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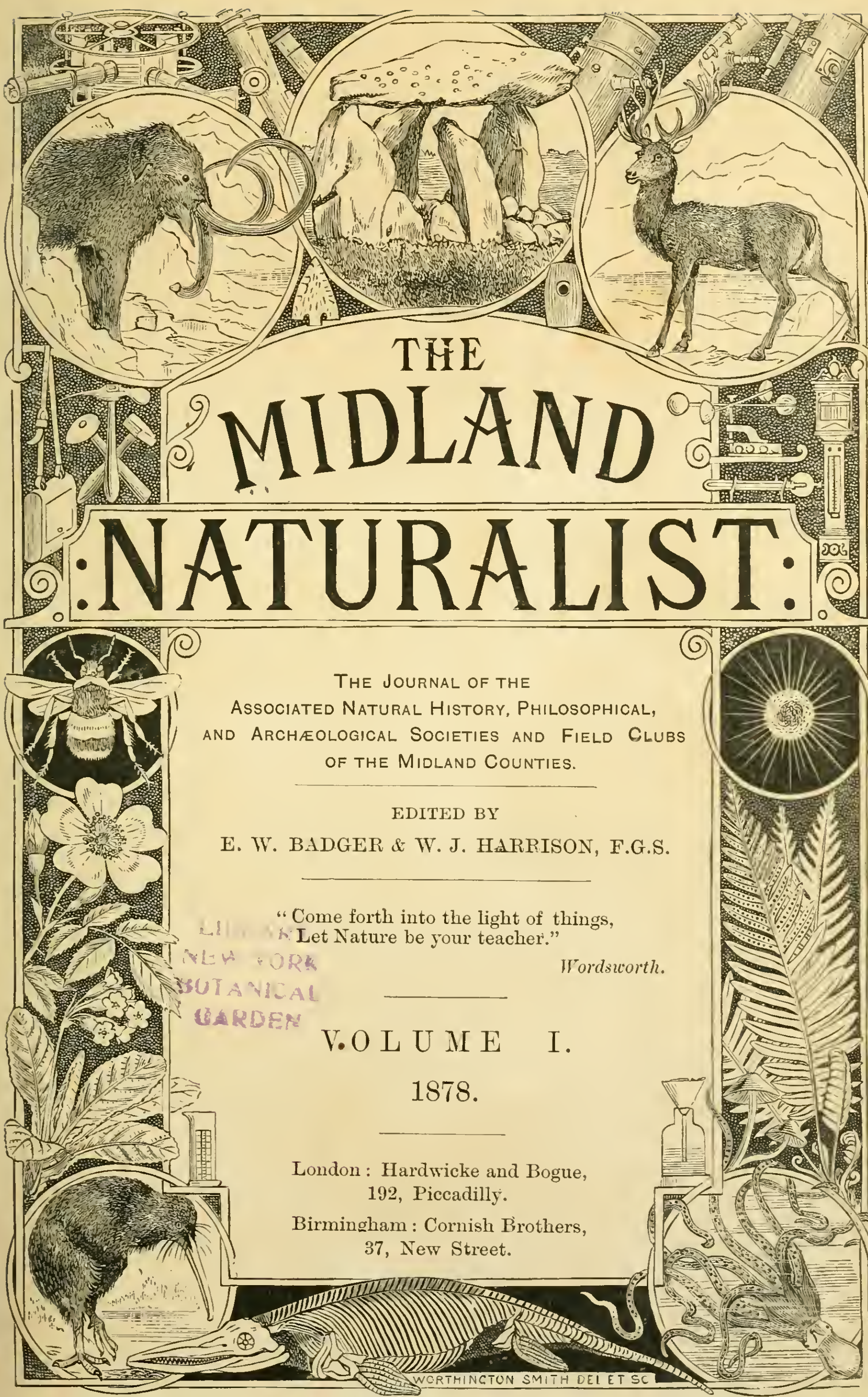

THE MIDLAND NATURALIST:

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

EDITED BY

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

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

Wordsworth.

VOLUME I.

1878.

London: Hardwicke and Bogue,
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PREFACE.

The completion of the first volume of the "Midland Naturalist" seems to call for a few remarks from those who undertook its editorship.

The purposes and aims of this periodical are fully set forth in the opening address (p. 1.) How far the ideas and hopes therein expressed have been fulfilled we must leave our readers to decide, but we can earnestly assure them that on the part of the Editors and Publishers no efforts have been spared to realise all that was promised.

It is, however, with the future rather than with the past that we are now concerned. If the "Midland Naturalist" is to assume its proper position in scientific literature, as the official organ of so large and influential a body as the *Midland Union of Scientific and Literary Societies*, then continual efforts must be made for its improvement. But the power to so improve our Magazine, to illustrate it well, as we wish to do, to enlarge it so as to admit both popular and abstruse scientific communications, is entirely dependent on the number of subscribers. Of the 4,000 members belonging to our Union, too few have, as yet, become annual subscribers to this Journal. During the coming year their number ought to be largely increased, and we ask every one of our readers to aid in bringing this about.

Furthermore, every subscriber should consider him or herself as commissioned to observe and report on all occurrences of scientific interest which may happen in their neighbourhood. It cannot be doubted that hundreds of facts, which if published would be of scientific value, are yearly observed by some one or other, but lost because not recorded. If our readers will help us in this respect, our endeavour to make the "Midland Naturalist" a magazine of Midland Counties Natural History will be realised.

Many of our readers have given us valuable assistance, and to all the kind friends who have contributed to our pages we tender our warmest thanks. We owe especial thanks to Mr. W. R. Hughes, F.L.S., and Mr. W. B. Grove, B.A., not only for contributions, but for unceasing help in correcting proofs, and in other ways.

We also gratefully acknowledge the services rendered by our eighty Meteorological observers, who have enabled us to publish from month to month a very complete record of the weather of the Midlands.

To Mr. Charles E. Scarse, of the Birmingham Library, both we and our readers are greatly indebted, for compiling the excellent Index we are enabled to publish of the contents of our first volume.

During the coming year we hope to present our readers with a number of interesting papers. To the January part Philip Henry Gosse, Esq., F.R.S., will contribute a most valuable account of a Marine Aquarium on the circulating principle recently erected by him in his house at Torquay. We shall also soon commence a series of practical Geological papers, entitled "Rambles with a Hammer in the Midland Counties." The important communications with which Dr. T. Spencer Cobbold, F.R.S., has favoured us will be continued, as will also Mr. James E. Bagnall's "Moss Habitats;" the latter gentleman is also preparing some articles on "The Cryptogamic Flora of Warwickshire." Mr. W. B. Grove, B.A., will contribute some papers on "The Pronunciation of Scientific Names." The Glacial scheme (see p. 242) will, we trust, be productive of good results, which we shall be glad to chronicle. A paper on "Practical Meteorology," with illustrations of the most recent improvements in meteorological apparatus, is also in hand. Entomology, Ornithology, and Microscopy will not be forgotten; but for these subjects we invite and shall be glad to receive further aid.

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COMPILED BY CHARLES E. SCARSE.

1878.
BIRMINGHAM:
PRINTED AT THE MIDLAND COUNTIES HERALD OFFICES.

THE MIDLAND NATURALIST.

"Come forth into the light of things,
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OPENING ADDRESS.

The first idea of a Midland Union of Natural History Societies dates back about four years. Early in 1874 the Tamworth Natural History, Geological, and Antiquarian Society held a very successful *soirée*, in which the Birmingham Natural History and Microscopical Society took part. That meeting was in every way so satisfactory, and gave such proofs of the value of co-operation, that many who attended it expressed a desire for more instances of a like kind. Mr. W. G. Blatch, the then Honorary Secretary of the Birmingham Society, suggested that an Annual Congress should be held, and proposed the combination, in some way, of our Local Natural History Societies. Although the suggestion was favourably received and formed the subject of frequent conversations, and although it was generally admitted that an association of the kind could scarcely fail to be attended with valuable results, no practical step was immediately taken.

It was not till the 17th August, 1876, that anything definite was done. A proposal was then made, at a meeting of the Committee of the Birmingham Society, which resulted in the appointment of a sub-committee, (consisting of Messrs. Lawson Tait, John Morley, and James Bagnall,) which was requested to obtain information as to the possibility of forming a Union of the Natural History Societies of the Midland District. In the following October Mr. Blatch read a paper at a *soirée* of the Birmingham Society on "Suggestions for a Congress of Natural History Societies." The Sub-committee, having reported on what had been ascertained, were further directed to proceed with the formation of the Union. In this matter considerable delay was caused by difficulties in obtaining information and in eliciting replies. Delegates having been appointed by the various societies who were willing to join the Union, the Sub-committee summoned them together, and they met at the Midland Institute, Birmingham, on August 28th, 1877. At this meeting the basis of the Union was laid down, and a Council elected.

