*. In the case of the latter insect it is probable that the grub is deposited in the pitcher by the mother before the special armature of the first zone is developed. This development afterwards leads to the peculiar method of escape of the mature grub in a way serviceable to the plant in which it has fed. Sparsely scattered over this surface are multifid buds, raised above the epithelial level for the greater part of their bulk, but slightly dipping below it, being therefore transitions from the multifid bud to the ostiole. I have failed to find anything which I could regard as nectaries on this surface. It ends quite abruptly in a line of crescentic markings, armed with stunted setæ, and when wetted it does not throw off water. (Fig. 9.) The second zone presents to the naked eye a remarkable bald appearance, and when wetted it throws off the water, a circumstance which seems to be due to a peculiar arrangement of the epithelium. Each cell is produced into a mammillary process, (Fig. 9,) pointing downwards, and is marked by a number of flutings, like the back of a pecten shell, these flutings converging towards the apex of the process. The process of each cell overlaps the upper margin of the cell immediately below it, and in this way a subsidiary barrier is formed which must prevent the egress of insects small enough to creep between the large setæ of the first zone. On this surface the intercellular spaces are evidently canalicular, and multifid buds abound, but they are covered by the altered epithelium. Whether this covering means that they are only hidden by the peculiar development of the epithelium, or are really embedded, I am unable to say. This zone is about six millimetres wide, and ends as abruptly as it begins. I have failed to obtain any evidence of secretion from this surface, and therefore I regard its glandular structure as purely absorbent. Stomata are of very occasional occurrence on this surface. In the third zone the epithelium is of the sinuous pattern, with well marked intercellular canals and very abundant included glands. These bodies are entirely covered by the epithelium, the divisions of their protoplasm appearing, however, very close under the surface. They are about ·065 of a millimetre. There are no stomata on this surface. The transition from the third to the fourth and most extensive zone is rapid, but not quite sudden, and consists in an alteration of the cells of the epithelium from the sinuous shape into irregular polygons. The subepithelial cells are, however, of the sinuous shape, a fact which may account for the view expressed by Dr. Hooker, that this fourth zone has no cuticle. There are no stomata to be found in this zone, and no subepithelial glands, the place of the latter seeming to be taken by the tubular trichomes already described. These trichomes are not nearly so stiff and strong as the setæ on the first zone, and the surface on which they are situated is peculiarly retentive of water, the innumerable hairs taking it up between them like a sponge. I have not seen spiral vessels in the tissue of *Sarracenia purpurea*. All my efforts to discover the presence of any ferment having digestive properties in the fluid taken from *S. purpurea* have failed. Fluid taken from pitchers containing insects generally gives a distinctly alkaline reaction, and in the few instances where I have obtained a faintly acid reaction, it has seemed to me to be due to the presence of ants. In virgin pitchers, fed with albumen, no acid reaction has ever been obtained, and the albumen rapidly decomposes. I may here state that the ordinary method of testing these fluids by litmus paper is crude enough not to be always trustworthy. A more delicate way is to make a concentrated solution of litmus in distilled water, and add to it about ten per cent. of absolute alcohol. A drop of this should be placed on a white porcelain plate, side by side with a drop of the fluid to be tested, and the drops then made to touch. An amount of acid may thus be detected which will escape the eye of the observer if litmus paper be used, and there can be no possibility of error. I draw the conclusion, therefore, that the glandular structure of *S. purpurea* is purely absorbent, that its pitchers are merely passive insect traps, and that the advantage gained for the plant by the destruction of flies is to be attributed entirely to their maceration. Another argument in favour of this, the importance of which will be seen by and by, is that flies continue to live an indefinite time after having been introduced into a Sarracenia pitcher containing fluid. The very interesting observation of Prof. Riley concerning the habits of the *Sarcophaga sarraceniæ* would show that considerable advantage is gained for the plant by the direct application of the insect debris to the roots of the plant. I am quite certain from my experiments with the nutrition of Nepenthes that if *S. purpurea* had a secretion at all like it, no insect could visit the latter with impunity. A series of experiments made during the summer with test tubes of various sizes and diameters, and containing fluids of various kinds, have convinced me that as far as the common house fly is concerned, no specially disguised or attractive form of trap is required. But there is no doubt that the addition of the coloured venation on the lip of the *S. purpurea* must make it more attractive to certain kinds of insects, as Sir John Lubbock has shown that bees are greatly influenced by colour. The armatures of the upper zones must also be advantageous by imprisoning the insects. It will be seen, then, that I differ from Dr. Hooker in that I regard the first and second zones of the *S. purpurea* as the truly detentive surfaces, and the third and fourth as absorbent.

S. flava.—I examined the pitchers of a young plant in which the lip covered the mouth of the pitcher. If I may argue from the facts observed in Nepenthes this ought to be the most active condition of the pitcher. I found spiral vessels in the lid, and numerous stomata and ostioles. The latter in this case suggested that they may be the local centres for the growth of epithelium, for the cells in their immediate neighbourhood were all small and seemed to radiate from the ostiole as from a centre, and the intercellular canals seemed to grow with them (see Fig. 7, also Fig. 4 from *S. rubra.*) There were also a few multifid buds. The first and second zones of this pitcher resemble those of *S. purpurea*. The third has short tubular trichomes and no glands, and the fourth has long tubular trichomes. This variation in the third zone is noteworthy. I found no evidence of secretion here, and when the pitcher was over-fed, whether by albumen or naturally by a too large fly, the decomposition spread to the parenchyma of the leaf and killed it.

[TO BE CONTINUED.]

SCIENTIFIC NAMES.—II. PRONUNCIATION.

BY W. B. GROVE, B.A.

(Continued from page 272.)

It may be interesting to some, if, before I enter upon the details of the reformed Latin pronunciation, I give a few particulars concerning the circumstances of its introduction. The great authority upon the subject is the Rev. H. A. J. Munro, formerly Latin Professor at Cambridge. Mr. Munro remarks that "it is a delusion to suppose that there is a foreign as opposed to an English method. In England itself there is no one unvarying system." "To insure complete uniformity is an impossibility," but it seems to him "desirable to endeavour in theory after a worthy ideal, even if in practice we should many of us fall short of it." These and other reasons having been urged by a few enthusiastic spirits, the Oxford Philological Society proposed several alterations, and the head masters of some of the greatest schools in England met and discussed the matter. At their request, Professor Munro, in conjunction with the Latin Professor at Oxford, published in 1873, a "Syllabus of Latin Pronunciation," * in which the full extent of the proposed changes is enunciated. The question has since been discussed in various reviews and periodicals.† I find that at the present time some of the most important schools, as Eton, Harrow, and Rugby, have not yet adopted the reform. Among the schools that have adopted it are Marlborough, the City of London, Liverpool College, and most of the schools of the Girls' Public Day School Company.