The first meeting of the Council, composed of two representatives from each society, was held on the 16th October last, Mr. Edmund Tonks, B.C.L., presiding, and Mr. Lawson Tait acting as secretary. These gentlemen represented the Birmingham Natural History and Microscopical Society. There were also present the Rev. O. M. Feilden, M.A., (Hon. Sec. of the Oswestry and Welshpool Naturalists' Field Club,) Mr. C. T. Musson, (Hon. Sec. of the Nottingham Naturalists' Society,) Mr. Egbert D. Hamel, (of the Tamworth Natural History, Geological, and Antiquarian Society,) Mr. Thos. Carter, LL.B., (Hon. Sec.,) and Mr. F. T. Mott, (of the Natural History Section of the Leicester Literary and Philosophical Society,) the Rev. W. Elliot, M.A., (Hon. Sec. of the Caradoc Field Club,) and Mr. C. U. Tripp, M.A., (Hon. Sec.,) and Rev. C. F. Thornewill, M.A., (of the Burton-on-Trent Natural History and Archæological Society.) The following resolutions were passed:—1.—That the annual meetings of the Union be held in May. 2.—That the first annual meeting be held in connection with the Birmingham Natural History and Microscopical Society. 3.—That each society in the Union shall, for the purpose of meeting necessary expenditure, contribute annually the sum of one penny per member, but societies whose members are less than 24 in number shall each contribute two shillings for the whole of such society. 4.—That a monthly magazine, to be called the MIDLAND NATURALIST, be issued by the Union, and that Mr. E. W. Badger, of Birmingham, and Mr. W. J. Harrison, F.G.S., of Leicester, be appointed Editors. 5.—That the Editors of the Magazine be Hon. Secretaries of the Union. 6.—That Messrs. Thornewill and Tait be a Sub-committee to prepare bye-laws and report thereon. 7.—That Mr. Egbert D. Hamel be Treasurer of the Union. 8.—That the Secretary of each Society in the Union be requested to ascertain, and communicate to the Editors, the number of members who will subscribe to the Magazine. 9.—That Mr. Lawson Tait be authorised to issue a prospectus of the MIDLAND NATURALIST, and provide the Secretaries with a sufficient number for distribution among the members. 10.—That the best thanks of the Council be given to Mr. Lawson Tait for his successful efforts, which have led to the formation of the Union.

The objects of the Union may be broadly stated to be to extend the usefulness of local societies by affording facilities for inter-communication through an authorised and regularly published magazine, which shall record the more important work done by them; announce their forthcoming meetings; and assist in the interchange of notes and specimens; and, by providing opportunities for personal intercourse among the members at meetings to be held from time to time in various places of interest, and in other ways, to promote the study of natural history, especially that of the midland district.

The affairs of the Union will be managed by the Council, which consists of two members from each of the Societies, one of whom must be a Secretary; and the Secretaries of the Societies in the Union will form a Standing Committee to arrange for Joint Excursions, timely notice of which will be given in our pages.

The work proposed has been set about in a quiet, unostentatious manner, but we feel sure the results cannot fail to be important, if only the many earnest students resident in the central counties of England, will each do his own share of it.

The Societies already in the Union are the following:—

Birmingham Natural History and Microscopical Society.
Birmingham Philosophical Society.
Birmingham School Natural History Society.
Burton-on-Trent Natural History and Archæological Society.
Caradoc Field Club.
Derbyshire Naturalists' Society.
Dudley and Midland Geological and Philosophical Society and Field Club.
Leicester Literary and Philosophical Society.
Northampton Naturalists' Society.
Nottingham Literary and Philosophical Society.
Nottingham Naturalists' Society.
Rugby School Natural History Society.
Oswestry and Welshpool Naturalists' Field Club.
Severn Valley Naturalists' Field Club.
Shropshire Archæological and Natural History Society.
Stroud Natural History and Philosophical Society.
Tamworth Natural History, Geological, and Antiquarian Society.

One of the means which the Union intends to employ in effecting its objects is the monthly publication of the MIDLAND NATURALIST.

The present issue will afford a general notion of the character of future numbers, though we may fairly hope that many improvements will be made as experience is gained, and the circle of our contributors widens. We shall hope to be able to secure for each month well written original articles; short items of science news; meteorological and other observations; brief reports of the recent work done by each Society; a diary of coming meetings and excursions; queries and answers to them; correspondence, and other matters.

But we cannot hope to do this single-handed. We wish to interest all our subscribers, and to do this we shall want a large amount of help. We, therefore, solicit the communication of short original articles of general interest, from students of every branch of Natural History, Microscopy, &c. We shall be glad to receive brief notes of original observations on any subject suitable for our pages, and shall be grateful for judicious hints and suggestions.

At present, whenever a good paper is read before one of our local societies its usefulness is too often limited to the members of that society, and generally to that part of them who chance to hear it read. By printing such papers, or abstracts of them, in this magazine, their usefulness will be widely extended, and all the Societies may benefit by them; while to the younger members, and the less informed generally, they may prove of incalculable advantage by aiding them in studies already entered upon, or pointing out suitable ones to engage in.

We should like our readers to bear in mind that this magazine is not intended to supersede or in any way to interfere with the publication of Transactions by individual Societies. We shall on the contrary aid in making them known.

Occasionally reviews of new scientific books will occupy a part of our space, and we hope to have it in our power to aid such of our Societies as recognise local antiquities and archæology as part of their work.

The publication of a diary of coming meetings and excursions ought to prove most useful, and if members generally will send their names as subscribers for the magazine they will justify their Societies in ceasing to issue their monthly programmes, the cost and postage of which at present forms a considerable item in the sum of incidental expenditure, especially in the larger Societies.

If this magazine is to be a permanent publication we must secure a good circulation. We therefore ask the cordial co-operation of our subscribers by assisting us among their friends. In helping us they will be helping themselves. If every reader of this first number who approves of our labours and object will be good enough to obtain for us at least another subscriber he will materially aid us in our endeavours, and increase our power of making the magazine a useful medium for intercourse between naturalists of all classes in the Midland Counties.

METEOROLOGY.—In future numbers it will be our aim to present as complete a record as possible of, at all events, the Temperature and Rainfall in the Midland Counties. All observers who can aid in this matter are requested to communicate with Mr. W. J. Harrison, Town Museum, Leicester, who will forward forms on which to record observations.

ABNORMAL FERNS.*

BY E. J. LOWE, ESQ., F.R.S., &c.

The reproduction of ferns from spores is a study of much interest, and one worthy of more general attention. The *modus operandi* is fraught with difficulties. The minute size of the infant ferns in their first growth is in itself dangerous, as any neglect will at once destroy the whole crop. The spores germinate as mere green points, imperceptible at first to the unassisted eye, and only rendered visible by the look of greenness from a number springing into life together. Spores of ferns differ from seeds of plants, inasmuch as they have no special organs; consisting merely of a homogeneous cellular mass. In seeds the young roots and the young shoots are present in the embryo, being developed from determinate points; whilst spores, on the contrary, consist merely of single vegetable cells, growing indifferently from any part of the surface.

These points of life, (*germinal fronds*,) as they continue to grow have a strong resemblance to Liverwort, (hence the term Marchantia-like.) They gradually increase in size, and, if they do not become impregnated, will occasionally exceed half an inch in diameter.

The impregnation of the germinal frond does not seem to be capable of being accomplished without the action of strong light; indeed, grown in a somewhat dark corner the growth seems to be arrested before arriving at that particular stage of life. The following experiment will illustrate what is meant:—Three years ago a large Wardian case was prepared, and the surface of the soil scattered over with spores from a number of varieties of *Scolopendrium vulgare*, *Lastrea filix-mas*, *Athyrium filix-fœmina*, *Polystichum angulare*, and of *Lastrea dilatata*; each species being in a separate partition. This case was placed in a somewhat dark corner, under a plant stage. When the spores had been sown about six months the whole surface soil was covered over (and had been for several weeks previously) with the vivid green of the young ferns. At this time a second case was prepared, not for spore sowing, but for transplanting, in patches, the germinal fronds from the first case. Small portions of this green mass were lifted on the point of a knife and planted in thick lines. The second case was then placed in a light part of a greenhouse, having a north aspect. Under these circumstances the transplanted patches very soon grew rapidly, (whilst those in the case from which they were taken had made little or no progress,) and in six months the second case was filled with a mass of fronds, yet no fronds appeared in the original case. A third case was then prepared, and for the second time small portions were removed from the first case into the new one, and this also was placed in a well-lighted situation, having a north aspect. After being in this third case less than six months a large number of fronds appeared, whilst still no fronds appeared in the original case. A fourth case is now about to be planted from the same original stock, which, although still looking green and healthy, has no fronds developed, and, indeed, the germinal fronds it contains are still little more than mere points. Thus, for three years the growing spores in a darkened corner have remained all but dormant, whilst those transplanted from it have, in a situation of stronger light, a forest of fronds, varying between one inch and six inches in length, according as they have been selected from the second or third cases. This is mentioned as a very curious fact.

* Read before the Biological Section of the Birmingham Natural History and Microscopical Society, December 11th, 1877.

In reverting to the various stages of development from the spore on the frond to the fully-grown plant, most persons have observed what they choose to call seeds on the underside of the frond (though not always necessarily on the underside). They are not, as we have just said, real seeds, but spores, the first process towards the development of a fresh plant. It may be mentioned briefly that about the year 1840 Professor Nageli, of Zurich, announced that he had made the discovery that in the Marchantia-like germinal frond (*i.e.*, whilst in the Liverwort-like condition) were to be seen the organs of reproduction; and in about the year 1845 Count Suminski, of Berlin, confirmed the existence of these so-called Antheridia, and also that two kinds of cells existed on the young germ frond, and that the male cells on bursting threw out spiral thread-like bodies, thickened at one end, and furnished with cilia about the thickened part, and these, from their activity, were called "Animalcules." The Count further stated that he had seen one of these spirals landed in a female cell. Hofmeister has since then distinctly observed the terminal bud of the new axis produced within the pistillidium, (or female cell,) and looked upon the globular cellule in its centre as itself the rudiment of the stem, the embryo originating from a free cell produced within it. Mettenius observed a nucleus within the globular cellule. Mercklin then declared that the spiral filaments swarmed about the pistillidium in numbers, and that he had seen them on rare occasions penetrate it. Professor Henfrey, about 1850, wrote an interesting article on this subject.

Spores, when they are sown, germinate, yet they need not necessarily produce the same form as the frond from which they are taken. In their caterpillar or Marchantia form stage of life they are said, as before mentioned, to flower, to have male and female organs or cells, (more male than female cells,) and these be it remembered are before there are any fronds, and it seems probable that it really depends upon how this impregnation is effected as to what kind of frond springs up from the germinal frond. The female organs are described as cells, and the male organs as spiral filaments which are tossed into the air, some of which, by landing in these cups, fertilise the plant in its caterpillar stage, and thus enable it to put on its butterfly-life or fronds.

Let an example be taken in the Lady Fern, where a number of varieties have been sown together. Now, if a spiral filament from the variety *Victoriæ* be tossed into one of these female cells, we may naturally expect the fronds when they do appear to be more or less cruciform, like those of the variety *Victoriæ*; whilst if this filament had been thrown from the var. *multifidum* instead, the result would be quite a different plant, a multifid but not a cruciform frond, unless the female cup belonged to a cruciform variety, under which circumstances there would probably result a combination of the two forms. Hence the endless variety that are now to be seen in a good collection. When once an abnormal form has been obtained, it seems only necessary to get a pedigree, *i.e.*, three or four generations, and it becomes almost impossible to raise a seedling of the original normal form; whilst without this abnormal blood it is equally almost impossible to raise any but normal forms.

As regards the various normal forms that species will assume, it is a singular fact that most of our British ferns put on appearances closely in imitation of each other, that the varieties of each species have many characters in common, and that a certain law of form of variety seems to extend more or less through both British and exotic species. The usual forms running through nearly all our British ferns are those having the fronds *crested*, *crisp*, *imbricated*, *confluent*, *multifid*, *acuminate*, *narrow*, *plumose*, *interrupted*, *depauperate*, *ramose*, and *dwarf*; and not only this, but we have the multiple of these, or the combining together of two or three characters in one frond, such as the *narrow-crisped*, the *multifid-crisped*, or the *narrow multifid* as examples. In a wild state abnormal forms are found most commonly where, from various causes, ferns do not grow luxuriantly, *i.e.*, grow under difficulties. When ferns flourish in a high degree, it is almost useless to hunt for abnormal forms.

It seems that spores gathered from one portion of an abnormal frond will produce different varieties from those of spores gathered from another portion of the same frond; so that if an accidental abnormal portion of a frond be fertile it is not impossible to reproduce from its spores plants having fronds in imitation of the accidental abnormal form.

The method adopted by the author of this paper in raising plants from spores is one that can be recommended. Having carefully prepared the soil, and then roasted or boiled it, in order to destroy all animal and vegetable life, it is placed in a Wardian case or pan, having a glass cover. The soil if roasted will require to be wetted with boiled or distilled water in order to be of a proper moistness. It is then pressed until there is a smooth surface, and after this sown with spores, which should not be covered with soil. All watering must be done from below, *i.e.*, the pan placed in a saucer full of water, immersed about one-third of its depth, and this must either be boiled or distilled water, to prevent a confervoid growth on the surface, which would kill the young fern germs. On the surface becoming green with growing ferns, transplant with the point of a knife into much larger pans; and this can be best done by making small indents in the surface, and placing in them small patches of the spores, and lightly pressing each with a finger, taking care to wipe the finger dry after every pressure, or the young plants will cling to it. To procure new varieties, spores are scraped off portions of a number of curious fronds or parts of fronds *of the same species*, and sown thickly together; and the reason for sowing thickly is that the germinal fronds by being pressed closely together by each other become more or less vertical, a position thought to be more easily fertilised by the male organs falling more readily into the female cells than when in a more or less horizontal position, as they would be if sown very thinly. Nature does, to some extent, provide for this by curling the thickened edges; yet under these circumstances, with thin sowing, the male spiral is more likely to be one from the same individual, and would therefore more probably produce a form identical with the parent germ frond; whereas, if the spores of many forms be sown together the chances seem to be much more in favour of the fertilization by another variety being accomplished. After gathering the fronds for spores, it is better to place them in drying papers for a day or two, and then scrape off the spores and sow immediately. Freshly gathered spores germinate much more quickly than those that have been kept for a time.

It has been said, sow together only varieties of the same species, though occasionally, but *very rarely*, two species may be crossed and a *hybrid species* produced. Still, it is so difficult to cross species that we have at the most only a few examples to quote. These instances are probably,—first, *Lastrea remota*, a cross between *Lastrea dilatata*, and *Lastrea filix-mas*; second, *Asplenium microdon*, a cross between *Asplenium marinum* and *Asplenium lanceolatum;* and third, *Asplenium Germanicum* a possible cross between *Asplenium ruta-muraria* and *Asplenium septentrionale*. The author has failed to raise spores from any of these, and is not aware of any one else succeeding, whilst in a wild state the two so-called parents appear always to be growing together where the third form is found.

There are plenty of good-looking spores on *Lastrea remota*, yet they will not germinate. For the last ten years several pans of spores from this fern have been sown yearly without a single plant having been raised.

It has been also a question with the author as to whether some of the forms of species that only bear sterile fronds may not also be hybrid species. All the varieties of the species will reproduce the abnormal forms as prolificly as the normal ones, whilst a so-called hybrid species will not reproduce.

There are not only abnormal varieties of ferns, but the normal forms of different localities differ so that when the common forms of certain localities are gathered together they display in a marked degree the departure from one form.

In nature the progress of change in form is very slow, although in the forms of some plants a more rapid development in some localities can be observed; thus, nearly all the Harts tongue ferns at Westward Ho; on the Castle Rocks, Scarborough; and at Dawlish, are once or twice branched or crested. These changes, however, become much more rapid when under the most favourable circumstances, such as obtaining a pedigree and continuing it.

With regard to the origin of species, it is learnt from the doctrine of evolution, that all are the descendants of a comparatively few originally created simpler forms; this doctrine teaches, (I now quote Sir Joseph Hooker's admirable Botany):—1st. That the descendant of every plant departs more or less in character from its parents. 2nd. That of these variations, some are better fitted than others, and even sometimes than their parent was, to survive in the area the plant inhabits. 3rd. That the conditions of the area are, like the individuals, variable. 4th. That the number of deaths previous to maturity amongst the descendants is enormously greater than that of survivors, and that these deaths are due to the conditions of the area not having suited them. 5th. That the descendants best fitted to thrive under the conditions of the area will be the survivors. 6th. That these variations will hence ultimately, in certain places, supplant the parent form; and 7th. That the difference between a species and a variety being one of degree only, the variations accumulated through successive generations will become specific, and these again by a like process generic, and so on.

No investigations demonstrate in a more striking manner the truth of the Darwinian theory than such as this paper briefly illustrates. There is undoubtedly a mathematical law in the changes of form, and this fact proves that Dr. Darwin's discoveries have vastly advanced our knowledge of the laws of nature.

ON AN IMPROVED ANEROID BAROMETER.

BY W. J. HARRISON, ESQ., F.G.S.

An instrument which shall accurately indicate differences in level or height above the sea is much needed by practical men of science. The geologist requires it to ascertain the varying heights of his beds of rock, the zoologist and the botanist to know the limits of the zones of animal and vegetable life, and it is of not less service to the meteorologist, the surveyor, the engineer, and the traveller.

The most accurate instrument for this purpose is the ordinary mercurial barometer, arranged in as compact a form as possible, and swinging by the centre from a tripod stand, when it is known as a MOUNTAIN BAROMETER. Even in this form it is, however, of considerable weight, of awkward form, and liable to break.

The HYPSOMETER is a simple instrument, consisting of a thermometer inserted in a partly closed vessel containing a little water, which is made to boil by means of a spirit lamp. Now on a mountain top, the water being under less pressure, will boil at a lower temperature than at the sea level. Thus Tyndall found the boiling point of water on the top of Mont Blanc to be 185° F., showing a lowering of the boiling point of 1° F. for every 590ft. of ascent.

The SYMPIESOMETER, invented by Adie, of Edinburgh, measures pressure by means of a glass tube some 18in. long, closed at one end and bent round at the other. The lower part is filled with glycerine, and by the varying pressure of the outside air on this fluid, the air in the upper part of the tube is compressed or allowed to expand as the case may be, the amount being shown by a scale marked on the tube.

Lastly we have the ANEROID BAROMETER, which consists of a thin, hollow corrugated metallic box, almost exhausted of air, and the lid of which is prevented from sinking too far in by a strong spring which is attached to it. The spring is connected with levers, which move a pointer over a graduated dial. When the pressure of the air increases, the lid of the exhausted box is forced further in and the pointer moves in one direction, and *vice versa* should the air become lighter. All aneroids are graduated by comparison with a standard Mercurial Barometer, and they vary in size from 2in. to 12in. in diameter.

A few months ago it was proposed to attempt the construction of an accurate topographical model of Leicestershire, commencing with the Charnwood Forest district, and gradually adding square by square of the region around until the whole county was shown in relief. The model once executed several casts could be taken from it, and it is intended to colour one of these geologically, and to show river-basins, the distribution of plants, &c., on a second. Such models would teach many important lessons, would be interesting and instructive to everyone, and the very task of construction could not fail to yield valuable results. The best method of executing such models I hope to lay before readers of this journal on some future occasion.