The new pronunciation of Latin affects chiefly the vowel sounds. It is well known that in this respect the English language stands nearly alone; in most of the other European tongues—especially those which had their remote origin in the Latin—the greater part of the vowels is pronounced as in the following table:—

a as in făn, fāther.	*æ* = *a* in fate.
e as in fĕn, fête, (fate.)	*au* = *ow* in cow.
i as in fĭn, fatīgue.	*eu* = *you*.
o as in hŏp, hōpe.	*ei* as in height or veil.
u as in fŭll, rūde.	*œ* = *oi* in coin or like *æ*.

This is believed to represent (minute distinctions excepted) the vowel-sounds of the ancient Romans. Thus *ā* has the so-called broad (Scotch) sound; *ē* and *æ* have the sound which we generally give to *ā* in our own language; *ī* has the sound which we generally give to *ē*; and the two sounds of *u* are the same as those of *oo* in pool and book. But while this may be considered certain, the remaining diphthongs, especially *œ* and *ei*, are still doubtful. Little seems to be known of the sound of *y* in classical words; at present we must be content to pronounce it like *i*.

Among the consonants the changes are fewer; *c* is always hard like *k*, *g* is always hard as in *get* and *girth*, *j* always equals *y* in *yard*. The

* Deighton, Bell, and Co., Cambridge.

† See the "Academy," February—June, 1871. "Contemporary Review," April, 1871.

remaining consonants may be pronounced as at present; by some *v* is sounded like *v*, by others like *w*. It is not my business here to enter into the reasons which have led to the conclusion that these are the proper sounds of the letters, but it may be noticed that *j* and *i* were originally the same letter, and may be presumed to have been pronounced the same, while the evidence in favour of the hardness of *c* and *g* is overwhelming.

But here, to prevent misapprehension, it must be observed that no one proposes to introduce this change into English words, as is sometimes imagined. No one wishes us to pronounce circle, *kerkle*. In all truly naturalised words English habits will of course prevail; even the ill-used Cicero, when occurring with English words in an English sentence will be pronounced as at present; the reformation only applies to classical words used as such, and those formed in imitation of them. It will be certainly some time before it will be generally accepted, but its ultimate triumph seems at least probable. In the case of *g* there is not so much difficulty, as many English words contain a hard *g* before *e* or *i*, as *gear* and *gift;* but there seems to be a considerable reluctance to apply the same principle to *c*, though we have a precedent in the word sceptic, and also in Celt, Celtic, which are sometimes pronounced as if written with a *k*. If we adopt the "reformed" principles, we must sound all scientific names in this way, as, for instance, Cerastium and Geum; but the practice seems as yet so like an affectation that very few have adopted it. The novelty once overcome, it will be found that to an unprejudiced ear the new sounds are, to say the least, as euphonious as the old. The greatest obstacle lies in such words as Geranium and Cyclamen, which are used in English in an unchanged form. It seems strange to pronounce these in different ways at different times, as must be done in that case. Thus we may talk of scarlet Geranium as at present, but we should say *Geranium coccineum* with a hard *g* and *c*. Now to pronounce in this two-fold way words which are spelled alike is no more than is done every day by those persons who can speak more than one language. No one thinks of pronouncing the German *general* like the English *general*, or the French *voyage* like the English *voyage*, though they may have the same spelling and meaning.

There is one point in connection with the reformed scheme which finds admirers even amongst those who do not adopt the changes in the sound of the letters. I mean the pronunciation of the vowels strictly according to "quantity." As was explained above, (p. 269) every vowel-sound has two varieties, called respectively "long" and "short," but in the former conventional mode of pronouncing Latin this distinction was grossly neglected. Thus, *gĕnus* was generally pronounced with the *e* long, as if written *jeenus*; the word Ptĕris is often similarly mispronounced. To take another instance, it is usual to say "dulce dōmum," but the *o* is short, and the word should be pronounced thus—dŏm-um. To apply this principle, however, to scientific names requires an acquaintance with the quantity of the vowels in the different words, which can be obtained only by frequently consulting the dictionary, and is within the reach of few.

Finally, I must mention that in the reformed pronunciation all the consonants must be sounded no less than all the vowels. Thus in all such words as the following the initial letters must be heard :—Bdella, Cnestis, Ctenodus, Gnetum, Psammobia, and Pteris. Also the consonants must preserve their proper sounds under all circumstances, so that the *t*, *s*, and *c* in such words as Spartium, Blasia, and Vicia have the same sound as in other words where they are not followed by *i* and a vowel. The two latter practices might be adopted with advantage by even those who will consent to no other change, and are capable of a wider application. For instance, I do think that those who pronounce Calcium "Calshium," Strontia "Stronsha," etc., carry their love of the corrupt sounds of the English language to an unreasonable extent.

Having now touched on the chief topics connected with the pronunciation of Latin, we come to the far more difficult case of words derived from the modern languages. I have already laid down the only principle which seems to me to afford the slightest hope of general agreement upon this point. It is useless to attempt to tinker at the matter by dealing with special sounds, such as *ch*, as has been done by some; we must adopt one broad rule, which will comprehend all questions, or leave the present chaos undisturbed.

There are three cases of which examples may be found: (1) a word may be borrowed from a foreign language without undergoing any change—in this case we borrow the pronunciation also; (2) the word may be Latinised—in this case it will be treated exactly as a Latin word; (3) it may have a Latin ending tacked on to a "barbarian" stem—in this case we must take the pronunciation of the stem from one language, and of the termination from another. This would sometimes produce a curious result, were it not that the ending is generally simple, such as *-a*, *-ia*, or *-ii*. In some few cases the ignorance or inadvertence of authors has perpetrated worse combinations, *e.g.*, *Indigofera anil*, of which indigo is French, -fera Latin, and anil Portuguese.

A word by the way to prevent misconception: in speaking thus, I must not be understood to mean that ignorance of the niceties of Latin and Greek etymology is of itself blamable. It is so only when it pretends to be knowledge, and forms the incorrect assemblages of letters, which some naturalists (and also some barbers and tailors) elaborate. Looking at the jaw-breaking names often imposed upon innocent little creatures or plants, it might be thought that the number of euphonious combinations was nearly exhausted. So thought Charles Kingsley, when he said that men of science had been obliged to invent what we may suitably call these *cacophonic appellations*, "since they took to breaking up one species into ten." But it is not so; the number of smooth-sounding pleasant names is not only not exhausted, but practically inexhaustible. Even if Pleuroschismatypus were a correctly formed and very expressive term, we would readily exchange it for a simpler word. But I do not agree with those who are horrified at such names as Schweyckherta and Razoumowskia, they must stand on the same footing as Daltonia, Cruikshankii, and Fothergilli. We are not the only scientific people, and there are probably some who find the three latter as hard to pronounce correctly as we do the two former names.