Having obtained a plain Ordnance map of the district we inhabit, if we desire to ascertain the height of the places named thereon, we must refer if possible to some standard. Now the Ordnance Survey published in 1861 an "Abstract of the principal lines of Spirit Levelling in England and Wales," giving to a fraction of an inch the heights of some thousands of stations. In this valuable work are given the heights of many points between Rugby and Leicester, between Leicester and Burton, and between Leicester and Nottingham, which heights are indicated upon public buildings, &c., by means of the well-known bench mark ⩚. The points thus marked would then serve as starting points or for reference, but it is necessary to ascertain the height to within a foot or so of a great many other places, and after a consideration of the various instruments described in the early part of this article, it was determined to use a new form of aneroid, invented by Mr. Rogers Field and made by Casella, and a grant for the purpose was obtained from the Literary and Philosophical Society of Leicester.

Most aneroids have attached to them a scale of feet; in some this is moveable, the altitude being obtained by setting the zero of the scale at the lower station to correspond with the position of the hand, and then reading off at the upper station only. This cannot give true results, as the scale can only be correct when the zero is in the position in which it was graduated. Aneroids, with *fixed* scales, are correct only at one given temperature, and at one only. It is true that, by using the aneroid as an ordinary barometer, and reading off in inches, we can, by a long calculation, arrive at a correct result, but when some hundreds or thousands of observations have to be made, the process of reduction will evidently be a wearisome one; and if we can read off correctly in feet, at once, it will be a great advantage.

The accompanying woodcut shows Field's aneroid as an instrument 2¾in. in diameter, and a little more than an inch in thickness, thus fitting easily in the waistcoat pocket. Its novelty consists in the fact that the lid marked A A is moveable, and bears nicks, which lock with a pin on the fixed lower case. These nicks are marked from 30° F. to 75° F., and the rim must be moved round until the nick bearing the temperature of the air at the time of observation is fixed by the lock pin. The scale of feet on the inside of the rim is then correct for that temperature. The altitudes are in all cases determined by taking two readings, one at the lower station and another at the upper, and then subtracting.

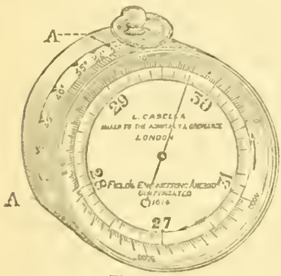


Fig. 1.

The principle, in fact, is this: an ordinary aneroid scale is correct at one temperature only, and is incorrect at every other; but "the very fact of the scale becoming inaccurate for the temperature for which it was graduated, renders it practically accurate for some other temperature, so that the shifting of the scale into certain fixed positions answers the same purpose as if the original scale were altered to suit various temperatures of the air."

Another improvement which has been introduced has been the jewelling of the working parts of the interior like a watch, the effect of which has been to increase its sensitiveness in a marked degree, and to render unnecessary the repeated tappings to which an ordinary aneroid must be subjected. It has further been tested and verified at Kew Observatory. A certificate from Kew should be demanded by every purchaser of meteorological instruments, of whatever description. The aneroid thus constructed is not intended to measure very great elevations; indeed, its scale does not extend above 5,000ft., but this permits of reading with accuracy, by means of a pocket magnifier, to 2ft. or 3ft. To set it, we obtain the temperature of the air, by means of a small whirling thermometer, *(thermomètre fronde,)* which is slung round the head by a cord, thus giving true shade temperature even under the direct rays of the sun; but this is really hardly necessary, as if it be set approximately within 5° F. a nearly correct result will be obtained.

The following instances may be taken as a fair test of the accuracy and simplicity of this aneroid :—

August 18th, 1877. Temperature of air, 65° F., and scale set accordingly.

	Feet.	
Journey to Derby.—Reading at Leicester Museum	2,167	
,, Town Hall, Derby	2,092	
Difference	——	75

Journey from Derby.—Reading at Town Hall, Derby....	2,100	
,, Leicester Museum	2,185	
Difference..........	——	85
		2)160
Average difference ..		80ft.

Now, the true difference of the heights of these two points, according to the Ordnance Survey, is 78ft., the Leicester Museum being 237ft., and the Town Hall, Derby, 159ft. above mean or half-tide sea level at Liverpool, the error in determination being 2ft. only.

September 5th, 1877. Temperature 60° F.

Journey to Charnwood Forest.—Reading at Leicester Museum	Feet. 1,725	
Reading on top of Bardon Hill....	2,395	
Difference............	——	670
Journey from Charnwood.—Reading on top of Bardon Hill	2,400	
,, Leicester Museum..	1,736	
Difference....	——	664
		2)1,334
Average difference....		667ft.

Adding this difference of 667ft. to the known height of the Museum above the sea (237ft.) we get 904ft. as the height of Bardon Hill, while the height obtained by levelling is 902ft.

MARINE ZOOLOGY AT ARRAN.

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

In the early autumn of 1873 upwards of twenty members of the Birmingham Natural History and Microscopical Society ventured upon a marine excursion at Teignmouth, on the south coast of Devon. The weather in a somewhat rainy year proved very fine, consequently dredging was pursued daily on board the yacht "Ruby," hired for the purpose, and there were regular botanical and geological excursions in the neighbourhood for those who were minded to go, as well as a special excursion to Kent's Cavern. Upwards of a week was thus passed pleasurably and profitably, many interesting forms of marine life being taken. On the whole the experiment gave such general satisfaction that it was determined to repeat it this year (1877) on a more extended scale, and in a locality which should, as far as possible, offer a decided contrast to that previously visited. The Island of Arran was selected, and the results were equally satisfactory. About twenty members—ladies and gentlemen—formed the party; the arrangements were left to a small Sub-Committee, and, as the number of members was sufficiently large, very favourable terms were granted by the Midland Railway Company, and the luxury of a Pullman Sleeping Car was indulged in at a moderate expense. A small sum—about a sovereign—was contributed by each member to a common fund, and thus a boat for dredging, or a carriage for land excursions, was at the service of the members daily as they felt inclined. An admirable general account of the proceedings having already been given * by one whose kindly disposition and richly-

* "Birmingham Natural History f Society. Excursion to Arran."—*Birmingham Daily Post*, Monday, Sept. 10th, 1877.

stored mind did much to add to the social geniality of the party, it is thought that a record of the Dredgings may not be uninteresting here, accompanied by some suggestions for another excursion during 1878. When we arrived at "the Island of the Many Peaks," much difficulty was experienced in obtaining a suitable boat, but eventually we made arrangements with the "Cutty Sark," a herring smack, and the "Mona," a small yacht, both of which did the work very well. The Dredgings, which commenced at the neap tides succeeding the August full moon, were carried on for a week principally in Lamlash Bay, but we had several good hauls both in the Bays of Brodick and Drumadoon. The depths did not exceed about twenty-five or thirty fathoms, and thus it was not found necessary to take temperatures, although we had provided ourselves with one of Negretti and Zambra's "Deep Sea Thermometers," in addition to the "Miller Casella" which we used before, both of which worked well. The results were officially reported to the Society on our return by Dr. Marshall and the writer, at a General Meeting, held on the 18th September last. Mr. John Morley, the Hon. Sec., also alluded to the Botanical excursions which were made under his guidance, and that of the President, Mr. Edmund Tonks, B.C.L. On the present occasion it is not, therefore, proposed to give more than a brief account of the more interesting forms of marine life taken.

The ground which we went over has long been a favourite spot with marine naturalists. Among others of eminence who had been there, we were informed that the late Dr. Landsborough had, with Major Martin, dredged the locality for five years. Our hopes of taking any novelty were not therefore very great. Nevertheless, on referring to the lists in the chapter on Marine Zoology in Dr. Bryce's book, "Arran and other Clyde Islands," (4th edition, 1872,) a charming volume, which should be in the hands of all naturalists visiting the Island, we have reason to believe that two forms, *Thyone* and *Elysia*—to be hereafter referred to—have been added by us to the local fauna. The distribution of marine life was extremely local. Within a few yards each haul of the dredge usually brought up an entirely different series of animals. Sometimes these consisted of the rosy feather star—sometimes of brittle stars—another haul would contain Pectens only—another the nest-building bivalve, *Lima hians*—another the common egg urchin *Echinus sphæra*—another yielded four beautiful specimens of Prideaux's Hermit crab, (*Pagurus Prideauxii,*) with its "commensal," the Cloaklet anemone (*Adamsia palliata*)—another would be of *Melobesia calcarea*, a curious coralline, largely composed of calcareous matter, prettily coloured purple or pink when living, but speedily becoming white after taken from the sea. Sometimes the dredge would contain nothing but mud or sand—to the great disappointment of the dredgers—and on one occasion a common wine bottle came up. It was brought from about twenty-five fathoms, was unbroken, full of sand, and covered with specimens of *Polyzoa* and *Hydrozoa*. As at Teignmouth, in the year 1873, we were too late to observe the developmental processes in the *Hydrozoa*; but it was an interesting fact that, although in point of date we were synchronous with the Teignmouth excursion, when we took several stalked forms of the rosy feather star, (*Antedon* (*Comatula*) *rosaceus*,) not a single specimen was obtained in Lamlash Bay, although every frond of *Laminaria* dredged was diligently searched. Numbers of the adult form were taken in many varying shades of richness of colour. On the whole, our best prizes were in *Echinodermata* and *Mollusca*, but there were several objects of interest in other classes. For instance, in *Porifera* we took specimens of the little calcareous sponges, *Grantia compressa* and *G. ciliata*; in *Zoophyta*, a fine mass of *Antennularia ramosa*; but with the exception of the four beautiful specimens of the Cloaklet anemone, (*Adamsia palliata*,) before alluded to, no other anemones of interest were dredged, nor any corals.