This brings us face to face with the difficulty of discovering the true sound of the letters in foreign words, but all that is wanting is a ready means of access to information on the subject, and a desire to learn on our part. The number of sounds really different from those which we ourselves use is fewer than is imagined, and still fewer are difficult for our tongues to pronounce, at least approximately. Absolute accuracy in all the nice shades of intonation which sometimes occur is out of the question, and besides quite unnecessary.*

In conclusion, then, I will sum up the system I propose for the pronunciation of such words as Lachenalia and Grabowskii. Let the vowel-termination have the sound already assigned to it in Latin words, (according to the reformed scheme,) and let the body of the word be pronounced as nearly as possible the same as in the language from which it is derived. This, however, is rather an ideal to be aimed at than a result to be attained, but it is not less worthy of pursuit than the far more unattainable ideal, in such cases, of a uniform Latin or a uniform English pronunciation.

SUBURBAN GARDENING.

BY EDWARD W. BADGER, F.R.H.S.

[*Continued from page 278.*]

SEASONABLE HINTS FOR AUTUMN.

The gardener is unceasingly called upon to exercise forethought. Scarcely an operation is performed by him the effect of which is immediate; in nearly all he does he has "to labour and to wait" for results. Whether he tills the ground, sows seeds, hybridises, grafts—whatever he does, he is dependent on the future for the fruition of his work. He cannot be successful in his pursuit unless he is always looking forward: hence moralists have seen that the work in which he is engaged is a good school for the training and development of his better nature. No part of his occupation is usually more pleasurable than the anticipatory work of autumn and winter. This is the time of year when he makes alterations in the arrangement of his beds, when he lays his plans for removing defects or supplying deficiencies with which previous seasons have made him acquainted. It is the time when he selects bulbs and early flowering plants for the adornment of his beds and borders, when the renovating spring time once more arrives and vegetation enters again on its annual period of active growth. It is also the time for the careful uplifting and re-planting of fruit and other deciduous trees and

* The nonsense which has appeared on this topic in several periodicals is amusing. Those who know little about it generally instance the German *ch* as a great stumbling-block; but, with strange fatality, they always quote as an example the word Fuchsia. Now it happens that in that word the *ch* has *exactly* **the sound of *k*, and as a botanical name it should be pronounced *Fooksia*.**

shrubs, which are overcrowded or unhealthy, or which, growing too vigorously, require a gentle check to induce a sturdier and more compact style of growth. And now it is that he makes new plantations of nearly all sorts of trees, except evergreens.

I have already indicated the method of renovating and preparing the soil by trenching or double digging. This plan can generally only be employed in that part of the garden which is free from crops, and is scarcely applicable to the portion devoted to flowers, except in such beds as have been entirely filled with summer flowering plants of annual duration, or those which are too tender to winter out of doors, and which are usually known as "bedding out plants." Such beds when empty should be annually deeply dug and renovated by the addition of good turfy loam and partially decomposed manure. If they are to be used, as in suburban gardens they mostly will be, for "spring gardening," this work should be done at the earliest possible time after the summer occupants have been removed, so that the planting of bulbs and other flower roots may be done before severe winter weather sets in; thus doing what will be conducive to a fine display of flowers in the spring by affording ample time for the plants and bulbs to get well rooted. In beds not required for spring bedding the digging and renovation being done, the surface should be left as rough as possible, so that the largest amount of surface may be exposed to the sweetening and disintegrating influences of air and frost.

This, too, is the period when the mixed flower borders should be enriched and stored with material for the supply of food to the occupants in the coming year. Every herbaceous plant and patch of bulbs left in the ground should have its place marked by a tally, so that unnecessary disturbance or injury may be avoided. Where there is sufficient room between the plants and bulbs the vacant spaces should be gently forked with a small steel digging fork, (such as everyone should possess for use in the flower garden,) so as to loosen the soil as much as possible. Having gone over the bed or border in this way, some well-prepared compost should then be scattered all over it so as to finish it off neatly, though it will be better to avoid raking the surface. A handy workman will know how to complete the work in such a fashion as to leave it pleasant to look at, though sufficiently rough to get a good deal of benefit from the atmosphere and the varying temperature of the winter. Raking is a very unsatisfactory and deadening operation. It gives a smooth appearance to the soil and that is its only recommendation, but it produces a firm compact surface, very detrimental to the well-being of the plants, and I therefore advise the almost entire avoidance of the process.

The preparation of the compost to be used in the renovation of flower borders may fitly be described here, as I fear none but good gardeners know anything about it. A moment's consideration should satisfy any one that if plants are grown as they commonly are in the mixed flower border year after year in the same spot, and it is considered undesirable or inconvenient to move them very often, the soil in which they are planted must annually get more and more impoverished.

To compensate for this continual withdrawal from the stores of the soil an annual supply of such food as the plants require should be added at the surface, which is the only available spot. Every shower of rain will act on this surface dressing and carry some of its fertilising properties downwards, while the roots of the plants nearest the surface will be nourished directly and encouraged. This will give a general indication of the kind of compost most likely to answer the purpose. It should be rich in suitable materials, and in a condition easily soluble. It should not be littery in appearance, for it is to be applied to the ornamental part of the garden. This compost will vary according to circumstances. It should be prepared as opportunity offers and may consist of such thoroughly decomposed vegetable matter as can be most easily obtained, foremost among which may be named leaves of trees decayed into leaf mould, top-spits of old turf, especially of a loamy texture. Both these ingredients supply excellent food for nearly all sorts of plants, and when they have been turned over a few times, and are well pulverised, the food is in a condition of which the roots will rapidly take advantage. Well rotted dung, soot, and almost any other fertiliser, may go to enlarge and enrich the compost heap, the formation of which should be always going on in some reserve spot from whence it can be easily conveyed to any part of the garden where it may be wanted. This compost may be made still more valuable by the admixture of some of the good artificial manures which are now everywhere obtainable, and which supply easily soluble food for plants in general. By careful admixture the artificial manure will get evenly distributed; and, as it rarely happens that much of it is wanted at any one spot, the compost heap may well be made the means of causing its distribution in such doses as are compatible with its own richness and the wants of the plants it is applied to. This will be found a good plan for avoiding the injuries which sometimes occur through concentrated chemical fertilisers being applied in too large quantities, a cause of much mischief when they are applied by the inexperienced.

As has been hinted above, now is the time for planting many kinds of bulbs out of doors. Most of them will thrive in beds and borders prepared as above described. Crocuses should be got in the ground directly they are received from the seedsman, for they rapidly deteriorate, and are usually ready to commence forming roots as soon as they can be purchased. Snowdrops, Winter Aconites, and all other early blooming bulbs, should also be planted early. They should be placed not less than two inches below the surface, and where the soil is light in texture they may be planted deeper with advantage, especially Crocuses, if they are intended to occupy the same spot for more than one year, their habit being to grow nearer the surface every year. Tulips and Hyacinths may be planted somewhat later, and batches may be reserved to be planted later still to provide a succession of bloom. Both sorts of bulbs are plentiful and cheap. Where quantities are grown, it is as well to grow masses of the same kind together, so as to ensure uniformity in height, style of growth, &c., and very pretty effects may be produced by such an arrangement of the groups that the colours of the flowers may contrast and harmonise well. But, in the bulk of small gardens, for the owners of which these hints are chiefly intended, mixed beds will be found the most useful. For instance, an interesting display may be made in the same bed by planting together mixed Hyacinths and single and double Tulips, using both early and late blooming kinds to prolong the show of flowers. These bulbs should occupy the central portions of the bed. Then around the larger bulbs a border of lines or patches of mixed Crocuses will find a proper place, and plants of Daisies, Forget-me-Nots, *(Myosotis dissitiflora,)* and dwarf-growing Wall Flowers may be planted thinly all over the bed, giving it a furnished appearance even in winter, and adding to its charms in spring.

Among the hardy bulbs which should be grown, Scillas will generally be included. There are many kinds, but the two I shall recommend are *Scilla amœna* and *S. sibirica;* they should be planted in clumps of not less than six bulbs each, a couple of inches apart all ways. Then the Narcissus family will afford early and late flowering kinds, most of which are very beautiful. These may remain in the same spot for several years with advantage. The kinds now to be purchased cheaply are so numerous I cannot attempt their enumeration ; any seedsman will supply a collection on receiving an order, and as none are without beauty I do not think any one will be disappointed by leaving the selection to the tradesman from whom he buys his bulbs. Of course no one will omit to secure a goodly number of the single and double Poet's Narcissus; and none of the family will yield more pleasure or lighten the garden with brighter beauty than clumps of the bunch-flowered Daffodil *(Polyanthus Narcissus.)* A well-selected collection will furnish a succession of flowers from February till June.

Dog's-tooth Violets are charming in leaf and flower; the Wood-hyacinths, of which we have now many lovely kinds, are easy to grow and beautiful; Triteleias, too, deserve a place everywhere, and their beauty is enhanced when *Anemone apennina* is grown in association with them. And having mentioned Anemones, I cannot resist advising the planting in every garden of *Anemone fulgens*. This is an early blooming kind, producing lovely flowers of the brightest scarlet. Half-a-dozen roots should be planted together, so as to ensure a decided effect. Other sorts of Anemones should also be planted for early blooming, the middle of October being generally regarded as the best time. For the later period of flowering, the roots should be planted at the end of January on a dry day. I must not pass from bulbs without a word about Irises. Many of them are as varied and beautiful as Orchids. The bulbous kinds best known are those called English Irises and Spanish Irises, the latter blooming earliest, and having the smallest flowers, which are, however, most lovely. Both sorts should be planted forthwith. *Iris reticulata* is a gem which blooms from February to April, opening its sweet-smelling flowers in a temperature too low for the development of Narcissus blooms. Then there are the Flag Irises in numberless variety, the most exquisite of all being the Japanese sort, *Iris Kæmpferi*, which thrives and blooms best if planted in sandy peat. It is necessary to bear this in mind, as this Iris does not bloom freely in all soils.

The plants on which, next to bulbs, we mainly rely for the decoration of the garden in the spring must of course be planted at once. I have already alluded to them incidentally, and I will merely, as a reminder, mention such as may be relied on to assist in producing an effect which I am glad to say is yearly becoming more common—a garden gay with bright flowers during some of the early months:—Alyssum saxatile, Arabis albida, the variegated form of same, Aubrietia Græca and grandiflora, Alpine Auriculas, Cheiranthus alpinus, Daisies, (white, pink, red, and crimson,) Dielytra, Forget-me-not, Hepaticas, (particularly H. angulosa,) perennial Candytuft, Pansies, Polyanthuses, Primroses, (double and single,) Silene pendula, Veronica incana, Violets, Violas, and Wallflowers. To these many others might easily be added, but from this list enough may be selected for most small gardens. I will not pass from this subject without recommending any who may wish to know more about spring gardening to buy a little book, (published at the "Journal of Horticulture" Office, in London,) by Mr. John Fleming, the famous gardener at Cliveden, the title of which is "Spring and Winter Flower Gardening." Its price is half-a-crown.

Roses should be planted now in preference to spring; first, because deciduous trees are best transplanted while in a state of rest, and especially just after the leaves have fallen; and, secondly, because in purchasing plants from the nurserymen the best plants can be obtained early in the season. Roses should be planted in rich, deep soil, heavily manured, inclining to stiffness naturally, or made so by the addition of marl. Standard roses are often preferred, but they are shorter lived than dwarfs budded low on Manetti or seedling briar stocks, or grown on their own roots. Roses on the Manetti will thrive in lighter soils than those on the briar; but they must be so planted that the point of junction between stock and scion is a couple of inches below the surface of the soil. It is therefore necessary to know whether the plants are on the Manetti or not, as failure to attend to the foregoing direction will be injurious to the plants.

All kinds of hardy herbaceous plants may now be planted. Of these I will only mention two kinds, which are not so well known as they deserve to be. *Pyrethrums* are some of the flowers in which the florist has worked the most wonderful improvement during recent years. They are cheap and perfectly hardy, and the best forms are very double. Their colours are most varied, for we have whites, lilacs, pinks, reds, crimsons, and purples of various shades. The flowers are early, plentiful, and most enduring. For a lasting, useful autumn flower nothing is better than *Anemone Honorine Jobert*. It is tall in growth, and yields a profusion of large white flowers, most valuable for cutting. It is very hardy and easy of cultivation. This and the *Pyrethrums* should be planted at once in good soil, and plenty of room allowed for the proper development of the plants, for the finer they are the better they will bloom.

[TO BE CONTINUED.]

METEOROLOGY OF THE MIDLANDS.

THE WEATHER OF OCTOBER, 1879.