In *Echinodermata*, what immediately struck us on our first hauls of the dredge in Brodick Bay, and again and again in Lamlash Bay, was the gorgeous colour displayed by the lovely star fish, *Goniaster Templetoni* (Templeton's cushion star.) It was of bright scarlet above, varied with cloudy whitish markings, and of straw-colour beneath. When living there is a peculiar viscosity about the animal—the colour soon fades in confinement. But the brilliant colour of this star fish, as well as that of others of the class, served to dispel the popular notion, in those of us whose experience had been limited to a southern fauna, that as one proceeds northward colour diminishes in intensity. The following is a list of the Echinoderms:—*Antedon rosaceus* (the rosy feather star)—many specimens in the free or adult form, taken off Holy Island. In brittle and sand stars we took numerous specimens of *Ophiocoma bellis*, *O. granulata*, and *O. rosula;* also *Ophiura texturata*, *Uraster glacialis*, (the spiny cross-fish.) and *U. rubens*, (the common cross-fish,) the former very fine specimens—the latter in many instances renewing lost parts. *Cribella rosea*, (the rosy cribella,) one specimen. (*two* only are recorded in "Bryce;") *Solaster endeca*, (the purple sun star,) one specimen only, (of this beautiful star fish only *one* is recorded in "Bryce;") *S. papposa*, the common sun star, several specimens. *Goniaster Templetoni* (Templeton's cushion star) was taken numerously, and was most interesting, as indicating the connection—as the late Professor Ed. Forbes pointed out—between the true *Asteriadæ* and the *Echinidæ*, both in the general form and the shape of its spines. *Asterias aurantiaca* (the Butthorn) was represented by one specimen. *Echinus sphæra* (the common Egg Urchin) was taken plentifully; and a few specimens of *Echinus miliaris* (the purple-tipped Sea Urchin). *Echinocyamus pusillus*, (the green-pea urchin,) one specimen only. *Holothuriadæ* were notably absent, if we except a solitary specimen of *Thyone papillosa*, (the common Thyone.) This, which is not in the local list, was most valuable, as showing the passage of the class towards the *Annelida*. The linear arrangement of the suckers peculiar to the class is, in this genus, replaced by a diffused series spreading over the whole extent of the body. In *Annelida* our principal capture was *Nemertes Borlasii*, so graphically described by the late Rev. Chas. Kingsley. *Crustacea* were represented by about twelve species, in which *Stenorynchus* and *Inachus* were conspicuous; all are referred to in the local list. In *Polyzoa* we took *Salicornaria farciminoides*, (alive,) but in this class the specimens were not very numerous—nor were those of the *Tunicata*. In the class *Mollusca*, many specimens were taken which space will prevent recording. The most noteworthy (taken alive) were *Lima hians*, *Scaphander lignarius*, *Dentalium entalis*, and *Aporrhais pes-pelicani*. All these greatly interested us, but especially *Lima hians*. Several "nests" of this remarkable bi-valve were taken, in each case tenanted only by a single individual. The "nests" themselves consisted of comminuted shells, stones, &c., formed into a matted cluster by their byssal threads. When the animals were removed and placed in a vessel of sea water, their great beauty was apparent—some of the tentacles which had become detached remained apparently alive for some hours afterwards, twisting about like small earth worms. In the *Nudibranchiata* we dredged a single specimen of *Elysia viridis*—not recorded in "Bryce." This animal is exceedingly interesting, as belonging to the order *Pellibranchiata*, wherein the respiratory function is effected by the whole surface of the body, which is clothed with vibratile cilia. In the class *Pisces*, which terminates the collection, our most interesting finds were a few specimens of both the pretty little sucking fishes, *Lepidogaster bimaculatus* and *L. Cornubiensis*. They were very small, and the colours were not very well marked. I expect they were immature specimens. One, which was unfortunately lost, exhibited markings of a beautiful pale green colour, and differed in some other minor respects from the normal conditions of the species.

In the evenings, after our day's work was done, the examination and comparison of our captures afforded great interest to the members; and Dr. Marshall, Professor Keeping, and Mr. Chas. Pumphrey were indefatigable with their microscopes, and exhibited and explained peculiarities of structure and pointed out analogies and affinities.

Such of the specimens as were not required were returned to the sea, and the remainder were put up in spirits and preserved, as a nucleus for our museum.

If, as seems probable, another excursion is organised during this year, it would be desirable, for those interested, to give in their names soon to Mr. John Morley, the Hon. Sec. of the Society, Sherborne Road, Birmingham, so that a meeting may be held in the early spring, and plans determined accordingly. If it is possible to arrange for a week in the month of June, or not later than the first week in July, opportunities would be afforded for the examination of many most interesting forms of marine life in the larval condition, not to be found in the autumn. It is suggested, that if a small steam launch could be chartered for a week, much time would be saved, and dredging might be attempted in deeper water than hitherto. In fact, more work could be done, and it would be done in a better manner. A trawl similar to that which Sir Wyville Thomson states proved so serviceable in the Challenger Expedition might be used as well as the dredge and the towing net. Some shore collecting might also be undertaken with advantage.

LEPIDOPTERA AND THEIR CAPTORS IN THE MIDLAND COUNTIES.

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

The Lepidoptera of the Midland district have not hitherto received the same amount of attention which has been bestowed upon the same class in other parts of England. It is true that some of the greatest names among practical entomologists are to be found among the midland collectors. The name of the Rev. Joseph Greene must always command respect as that of the great authority on, and almost inventor of, pupa-digging; while another brother of the cloth, the Rev. H. H. Crewe, stands unrivalled in his practical knowledge of the puzzling genus Eupithecia. And another midland naturalist, Mr. Edwin Brown, of Burton, whose collections have lately been dispersed in consequence of his lamented death, stood equally high with either of the above named for general acquaintance not only with the Lepidoptera, but with Coleoptera, Diptera, and indeed almost every family of the multitudinous race of insects. It is not, then, for want of able and experienced collectors that this district stands below some others, as for example the London, New Forest, and Devonshire districts, from the Lepidopterist's point of view.

Nor again is it for want of sufficient material to work upon. The midland counties include, indeed, many purely manufacturing neighbourhoods, where it is hardly to be expected that Lepidoptera should flourish, (though, for the matter of that, one enthusiastic collector pursues his avocations with great success within a very short distance of the Staffordshire Potteries;)

but it includes likewise some localities which have been, and are likely to remain, amongst the best hunting grounds in England. Cannock Chase, the grand habitat of *G. ilicifolia*, is rapidly disappearing from the list of these localities; but Sherwood, Needwood, and Charnwood Forests still remain to delight the heart and furnish the cabinet of the ardent collector; and the Peak of Derbyshire, with its extensive moors, deep dales, and purling streams, has as yet been very little explored by entomologists. It is quite within the range of possibility that many new habitats, as well as species new to the district, may be discovered by midland collectors, if only they will travel a little out of the beaten tracks, and hunt for themselves, instead of following altogether in the steps of others. There is no assignable reason why the grand "catch" named above—*G. ilicifolia*—should not be found on the moors of North Derbyshire, or why *C. bicuspis* should be regarded as almost confined to the neighbourhood of Burton-on-Trent. The writer of the present article, during a sojourn of about ten days in the Peak in June, 1877, took forty-five different species of Macro-Lepidoptera, some, of course, common enough, but others quite sufficiently good to be worth having in any collection; and this, too, within a very limited extent of country. Nor should it be forgotten that considerably more than half the larvæ of *A. alni*, recorded in the "Entomologist" as having been taken during the autumn of last year, were secured by midland entomologists, the Rev. T. W. Daltry, of Madeley, having taken no less than seven, the Rev. H. A. Stowell, of Breadsall, three, and six or seven others (including the present writer) one each. What is principally needed, in order to secure an efficient and systematic working of the district, is something like union and inter-communication among workers in the same field, which should convert them from a body of irregular skirmishers into an organized army. There are plenty of individual collectors, first-rate localities, and ample materials to work upon. Almost every sub-division of the midland district possesses a Natural History Society, numbering its members from tens up to hundreds. But out of these many—to speak mildly—take but little interest in any branch of natural history, while far more devote their attention to other portions of the study, and the students of Lepidoptera are (generally speaking) few and far between. Even such a society as the North Staffordshire, with its 300 members, reports that in the matter of entomology its entire work for a year has been done by a single individual.

It is hoped, then, that the establishment of the Midland Naturalists' Union, with its annual gatherings, its combined excursions, and—last but not least—its monthly organ in the press, may contribute powerfully towards the existence of a more satisfactory state of things in this, as in all other branches of Natural History. Observers will become cognizant of each other's existence and particular line of study; they will have the opportunity of meeting from time to time on the field or in the annual gathering, and exchanging—as naturalists love to do—experiences of the past, and hints for the future; and many observations, which otherwise might have never seen the light, upon the habits and characteristics of different species, will be permanently recorded for the benefit of collectors and students in general. When we consider how many discoveries have been made, with relation to the habits of our moths and butterflies, during the last few years, and when, too, we find (as we may easily do by the perusal of any standard work upon the subject) how much yet remains to be discovered, it becomes pretty clear that there lies before the entomologists of the midland district an extensive field, upon which they have only to enter to reap a rich harvest of laurels for themselves, and—what is of far more importance—of useful information for all lovers of animated nature.