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.	1·12	·29	24	13	65·0	4	24·5	16
Stroud	S. J. Coley, Esq	1·24	·46	1	9	67·0	8	32·0	17
SHROPSHIRE.									
Haughton Hall, Shifnal	Rev. J. Brooke	1·42	·36	24	12	61·0	1	27·0	16
Woolstaston	Rev. E. D. Carr	1·59	·48	24	17	63·0	10,11, 12,	32·0	16
Leaton Vicarage	Rev. E. V. Pigott	1·52	·61	24	13	62·1	1 & 4 (13	25·0	16
More Rectory, Bishop's Castle	Rev. A. Male	1·40	·25	24	17	64·0	6	26·0	16
Larden Hall	Miss F. R. Boughton	1·47	·30	24	13	63·0	4	33·0	16
Bishop's Castle	E. Griffiths, Esq.	1·19	·28	19	12	62·0	8	26·0	15
Cardington	Rev. Wm. Elliott	·81	·27	24	7				
Stokesay	Rev. J. D. La Touche	1·20	·38	24	13	62·9	6	26·6	16
HEREFORDSHIRE.									
Stoke Bliss	Rev. G. E. Alexander	·97	·19	24	13	62·0	4	30·0	15
WORCESTERSHIRE.									
Orleton, Tenbury	T. H. Davis, Esq.	1·07	·21	24	12	65·0	4	27·3	16
West Malvern	A. H. Hartland, Esq.	2 17	·22	21	17	64·5	4	29·5	15
Pedmore	E. B. Marten, Esq.	1·37	·31	24	15	64·[illegible]	3	30·0	15
Longlands, Stourbridge	J. Jeffries Esq.	1·26	·30	24	12	64·0	1, 4, 7	26·0	15
Dennis, Stourbridge	Mr. C. Webb	1·21	·34	24	15	64·0	5	26·0	15
STAFFORDSHIRE.									
Thorganby Villa, Wolverhmtn	G. J. C. Broom, Esq.	1·06	·25	2 & 24	16				
Dudley	Mr. J. Fisher	1 14	[illegible]	24	12				
Sedgley	Mr. C. Beale	·98	·34	24	16	60·0	5 & 7	33·0	15 & 16
Kinver	Rev. W. H. Bolton	1·16	·26	24	15	63·0	4	27·0	15
Walsall	Mr. N. E. Best	·99	·29	24	13	60·0	4	31·0	15
Grammar School, Burton	C. U. Tripp, Esq.	·94	·25	2	15	67·0	5	28·0	16
Weston-under-Lyziard R'tory	Hon. and Rev. J. Bridgeman	1·37	·40	24	19	63·0	1	28·0	16
Wrottesley	E. Simpson, Esq.	·99	·29	24	12	61·7	6	30·2	16
Heath House, Cheadle	J. C. Philips, Esq.	1·27	·33	2	13	62·0	5	31·0	16
Alstonfield Vicarage	Rev. W. H. Purchas	2·03	·53	19	10	61·0	5	27·0	26
Farley, near Cheadle	C. L. Wragge, Esq.	1·89	·39	1	17	61·5	5	28·7	16
Oakmoor	E. Kettle, Esq.	2·61	·39			64·8	5	27·2	16
WARWICKSHIRE.									
Coundon, Coventry	Lieut.-Col. R. Caldicott	1·04	·34	2	12	62·0	1 & 4	33·0	15
Coventry	J. Gulson, Esq.	·85	·17	2	16	64·0	5	32·0	16
Bickenhill Vicarage	J. Ward, Esq.	·87	·35	21	5	50 0		32·0	
St. Mary's College	Rev. S. J. Whitty	·88	·27	24	11	64·9	5	31·1	16
Henley-in-Arden	T. H. G. Newton, Esq.	1·18	·30	2	12	65·5	4	31·0	16 .
Rugby School	Rev. T. N. Hutchinson	1·17	·28	1	13	66·2	4	31·0	16
DERBYSHIRE.									
Stoney Middleton	Rev. U. Smith	1·19	·26	14	9	61·0	4 & 5	29·0	15 & 25
Fernslope, Belper	J. G. Jackson, Esq.	1·11	·30	2	13	62·0	1 & 5	32·0	26
Linacre Reservoir	C. E. Jones, Esq.	·83	·20	14	10				
Spondon	J. T. Barber, Esq.	1·16	·35	2	13	60·0		29·0	14
Duffield	W. Bland, Esq.	1·35	·31	2	14				
NOTTINGHAMSHIRE.									
Hesley Hall	B. J. Whitaker, Esq.	·96	·24	14	13	66·0	7	32·0	29
Tuxford	J. N. Dufty, Esq.	·7[illegible]				59·0	2 & 4	30 0	26
Hodsock Priory, Worksop	H. Mellish, Esq.	·84	·21	14	13	65·5	1	28·2	26
Park Hill, Nottingham	H. F. Johnson, Esq.	1·14	·32	2	11	62·8	5	36·0	15
LEICESTERSHIRE.									
Loughborough	W. Berridge, Esq.	·66	·12	1 & 14	13	67·1	6	30·0	26
Ashby Magna	Rev. E. Willes	·77	·22	24	10	66·0	4	26·0	16
Market Harborough	S. W. Cox, Esq.	·59	·14	2	11	61·0	1 & 5	26·0	26
Kibworth	T. Macaulay, Esq.	·70	·15	23	9			27·0	26
Town Museum, Leicester	W. J. Harrison, Esq.	·91	·30	2	15	64·0	6	33 0	16
Belmont House, Leicester	H. Billson, Esq.	·90	·30	2	14	65·5	6	34·0	16
Syston	J. Hames, jun., Esq.	·75	·17	1 & 2	13	63·0	7	31·0	16
Waltham-le-Wold	E. Ball, Esq.	·90	·20	1	11	58·0	5	28·0	15
Little Dalby Hall	G. Jones, Esq.	·79	·23	2	12	65 0	4	26·0	16
Foxton Locks	Union Canal Company	·52	·20	2	6				
Coston Rectory, Melton	Rev. A. M. Rendell	·75	·20	2	1[illegible]	61 8	5 & 19	28·0	28
NORTHAMPTONSHIRE.									
Towcester Brewery	J. Webb, Esq.	·67	·20	19	8				
Castle Ashby	R. G. Scriven, Esq.	·62	·16	24	9	64·0	4	33·0	15
Kettering	J. Wallis, Esq.	·63	·21	24	12	62·0	2, 5, 6	33·0	16
Althorpe	G. S. Groom, Esq.	·59	·20	24	10	62·0	5	30·[illegible]	15 & 25
RUTLAND.									
West Deyne, Uppingham	Rev. G. H. Mullins	·56	·13	2	15	63·6	6	31·5	16
Northfields, Stamford	W. Hayes, Esq.	·56	·11	19	10	60 1	1	29·0	26
Ratcliffe Observatory	E. T. Stone, Esq.	·73	·18	21	10	65·1	4	32·[illegible]	15
Ventnor Hospital	W. T. Ryder, Esq.	1·13	·30	24	5	65·0	5	35·[illegible]	16
Altarnun Vicarage	Rev. J. Power, M.A.	4·04	1·02	20	21	67·0	8	27·0	16

At last we can record a cessation of the continuous wet which marred the summer of 1879. Although little rain fell, yet the effect of previous downpours and the thorough saturation of the ground was visible in the damp condition of the atmosphere, and the consequent heavy fogs which prevailed, more especially during the first half of the month; for the same reason there was little sunshine. Light easterly winds prevailed, with a high barometer. The harvest was in the main secured by the middle of the month, but was very deficient in quantity and quality.

NATURAL HISTORY NOTES BY OBSERVERS.—*Spondon.*—Of moths, *Mamestra brassicæ* has been abundant, and of course destructive. Very few *Plusia gamma* have been seen. *Burton-upon-Trent.*—Wasps very late and scarce; Ladybirds plentiful. *Nottingham.*—Scarcely any wall fruit has had the right flavour, and all had the appearance of wanting more sun. *Coventry.*—A wonderful crop of plums and damsons, but they have not for the most part ripened well, or come to much perfection. The dull and sunless character of the season has deprived the fruit of its usual flavour. *Cheltenham.*—A sharp frost on the 16th, causing the leaves to fall rapidly from some trees, and giving others their beautiful autumnal tints. By the end of the month the elm trees and oaks alone kept their foliage, that of others—as horse chestnuts and walnuts—being all off, or very much thinned. *Wrottesley.*—Fieldfares first seen on the 5th. *More Rectory.*—A few Redwings seen on 29th. *Stroud.*—Swallows finally left on 9th. *Hodsock Priory.*—First gray Crow, (*Corvus cornix,*) seen on 24th. *Shifnal.*—The harvest at length completed by the middle of the month; but all grain, although not greatly damaged, most deficient in yield. Damsons, an immense crop, 2d. per quart. Hazelnuts also abundant. Apples almost a failure, but Pears abundant, although many sorts cracked all over. Only one Peacock Butterfly seen as yet; not a single Red Admiral. A Humming-bird Sphinx caught on 27th. *Farley, near Cheadle.*—*Turdus merula* seen only occasionally; *T. musicus* become almost a *rara avis* in this neighbourhood. October 5th, noticed a few Blackberries ripe; Hazelnuts fairly plentiful, and ripening to full kernel; same evening observed *Spiræa ulmaria*, (Meadow Sweet,) still in flower. October 9th, Elm and Mountain Ash becoming rapidly bare. October 13th, top of Sycamore bare. October 16th, gathered some fine Wild Strawberries, quite ripe, and very fully matured. October 18th, samples of Elm, Sycamore, and Lime generally bare. October 20th, Harebell still in flower. October 21st, some Horse Chestnuts quite bare. October 22nd, "Hips and Haws" plentiful and fully ripe. October 25th, top of Beech bare; Acacia bare. October 26th, Harebell still in flower; same day noticed quantities of unripe Blackberries—a very little ripe fruit, blighted, (evidently by the recent frost.) October 29th, Birch, Wild Cherry, Lime, and Beech generally bare; Elm, Sycamore, and Horse Chestnut "universally" bare; Yellow Gorse in flower. October 30th, saw a *Digitalis purpurea*, (Foxglove,) well in flower. *Geranium pratense* (?) generally in flower at end of month.

Correspondence.

LEPTODORA HYALINA.— "Enquirer" is quite wrong in saying (p. 283) that in the order Cladocera the limbs are always enclosed within the carapace. If he will refer to Baird's Entomostraca, (p. 62,) he will find that the whole *body* except the head is so enclosed; (but not the feet.) In the first family Daphniadæ, there are five or six pairs of feet, all enclosed within the valves of the carapaces, (p. 62;) but in the second family Polyphemidæ, there are four pairs of legs, not contained within the shell; (p. 111.) Therefore the Leptodora is *not* excluded from the Cladocera on account of its feet being without the carapace.—W. S Beaumont, Bowdon, Cheshire.

Pronunciation of Scientific Names.—In the last number of the "Midland Naturalist" I notice a most useful article by Mr. W. B. Grove on the above subject; and as I have taken some pains in my work on British Conchology to accentuate the scientific names, I venture to make one or two suggestions to the author of the article. The first is with respect to the name of the oyster, *ostrea*, *ὄστρεον;* the *e* does not represent a Greek diphthong. Mr. Grove has twice placed the accent on the middle syllable; but it ought to be on the first syllable, the middle being unquestionably short. This quantity is given by all Latin poets, Lucilius, Horace, Juvenal, Ovid. A scholar might well stare if he heard the name *O'strea edu'lis* mispronounced by making the middle syllable in the first word long, and in the second word short. *Polygonum*, being the name of a plant, is derived from *γόνυ*, a knee, and not from *γωνία*, an angle; so that the penultimate syllable is properly short. If it had been derived from *γωνία*, the penultimate syllable would of course be long. *Polygo'num* (a polygon,) as well as *trigo'nus*, *tetrago'nus*, *pentago'nus*, and *heptago'nus* are cases in point. *Hypericum (hypericon*, a plant = *ὑπερικὸν*) clearly has both the middle syllables short; and therefore custom has adopted the right pronunciation. I may also mention that by the well-known rules of the British Association for zoological nomenclature the names of families should end in *idæ*. It would consequently be irregular to say *Craniadæ*. See page 271, line 6 from the bottom.—J. Gwyn Jeffreys, Ware Priory.

The Defoliation of Trees and Ripening of Fruits.—A yearly record of observations on the defoliation of our common trees and shrubs, the ripening of their fruits, with notes on the quantity and quality, can scarcely fail to be of interest and use to many lovers of nature. The following notes on the subject may not be unacceptable to some other readers of the "Midland Naturalist:"—Dewberries, or the fruit of *Rubus cæsius*, were this year ripe by August 26th; very few and small this year. Summering Apples were ripe about September 4th. Limes began to turn yellow by September 7th. A very poor show of Blackberries this season; *Rubus rhamnifolius* and *R. corylifolius* ripe about the 8th, the more common kind, *R. discolor* by 20th. Drupes more harsh and watery than usual. Plums ripened about the second week in the month; a very fair crop. Fruit of *Lonicera Xylosteum* ripe about 17th. Hazel Nuts and Filberts were very plentiful, many of them were small and unsound; ripened about 24th. Wild Plums ripe by 24th. Sycamore, Walnut, and Lime trees cast their leaves about 25th. Fruits of *Viburnum Opulus*, Lonicera, Solanum, Tamus, Bryonia, and Snowberries, *(Symphoria racemosa,)* ripened about the end of the month. Apples and Pears, both wild and cultivated, are rather scarce this year, although there were a few trees scattered about that bore a fair crop. Crabs and Poplar trees cast their leaves about October 8th. Hips and Haws ripe by 10th; very few in some places, more in others. Elderberries ripened about 10th; a very good crop this year. Damsons ripe about 14th. Sloes began to ripen by 15th. Many Ash trees are loaded with keys, (samaræ,) which ripened about 18th. The leaves fell from the fertile trees before the barren ones. Chestnuts began to fall about 13th; very few, and small. Fruits of *Viburnum Lantana*, *Cornus sanguinea*, and *Ligustrum vulgare* ripened about 20th. Beech, Birch, Maple, Alder, Chestnut, Elm, and other trees shed their leaves by 24th. Berries of the Buckthorn and Spindle trees ripe by the first week in November. Leaves of the Oaks, Aspens, Buckthorn, Hawthorn, Pear, Hazel, and many other trees falling in the second week in November. Many of the trees began to show their peculiar autumnal hues unusually early this year owing to the long continued wet weather.—R. R., Castle Ashby, November 13th, 1879.