The president of a certain Natural History Society, in one of the southern counties, remarked the other day, in the course of his annual address, that his society "had exhausted the district!" The accuracy of his remark may reasonably be doubted. But certainly no such opinion could be expressed with regard to this part of the country. Even among the Macro-Lepidoptera, there are several of our local rarities whose "life-history" still remains to be written. The earlier stages of *G. ilicifolia*, if known at all, are so only to a privileged few. *A. niveus*, in spite of the labours of Mr. Brown and others, remains to a great extent a puzzle. *D. bicuspis* would probably be far more frequently found if some competent observer would devote himself to examining into its habits, and informing his brethren 'anent' them. *C. xerampelina*, though probably far from scarce in certain localities, is still looked upon as such, mainly because the majority of collectors are unacquainted with its habits in the earlier stages. And so with many other insects. There is surely something better to be done, in such a field as this, than the mere amassing of a collection. It may fairly be doubted whether a cabinet of Lepidoptera is in itself such a desirable possession. What we really want are observers —men of the stamp of Thomas Edward, the hero of Mr. Smiles' fascinating book—who will note with a keen eye the characteristics of the insects inhabiting their own special locality, and add to the general stock of knowledge by recording their characteristics for the information of their brethren. We hope that many such records as these will find their place, before long, in the pages of the MIDLAND NATURALIST; and, if this be the case, it is certain that our own district will soon be as well worked, and as thoroughly organised for the study of Natural History in all its branches, as any part of England.

FRESHWATER LIFE.—1. ENTOMOSTRACA.

BY EDWIN SMITH, ESQ., M.A.

The Entomostraca, though commonly called "Water-Fleas," are not insects, but crustaceans. They breathe by a sort of gills and the general surface of the body. They have two pairs of antennæ; and mostly more than three pairs of legs, borne by the thorax and abdomen conjointly. They never have wings, or even traces of wings. Consequently it is incorrect to speak of them as "fleas." They are, in fact, little creatures allied to the shrimp and the lobster. With the exception of *Apus*, which is 2½ inches, and *Cheirocephalus*, which is one inch long, the Entomostraca are very small animals, yet not too small to be seen with the naked eye. They are readily picked, with a dipping-tube, out of the jar of water containing them, and are more easily managed in the live-box than the strictly microscopic infusoria. On this account they form a capital first study for any one beginning his researches in freshwater life.

About two-thirds of the British Entomostraca inhabit fresh water, the remaining third being marine. We shall limit our attention at present to the former. The student who is tolerably persevering will soon make out from his gatherings ten or more genera, comprising about a score species, which may fairly be considered common. He should plunge his dipping-bottle into every pond in his neighbourhood, particularly into those which are covered with a green mantle of any sort, under which these creatures like to shelter. A still drain is no bad place for search. The rain-filled cart-ruts on the borders of plantations may also be looked into with advantage. I once took up a bottle-full of water from a small pond in North Wales, which had evidently been shrinking in dimensions all through a dry summer, while the life in it had been fast multiplying. The water, held up to the light, was literally blood-red with abundance of Daphnia. Though warm days, especially if a little cloudy, are more propitious to the dipping-bottle than cold ones, I have tried my luck with success even in winter, when the ponds were covered with thick ice. A water-trap made in the following way will be found very useful :—A glass jar about three inches wide at the top is fitted with a large bung; the bung has two holes to receive two funnels inserted on opposite sides, one funnel being small enough to go mouth downwards into the jar, and having its mouth covered with a bit of fine muslin. This acts as a strainer, and keeps back the live objects of as many bottles full of water as you choose to pour into the larger funnel.

The Entomostraca are naturally and in the main carnivorous. Indeed, one of their great uses in the economy of nature is to eat up decaying animal matter, which might otherwise taint the air or the water. They appear also to prey upon one another; while they are themselves the food of numerous aquatic animals, beetles, larvæ of insects, and so forth. Common sense will dictate what must be done to keep these little beings in our aquarium for observation. We must retain their food and exclude their enemies. In the struggle for existence amongst themselves the Cyprides appear to have the advantage. Some sprays of *Vallisneria*, *Anacharis*, or *Myriophyllum* should always be placed in the tank, to keep the water fresh, and to afford suitable harbour for the Entomostraca, and for their prey.

The Entomostraca have been arranged in four orders, of which we shall take a series of examples :—

1.—*Ostracoda*, such as Cypris, Candona, &c.
2.—*Copepoda*, such as Cyclops, Canthocamptus, &c.
3.—*Cladocera*, such as Daphnia, Chydorus, &c.
4.—*Phyllopoda*, such as Cheirocephalus.

The aquarium is sure to contain, even when other kinds have disappeared, swarms of active little specks of a bivalve shape, clustering near the glass, and moving about unceasingly amongst one another. Take one out with the dipping tube; you have almost certainly one of the many species of *Cypris*. You observe that the body is nearly enclosed in a loose jacket of two valves joined over the back, leaving the animal free to protrude below the bristly organs by which it swims. Taken out of its jacket or carapace, the body seems pinched up about the middle into two halves, the one corresponding to head and thorax, the other to abdomen and tail. There are two pairs of antennæ; the upper pair being employed for swimming only, the lower for both swimming and walking. Next comes the mouth, consisting of an upper and a lower lip, a pair of mandibles, and two pairs of jaws. The number of legs cannot be stated with certainty. I have noticed only two pairs. Then follows the abdomen, with its two lengthened stalks, each terminated by three short hooks. This is the principal swimming organ, being rapidly jerked out behind for that purpose. Breathing is effected by means of gill-plates attached to the hinder pair of jaws, with some assistance from the feathered bristles of the larger antennæ and the general surface of the body. But there are no branchial appendages to the legs as there are in Daphniæ. *Cypris* agrees with most other Entomostraca in having only one eye. The species most common in the neighbourhood of Nottingham are *Cypris vidua*, *C. minuta*, *C. aurantia*. If you search carefully the surface of gravel in your aquarium you may chance to see a little oblong horny speck making its way by fitful jerks. This will probably turn out to be a rather large member of the same family, named *Candona reptans*. It has the comical habit of creeping in preference to swimming. I have found it about here in meadow drains, and have successfully bred it in my aquarium from season to season.

[TO BE CONTINUED.]

SOME NEW FEATURES IN THE GEOLOGY OF EAST NOTTINGHAM.*

BY J. SHIPMAN, ESQ.

Any one who has seen the Government Geological Survey map of the Nottingham district (71 N.E.) will hardly fail to have noticed two white lines stretching across the north-east of Nottingham. Those white lines mark the course, or what the Government surveyors believed to be the course, of two important faults, or dislocations of the rocks. The white line nearest to Nottingham takes a straight course from Colwick Wood, in the south, to Patchitt's Park, in the north. The other white line describes a parabolic curve, starting from the top of Sneinton Dale, sweeping round by the Hunger Hills and disappearing about midway between Carrington and Sherwood. To the geologist faults are peculiarly interesting, and they sometimes account for a good deal of what is obscure in the physical features of a district. They are the unwritten records of the action, at some remote period in the past, of those natural agencies which we know are ever at work somewhere at great depths, producing oscillations of level in the earth's surface. But, apart from whatever may be the origin of faults, there are some physical features connected with the curved white line which, to say the least, have always been perplexing to those who have cared to pay much attention to local geology. There has hitherto been an air of mystery about it, and nobody was ever able to meet with it at any part of its course. Even Professor Hull speaks disappointedly, in his work on the "Triassic Rocks of the Midlands," at not being able to find the fault just where it was marked to cross Woodborough Road at the end of Red Lane. This fault has hitherto been an object of interest chiefly because it was abnormal for a fault receding at both ends from the fault forming the opposite side of the trough, to help to produce a downthrow of the rocks lying between. It will readily be understood, therefore, why the course this fault really took should be an object of solicitude for years to local geologists. Indeed, I very well remember learning some of my earliest lessons in field geology while trying to trace it; and it was while engaged in the same work in the early part of this year, on account of the unusual facilities afforded by excavations all over that part of Nottingham, that I discovered such serious discrepancies in the Geological Survey's mapping as induced me to resurvey the north-east part of what formed the old borough—that is, the area lying between Mansfield Road, Great Alfred Street, and Coppice New Road, and the result is the map which I now bring before you. In compiling this map, I have necessarily had to fall back, to some extent, on my recollection of what was the geological character of some parts now built upon, and I have found those observations, begun in 1868, very useful in elucidating what would otherwise have been almost beyond reach. The task was far from being an easy one, however pleasant field geology may be. Even where the character of the strata was exposed by sections I found the Keuper, which forms the larger part of the area, extremely difficult to deal with, both in the tracing of faults and in determining the boundary line between the Upper and Lower Keuper. Many spots, too—geologically hallowed ground, ground unusually prolific in interesting points—had to be

* Read before the Nottingham Naturalists' Society, Nov. 28th, 1877. The paper was illustrated with a geological map, sections, photographed sketches of the main faults, the site of the geodes, and of the conglomerate.

visited again and again in order to obtain satisfactory results, chiefly owing to the uncertainty of building operations being begun. Then there was no map published that was on a scale large enough to admit of detailed observations, so I enlarged one to a scale of one inch to 200 feet, which, divided into small handy sections for field use, I found to answer very well. For the levels, without which it would have been impossible for me to have constructed the horizontal sections to illustrate the character of the rocks below the surface, I am indebted to the kindness of Mr. Tarbotton, the borough engineer. No. 1 Section extends from the top of Dame Agnes Street to a point on Blue Bell Hill, north-west to south-east; No. 2, from Hawkridge Street, along Blue Bell Hill, to a point a few yards beyond Belle Vue House; and No. 3, from Great Alfred Street South, along the slope of Blue Bell Hill, to Bombay Street; each to a scale of 50 feet to an inch, and a maximum depth of 220 feet.

Turning now to the new map, perhaps the most striking feature is a broad, ribbon-like band of Keuper marl, shut in on each side by two parallel white lines, stretching across the map from the south-east to north-west. Those white lines are the equivalents of the straight and the curved faults respectively of the Government map. The fault nearest to Nottingham I have, for convenience, called No. 1 fault; the equivalent to the curved fault is No. 2. No. 1 fault, you will observe, has the effect of bringing down the Lower Keuper marl (f5) alongside the Bunter sandstone (f2) all along its course after leaving Blue Bell Hill, where the outcrop of the Keuper is on the south-west side of the fault. This fault strikes N.W., but before reaching Mapperley Road it seems to become deflected, bearing N.N.W., through Patchitt's Park, and joining No. 2 fault somewhere near the bottom of Red Lane, while only a minor dislocation is found taking the north-westerly course. Both faults throw down the Lower Keuper marl, the N.N.W. fault being well seen breaking through the east end of the sandstone cliff and bringing down the Lower Keuper twenty or thirty feet. Beyond No. 2 fault, that is on its north-east side, instead of the three-cornered inlier of Bunter (f2) which appears on the Government map, we have a double tongue of Bunter stretching up towards the Westminster Abbey, (as on the Government map,) on the one hand, and forming the valley at the foot of the Hunger Hills on the other—evidently the extremity of a broad offshoot up the St. Ann's Valley from the main area of Bunter to the south-west. We thus find that what the Geological Surveyors supposed to be a curved fault turns out to be a parallel fault to the straight one, striking about 55° west of north. This fault was exposed during the excavations for lowering Mapperley Road, near the reservoir, some years ago, then at the top of Dame Agnes Street, again half-way down that street, where it crosses obliquely, and may be traced passing down Martin Street and through the field where the St. Ann's Flower Show is held, across the hills to Carlton Road, where it is again seen at the elbow turn, and also in a section off Crown Street, opposite. It appears to have a throw of about 95ft. in Dame Agnes Street, increasing slightly further south, throwing down the Upper Keuper alongside the Lower, and the latter level with the Bunter. When cut through in Dame Agnes Street this fault was found to hade to the south-east, just as we should expect, considering that it unites with No. 1 fault, which hades in the opposite direction, to let in a sort of broad wedge of clay rocks belonging to a higher level; and the space between the walls of the fault was filled with pebbles embedded in a crystalline calcareous red sandy matrix, associated with red marl and "skerry." Acting as a sort of connecting link between the two main faults, and shifting the boundary line of the Upper Keuper about four hundred feet, is a fault familiar enough to most of us on account of its being long exposed in the section of marl opposite

Cranmer Quadrant, where it is seen bringing down the lower beds of the Upper Keuper alongside the marlstones of the Lower Keuper. This fault strikes north 40 west, with a throw of apparently about 15ft.; it is not again seen. It so much resembles No. 1 fault, as seen on Blue Bell Hill, that one can scarcely wonder that, in the absence of more complete data, the Survey should have regarded it as a continuation of the same fault. Reverting to No. 1 fault, it evidently forms quite a focus of small dislocations on Blue Bell Hill, varying in direction between west and north. One of these, bearing 10° north of west, and throwing down the Lower Keuper against Bunter about 10ft., produces the triangular patch of Bunter, just at the apex of which were a few feet of Lower Keuper capping the Bunter. When these beds were cut through during the formation of Turner Street, a remarkably interesting section of the conglomerate at the base of the Lower Keuper was exposed.* Unfortunately, however, it has since been removed for building purposes. Another fault, having a down throw of 6ft. 3in. on the east side, is traceable crossing Blue Bell Hill Road 12° west of north, and coming out in the cliff in Lower Beacon Street. The other minor dislocations marked on the new map, mostly parallel with this, all have a downthrow to the east, but they are of no further importance than to serve to show the general tendency of the down-throw of the faults on Blue Bell Hill, east of No. 1 fault. In fact I met with more dislocations radiating from No. 1 fault than in any other part. I ought not to omit to mention that No. 1 fault is finely exposed in the section opposite the saw mills on the Blue Bell Hill Road. The Lower Keuper between Pease Hill Road and the Robin Hood's Chase is also much disturbed by faults. Two or three may be seen in the brick yard there, but others, having a downthrow to the north-east, probably exist; for, on the down-throw side of No. 1 fault at the junction of Cooper Street and Pease Hill Road, the Bunter was met with at a depth of 16 feet, while near the Chase, with a rise of ground of about 14 feet, the Bunter was not reached till a depth of 54 feet of Lower Keuper had been passed through, and then only on the upthrow side of a fault which was found to cut through the well. Again, just where we might expect to find the lowest beds of the Keuper, namely, at the bottom of Dame Agnes Street, over 40 feet of waterstones have been pierced without reaching the Bunter. This, coupled with the fact that brickyards existed years ago along the bottom of Blue Bell Hill on St. Ann's Road, leads me to infer the existence of a series of transverse faults running nearly parallel with that road, and letting in the higher beds of the Keuper.

While tracing the fault I have mentioned in the Beacon Street Cliff, I came across some very interesting geodes in the Lower Keuper sandstone beds. The geodes ramified in the thick beds of sandstone without any regard to the lamination; were lined with rhombohedral crystals of calcite, occasionally tinged with copper and a black mineral—probably manganese; and appeared to have been formed long after deposition and consolidation of the rock. The crystals were all rhombohedrons, except where the copper or the black substance was present, when they became double six-sided pyramids. These are the first crystals of calcite, as far as I know, that have been found in the Keuper—at least in this district. The geodes extended through about three feet of the marlstone, and were confined laterally to the space of a few square yards. The calcareous matter appeared to have come from above, a thin lenticular band of it, about three feet long, being met with about five feet above where the geodes were found.

[TO BE CONTINUED.]

* This conglomerate is described at a later stage.

Correspondence.

The Nest of a Sparrow, *(Passer domesticus,)* containing six eggs, was taken at Saltley, on the 30th of November. It is now in the possession of Mr. A. F. Shrive, 98, Lower Tower Street, Birmingham, where it may be seen by anyone interested in ornithology.

Leicestershire Flora.—The Natural History Section of the Leicester Literary and Philosophical Society is engaged in verifying and bringing up to date the MS. of the Flora of Leicestershire, left by the Rev. W. H. Coleman, of Ashby, about twenty-five years ago. Any botanist in the outlying districts of the county will be rendering useful assistance by sending lists of plants observed to the President of the Section, at the Town Museum, Leicester.

Magpie—Cuckoo.—A friend of mine who, as a boy, was a great hand at bird's nesting, and also a great observer of the habits of birds, has remarked that when a magpie built its nest in a larch or fir tree, and the nest was taken with a full complement of eggs, she would invariably build again near the same spot. But if the nest was taken under the same circumstances from an oak, elm, or other forest tree, she would never rebuild in the same neighbourhood. I should be glad to know, if any one else has remarked this, and if it can be accounted for. Also, if it is a generally acknowledged fact, that the cuckoo lays its egg on the ground, and carries it to the nest where it is to be hatched.—Oswald M. Feilden.

Conchology.—It may be interesting to your Conchological readers to learn that two species of shells not previously known to exist in Warwickshire have been recently added to the fauna of that county. Whilst searching for *Pselaphidæ*, in moss growing on a poplar tree near Knowle, the writer found a single specimen of *Zonites excavatus*, var. *vitrina* Fer. This species is interesting from its habit (unusual with snails) of braving the most inclement weather, being often found crawling on snow. Near Henley-in-Arden in the heart of Warwickshire, the turnpike road has been cut through a hill composed of red marl, and on the banks of the cutting, on both sides of the road, *Helix Cantiana*, Mont., abounds. The writer found it there during a Summer Excursion of the Birmingham Natural History Society, but has not discovered it in any other part of the county.—W.G.B.

A Suggestion for Naturalists.—Having in the early part of this year set on foot a Naturalists' Society, called "The Northwich Naturalists' Field Club," we are very anxious to establish a series of lectures on Botanical and other Natural History subjects, to be delivered during the winter months for the purpose—first, of instruction to the Class; second, of increasing interest in such subjects; and third, of aiding the funds—as we are at present very poor. The announcement of the "Midland Naturalist" has suggested to me the idea of soliciting through its pages the *gratis* services of some of the members of the Midland Union of Naturalists in the delivery of monthly lectures, trusting that there may be some who, out of love for the objects and a desire to extend the study of Nature, would be willing to deliver such lectures to our Society here without further remuneration than their necessary expenses. Our Society is in an *infant* state, and therefore the lectures need only be plain and elementary in their nature. If you would assist me by printing this letter I should feel very grateful, and it would be a great assistance to the work which we hope to carry on here.—T. Hartley, Curate of Witton, Northwich, Cheshire, Hon. Sec. of N.N.F.C.

Note on a Curious Beetle.—Presuming that the occurrence of the less common species of insects in our Midland district will be a matter of interest to the readers of the "Naturalist," I send the following note:—On the 12th of September, 1873, a young friend of mine brought to me from the newly-opened Clifton Colliery, near Nottingham, some specimens of a remarkable beetle. Its entire length, body and head, was ⅝ of an inch; its prevailing colour an iron gray, with lighter patches on the thighs and tarsi, and lighter strokes between the segments on the under side of the abdomen. But the most striking feature about the beetle was its antennæ. These were 3¼ inches long, composed of ten joints, the one nearest the head being much thickened. How this little creature manages to fly through the woods without breaking such long and slender organs is a puzzle. They are longest in the males; and as the males, so I am told, frequently fight, the antennæ do get broken. Several specimens were brought to me in this state. The beetle in question I made out to be *Astinomus ædilis*. Some authorities call it *Acanthocinus*. It appears to occur at Rannock, in Perthshire; and Mr. Rye says that "it may be not uncommonly seen flying across the glades of the Black Forest, with its long appendages streaming behind. It loves to settle on felled pine logs, with its antennæ spread out like compasses, from which habit it is termed by the Highlanders "Timberman." There seems to be no doubt that the beetle was imported in the timber needed for the colliery, and travelled from its proper home in the stage of larva or pupa. Waking from its quiescent state, it flew, attracted by the warmth, in great numbers to the tall chimney of the engine house, where several very fine specimens were secured. For a good figure see Rye's British Beetles, plate xiii.—Edwin Smith, Nottingham.