Ornithological Notes from Oxfordshire.—A fine specimen of Richardson's Skua was killed at Milcombe, in this county, on October 15th. It is, I believe, the first occurrence of the bird in this district. A Common Skua was obtained at Eydon, Northamptonshire, on the 18th of that month, and on the 7th instant a Cormorant was shot on Clattercut Reservoir. The occurrence of these sea birds so far inland, considering the fine weather we have been lately enjoying, is very unusual. Two Turtle Doves were seen on September 29th—a very late stay. I did not notice Fieldfares, nor could I hear of any being seen, till the 22nd ult., when I observed a flock of about a hundred flying over. Several Spotted Crakes were brought to Mr. Wyatt, the taxidermist at Banbury, during last month, all killed in the neighbourhood; also one Hawfinch. The former bird is believed to breed on the Cherwell. Mr. Wyatt informs me that he has had young birds once or twice. A Red-legged Partridge had its nest this season on the thatch at the corner of a corn stack about five feet from the ground—an uncommon situation, I should imagine. The bird, however, seldom breeds here; it is the only instance I know of its doing so in this parish; a few years ago it was unknown; now it is gradually increasing. Song Thrushes and Blackbirds are here now in large numbers, feeding on the berries of the yew; they are doubtless migrants, as during the summer they were far from plentiful. These berries are very attractive, and even draw a few Missel Thrushes into the gardens, shy as they usually are at this time of year. Greenfinches also come in small flocks. Snipe have been plentiful. I put one up from amongst some cut beans—an unusual place. A few Jack Snipe have been shot; the first was on September 24th, rather an early arrival. They do not come to us, as a rule, before the middle of October. I have recently obtained a young Hobby; it was taken about four miles from here, and reared by hand; I find it far more docile than the tame Kestrels I have come across—in fact, I have generally found the latter bird rather vicious.—O. V. Aplin, Bodicote, Oxon, November, 1879.

Ornithological Notes.—I have not at present seen any Fieldfares or Redwings, which indicates an absence of the very cold weather in the north, which drives them southward. I have noticed some large flocks of Peewits, which are very interesting to watch; I suppose they have rather enjoyed the wet season, as they usually congregate in the autumn over the low and marshy lands. I have sometimes observed a large battalion of them wheeling about for some time and then dividing into companies, flying off to their feeding ground, where they alight and seek their food, which consists of slugs, worms, and insects. For two or three nights I had the pleasure of hearing the distinct note of a Brown Owl in the Combe Woods. It is several years since I heard one. I suppose the poor bird met with the usual fate, as after a few nights I heard no more of him. The equinoctial storms have driven some of the sea birds as far inland as our midland district, and several species of the gull tribe have been seen in this neighbourhood. A "Pomerine Skua," not a common bird even on our coasts, was lately caught alive on Wyken Slough. The bird was nearly starved and too weak to make its escape. The Skua breeds in Iceland and the north of Europe, but visits our shores in autum and winter, and is occasionally driven inland, as this was. It is a very strong and powerful bird, of rapid flight, and rapacious habits. The Skuas are said even to drive away the eagles, and are encouraged and preserved by the shepherds in the countries where they build as a protection to their flocks. It appears to be a young bird, the legs and upper part of the beak being of a bluish colour. It would measure about three feet across the extended wings. Mr. Elkington, of this town, has also a nice specimen of the "Spotted Crake," which was lately shot at Whitley.—John Gulson, Coventry, November 5th.

SWALLOWS.—At this place a nest of young Swallows "flew" on the last day of September this year. The eggs were hatched about the middle of the month.—W. S. GRESLEY, Overseal, Ashby-de-la-Zouch.

Gleanings.

BOTANICAL CATALOGUE.—Mr. Wheldon, the well-known bookseller of 58, Great Queen Street, Lincoln's Inn Fields, has lately issued an extensive catalogue of botanical works, second-hand and otherwise, which may be of service to many of our readers.

METEOROLOGICAL BOOKS.—Those who are interested in the science of Meteorology should write to the editor of the "Meteorological Magazine," Mr. G. J. Symons, 62, Camden Square, London, for his "Catalogue of Duplicate Old Books, by Airy, Buys Ballot, Ellery, Forbes, Glaisher, De la Rue, Piazzi Smyth, &c."

LEPTODORA HYALINA.—Some doubt appears to exist as to the proper mode of pronouncing the generic name of this entomostracan. Its etymology, however, plainly points out the correct pronunciation. It is derived from λεπτος thin, and δορα, a hide or skin, in allusion to the thinness or transparency of the body. The "o" in *dora* is short, so in the word Leptodora, the penultimate being short, the accent must be placed on the anti-penultimate thus:—Lepto′dŏra, not Leptŏdo′ra.

THE MINUTEST FORMS OF LIFE.—The Rev. W. H. Dallinger, F.R.M.S., recently delivered a lecture at Birmingham on the investigations of the minutest forms of life, in which he and his fellow-worker, Dr. Drysdale, have been so long and successfully engaged. In a most lucid and interesting manner he gave some of the results of their laborious researches, and skilfully managed to convey a clear notion of such an abstruse subject as the life history of monads and other minute organisms to a mixed audience, most of whom were probably totally unfamiliar with the subject. It was one of the best lectures we ever heard.

NECROSCILLA WILSONI.—At the May meeting of the Geological Society a paper was read by H. Woodward, Esq., LL.D., F.R.S., F.G.S., on *Necroscilla Wilsoni* a supposed Stomatopod Crustacean from the Middle Coal Measures, Cossall, near Ilkeston, Derbyshire. The specimen described was found by Mr. E. Wilson, of Nottingham, in a nodule of clay ironstone. It consists of the four posterior abdominal somites and the telson. The author discussed its zoological characters, which led him to regard it as approaching the Stomatopoda rather than the Isopoda. He thought it probable that Dr. Dawson's Diplostylus is allied to this newly-discovered form, for which he proposed the name of *Necroscilla Wilsoni*.

Reports of Societies.

BIRMINGHAM SCHOOL NATURAL HISTORY SOCIETY.—GENERAL MEETING.—September 26th. Paper on "Hydra," by Bernard Badger, and living specimens of *H. fusca*, *viridis*, and *vulgaris*.—GENERAL MEETING.—October 10th. Paper on "Compositæ," by Charles. *Cristatella mucedo* was exhibited by Badger.—GENERAL MEETING.—October 24th. Paper on "Remarkable Beetles," by J. Dammann; specimen of Sexton Beetle exhibited.—GENERAL MEETING.—November 7th. Paper on "Vegetable Cells," by H. Devis.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—MICROSCOPICAL GENERAL MEETING.—October 21st.—Mr. A. W. Wills read a very interesting paper on the structure and life-history of *Volvox globator*, illustrated by beautifully executed coloured diagrams and specimens in the microscope. He described at length the gonidia, which stud the surface of the globe, the network which connects them together superficially, and the primordial utricle beneath, in which they are imbedded, each gonidium being provided with two cilia projecting through orifices in the latter. He next described the asexual reproduction of *Volvox*, when a single gonidium here and there enlarges and sub-divides continuously until it becomes a spherical mass of green cells, closely appressed to one another so as to be roughly hexagonal, but subsequently increasing the space between them until the whole forms a perfect *Volvox* sphere like the original, and a little before reaching maturity bursts from the parent sphere through an orifice, rather smaller than itself, formed at the north pole of its axis of revolution. This process may be repeated through many generations, but at length a true sexual method of reproduction occurs, a true spore being formed by the union of two gonidia, supposed to have the properties of male and female elements. This spore remains dormant through the winter, and develops into a fresh *Volvox* by sub-division in the following spring, but Mr. Wills had never seen this take place. He said that some observers were of opinion that the male and female gonidia occurred in the same sphere, others in different ones. Probably both may happen. He had not been able in every case to verify the results of Williamson, Busk, and others; and in some few respects his observations differed from theirs. GEOLOGICAL SECTION.—October 28th.—Mr. Montagu Browne exhibited a specimen of the Blue Shark, (*Squalus glaucus,*) captured near Great Yarmouth, 13ft. in length, and weighing nearly half a ton. Mr. R. H. Burman exhibited a pebble of quartz from the drift near Walsall, containing what appeared to be a flake of gold. Mr. J. W. Cutton sent some specimens of Manganese and the rocks in which the veins occur at Barmouth. Mr. T. H. Waller exhibited sections of opalised wood, from California. Mr. Watson exhibited dog-tooth and fluor spar, toadstone and bitumen, from Castleton, Derbyshire. Mr. J. Morley presented to the society, on behalf of Mr. Tressider, of Falmouth, some rock specimens from West Cornwall. Mr. R. H. Burman read an interesting paper on the geology of Falmouth and neighbourhood, illustrated by specimens of the slates, sandstones, granite, and serpentine of the district. GENERAL MEETING.—November 4th. Mr. Thos. Bolton exhibited *Ophrydium versatile*, from Walsall, and a number of Rotifers. Mr. J. F. Goode exhibited a female *Diaptomus castor*, with spermatic tube attached to the operculum vulvæ. Mr. W. H. Jones exhibited living specimens of *Ophiocoma neglecta*, which had been kept in artificial sea-water for three months. Mr. W. G. Blatch read an interesting paper on entomological work in winter, showing the fallacy of the popular notion that insects are only to be found in summer, by describing the results of an afternoon's hunt in Sutton Park, and the successful results of the various modes adopted for procuring insects. At the conclusion of the paper, a discussion took place, in which Fräulein Lauprecht and Messrs. J. Morley, J. E. Bagnall, J. F. Goode, H. E. Forrest, and others took part. The discussion drifted away from the subject of the paper to that of "garden pests," and elicited from Mr. Blatch a promise to give the society, at some future time, a paper on two of the commonest of these, the larvæ of the Sawfly and the Magpie Moth. BIOLOGICAL SECTION.—November 11th.—Mr. J. E. Bagnall exhibited *Leucobryum glaucum*, in fruit, from Massachusetts; and the Protonema of an Hepatica, probably *Pellia epiphylla*, shewing peculiar stalked bodies arising from it, described by Luerssen as "brood buds" (Brutknospe.) Mr. J. F. Goode exhibited ova of an Entozoon from the intestinal canal of a sprat. Mr. H. W. Jones exhibited *Callionymus lyra*, the yellow sculpin, found amongst a lot of sprats in the fish market; and living specimens of a species of prawn, *Palæmon varians*. Mr. A. W. Wills exhibited *Cylindrospermum humicola*, a minute Alga belonging to the order *Oscillatoriaceæ*; and zygospores of *Spirogyra*, in various stages of germination. M. G. S. Tye read his report on the Mollusca taken by members of the Society during the recent excursion to Falmouth, from which it appears that the total number of species taken was sixty-three, but that from the absence from among the party of any experienced conchologist many species were unrepresented which undoubtedly would have rewarded a more systematic examination of the ground.

BIRMINGHAM AND MIDLAND INSTITUTE SCIENTIFIC SOCIETY. —October 29th, Mr. E. Evans read a paper on "Scientific Culture." November 12th, Mr. Wright Wilson exhibited and described a "New Acoustic Apparatus."

BURTON-ON-TRENT NATURAL HISTORY AND ARCHÆOLOGICAL SOCIETY.—November 11th.—The President, (Mr. H. G. Tomlinson,) read his second paper on "Birds and their Habits," the substance of which will be given in a future number. A cordial vote of thanks was given to the President.

CHELTENHAM NATURAL SCIENCE SOCIETY.—November 5th.—An extra meeting was held at the Ladies' College, when J. Fisher, Esq., of Stroud, gave an admirable paper on "The Spectroscope and its application to Solar and Stellar Physics." The paper was illustrated by a very powerful instrument, and electric apparatus by Browning. About 120 persons were present.

EVESHAM FIELD NATURALISTS' CLUB.—The annual meeting of this club was held on November 11th, Mr. T. J. Slatter in the chair. Mr. Slatter was elected president, Mr. J. S. Slater treasurer, and Mr. J. H. Pumphrey secretary *pro. tem.*, Mrs. Martin, and Messrs. T. E. Doeg, A. H. Martin, F. Wright, and J. S. Slater were elected the committee. The annual report stated: "Your committee in presenting their seventh annual report, regret that the club has not recovered from the depression which they deplored last year, and can only hope that during the next twelve months it may take a fresh start, and flourish more vigorously than before. The numbers of the club have neither increased nor diminished, being twenty-eight. Owing to the bad weather the usual excursions during the summer have had to be abandoned. The evening meetings were held monthly during the winter, the following papers being read: 'Some Common Minerals,' by the Rev. M. Wood; 'The Glacial Deposits of the Vale of Evesham,' by the Rev. A. H. W. Ingram; 'The Reproduction of Ferns,' by Mr. J. S. Slater; and 'Some of the Birds of our Neighbourhood,' by Mr. T. E. Doeg. The financial position of the club is more satisfactory than it ever has been, the treasurer having a balance in hand of £4 16s. 1d."

NOTTINGHAM NATURALISTS' SOCIETY.—November 5th. Mr. J. Shipman read a most interesting paper, entitled "Notes on the Alluvial Deposits of the Trent Valley in the Neighbourhood of Nottingham." As the paper will be printed in a future number, it is needless to give a *resumé* of it.

NOTTINGHAM LITERARY AND PHILOSOPHICAL SOCIETY.— October 2nd, Soireé. October 3rd, Gilchrist Lecture, R. A. Proctor, Esq., F.R.A.S., subject "The Birth of the Solar System," illustrated by the oxyhydrogen light. October 9th, inaugural address by the President, Rev. R. A. Armstrong, on "What is Science." Ocober 24th, Gilchrist Lecture, Dr. W. B. Carpenter, C.B., F.R.S., subject, "A Piece of Limestone," illustrated by the oxyhydrogen lantern. October 30th. Gilchrist Lecture, Prof. P. M. Duncan, F. R.S., subject "Energies within the Earth: Mountain Making," illustrated by the oxyhydrogen lantern. November 20th, J. H. Brown Esq., subject, "Festus."

STROUD NATURAL HISTORY AND PHILOSOPHICAL SOCIETY.— November 11th.—Mr. E. Evans read a most interesting and instructive paper on "The Birds of Gloucestershire," which we hope may be published at length in a future number. The paper was illustrated by a fine collection of birds, so arranged as to make inspection easy.

EXCHANGE.

Land and Freshwater Shells in exchange for Books on Conchology, Botany, and Geology, or Shells.—C. T. Musson, 68, Goldsmith Street, Nottingham.

A good series of *Terebratula punctata* and *Rhynchonella tetrahedra* (two dozen of each) from the Middle Lias of Leicestershire, for any other Fossils.—F. G. S., 3, Melbourne Road, Leicester.