A Few London Notes, by an Occasional Correspondent.—Now that the season for the work of the learned societies has come, they are as busy and interesting as usual, and as admission is easily obtained to any or most of them, the subscribers of "The Midland Naturalist" cannot do better, when they are in town, than consult "The Weekly Calendar" of the *Illustrated London News*, and, choosing their society, ask a member for an introduction.—A great want in microscopy is likely to be supplied by the "Immersion Paraboloid," exhibited at the Quekett Club, which renders dark ground illumination possible with high powers. It is, being "immersion," somewhat more troublesome than the ordinary illuminator, but answers admirably.—Every one will be glad to hear that Sir Josh. Hooker is looking strong and well after his tour. He visited Colorado and the Sierra Nevada, with Professor Asa Gray, with the intention of classifying the Conifers on their route. The task is rendered difficult by every tree having as many local or scientific names as branches; but among other curiosities, he mentioned one pine which does not shed its seeds or cones, and showed a specimen of another and a piece of juniper, deeply scored and honey-combed in parts, to the depth of thirty annual rings, by sandblast. Considering the trees were grown at an altitude of some thousands of feet, and are so hard that a knife will not touch them, it can be easily imagined, as is the fact, that hundreds of years have been spent in making the excavations.—Professor Tyndall's lecture, at the London Institution, was a great success, the Theatre not being nearly large enough to hold the intending audience. His proofs, in opposition to Dr. Bastian's assertion of spontaneous generation, seemed unanswerable; but the Doctor is too tough an antagonist to be easily vanquished. In passing, I may remark that if scientific lecturers generally only knew the pleasure it gives an audience to listen to the fluent and animated delivery of Professor Tyndall, as opposed to the sing-song, monotonous *read* lectures, only too common, they would cultivate style as they do their other gifts, and doubtless as successfully. For fun, commend me to Dr. M. C. Cooke. We who had the privilege of attending the Quekett Club Dinner on the 1st will not easily forget his description, "*a la* Hood," of the Chinese Ambassador's visit to the *soirée*. The Dr. said "He brought his own China mug to tea," and he admirably described his surprise when he saw a flea under the microscope.—The Aquarium, at Westminster, is now well worth seeing, the tanks being fully stocked and the water bright. The latest addition—the Sharks, in the largest tank, are vigorous, and give us a good idea of the Squalidæ. Mr. Carrington, the naturalist, who has now the management of the fish department, has reduced the former terrible mortality of his *proteges* to an almost nominal rate, and may make the people of Birmingham hopeful of the future of their Aquarium when they see what difficulties have been overcome. Mr. Carrington is on a tour in Italy, and, as he purposes dredging on the Sicilian coast, and visiting Dr. Dohrn's most admirable of all Aquaria, at Naples, there will doubtless be something to see at Westminster, on his return, notwithstanding the loss of Pongo and the Whale.—W. J. S.

Gleanings.

Mr. Charles Darwin, the great Naturalist, has had the degree of Doctor of Laws conferred upon him by the University of Cambridge.

The Scotch Naturalist.—From a letter we have received from Banff, we learn that Thomas Edward is busily occupied in preparing for publication further reminiscences of his life and labours as a naturalist. We are sorry to learn from our correspondent that he is suffering from bad health.

The Bakerian Lecture was delivered before the Royal Society, (Sir J. D. Hooker, President, in the chair,) on the 15th November, by Prof. W. C. Williamson, the subject being "On the Latest Researches into the Organisation of the Fossil Plants of the British Coal Measures, especially of the Calamites and Lepidodendra."

The Beginnings of Life is the title of the first of the Manchester Science Lectures of the current Session. The lecturer is Professor P. Martin Duncan, F.R.S.

The Royal Society's Medals for the year 1877 have been awarded thus:—The Copley Medal to Professor James Dwight Dana, for his biological, geological, and mineralogical investigations, and for the valuable works in which his conclusions and discoveries have been published; to Mr. Frederick Augustus Abel, F.R.S., a Royal Medal, for his physico-chemical researches on gun cotton and explosive agents; a Royal Medal to Professor Oswald Heer, of Zurich, for his researches and writings on the Tertiary Plants of Europe, of the North Atlantic, North Asia, and North America; and the Davy Medal (first time of its award) to Robert Wilhelm Bunsen and Gustav Robert Kirchoff, for their researches and discoveries in spectrum analysis.

Chara Fragifera.—The discovery of *Chara fragifera*, (Durieu,) as a British plant, by Mr. John Ralfs, in a peaty pool, at Chy-an-hal, near Penzance, Cornwall, is recorded in the last number of the *Journal of Botany*.

Hybrid Brambles.—In the *Journal of Botany* for December, there is an interesting paper, by Dr. W. O. Focke, on "Some Hybrid Brambles," in which the author gives an account of his experiments in crossing the nearly allied varieties—*Rubus gratus* and *R. bifrons*, by which he has obtained a plant which he considers to be identical with *R. Villicaulis*. He says, "Now the question arises, what is the widely distributed *R. Villicaulis?* Is it, indeed, a constant race derived from a hybrid? It is not easy to understand how this can be the case, as *R. gratus* and *R. bifrons* grow scarcely anywhere at the same spot. In the greater part of Germany, where *R. Villicaulis* is abundant, and probably also in England, there is never seen either of its supposed parents." He has also succeeded in producing hybrids by fertilisation of *R. Idæus* L. and *R. Bellardi* W. and N., with the pollen of *R. Cæsius* L. The products are quite sterile, and that of *R. Idæus* resembles the spontaneous hybrids described as *R. Cæsio-Idæus*, &c.

Zoological Society. Amon the additions to the Society's menagerie during the months of August, September, and October are a Cape hedgehog, (*Erinaceus frontalis*,) a young American tantalus, (*Tantalus loculator*,) a Brazilian marmot, (*Momotus brasiliensis*,) two Guilding's amazons, (*Chrysotis guildingi*,) two sooty coots, (*Fulica ardesiaca*,) and a pair of African buffalos, (*Bubalus æquinoctialis*,) acquired by purchase.

Rare Birds.—The Rev. F. O. Morris, Nunburnholme Rectory, Hayton, York, has drawn public attention to the necessity of something being done to protect birds which yearly or occasionally visit our shores "who come to us, but never return again whence they came," being ruthlessly shot as soon as seen. He mentions the hoopoe, the bluebreast, the golden oriole, the roller, the bee-eater, the Orphean warbler, the great sedge warbler, the melodious willow warbler, and the Alpine warbler, the chough, the rose-coloured starling, &c., as some of the birds he would desire to have protected in order that they might have a chance of building, breeding, and so becoming naturalised among us, "as beyond all doubt some of them would if they were not destroyed."

The Challenger.—Measures are afoot for supplementing the researches of the Challenger Expedition by a series of deep-sea dredgings in the Indian Seas. These seas were purposely omitted from the scope of the Challenger's investigations. A new steamer is now being built in India, and an officer of the Coast Survey Department (Lieutenant Jarrad, R.N.) has been commissioned to see after the fittings and dredging appliances in England. Full information has been obtained from the old staff of the Challenger, and it is hoped that operations may be started next cold season (1878-79.) In that case it is probable that the first steps will be to run one or more lines of soundings across the Bay of Bengal in such directions as may seem best.

A fossil *Peronospora* of the Palæozoic age is described and illustrated by Mr. Worthington G. Smith, in the *Gardeners' Chronicle* of October 20th. It is the remains of a fungus found growing in the vascular bundles of a *Lepidodendron* from the coal measures, and the name he gives it is *Peronosporites antiquarius*. A criticism on the subject will be found in *The Academy* for November 17th, p. 475.

The Telephone.—At a recent meeting of the Society of Arts, Professor Graham Bell, the inventor of the telephone, gave an interesting account of the experiments by means of which he had arrived at the instrument in its present form, which, if not absolutely perfect, is rapidly tending thitherwards. The instrument was employed on the occasion successfully. To carry on a sustained conversation, it is found that two instruments are required at each end, one to speak to and the other to listen at.—A full report will be found in the *Times* of November 29th, p. 6.

The Phonograph is the name of an instrument, invented by Mr. Eddison, which is described as an improvement on the Telephone. The inventor has provided an arrangement, by which the undulations produced by the human voice are recorded on a strip of paper, from which the sentences uttered may be reproduced automatically.

OUR COVER.

BY WORTHINGTON G. SMITH, F.L.S., M.A. .,

Every work of art, whether important or uninnportant, should be able to speak for itself, and tell its own tale. It has been suggested, however, that the designer and engraver of the new Cover of the "Midland Naturalist" should write a few lines of description of the picture on the outside wrapper, and he has complied, with pleasure, by writing the few brief sentences which follow :—

Some of the ideas for the Cover belong to Messrs. Badger, Tait, and Harrison, others are the writer's ; the general design is intended to give a sort of conventional reflex of the chief Sciences. The study of animals recently extinct is indicated by the sketch of the Mammoth, *(Elephas primigenius,)* in the ice, and of living animals by the drawing of the Red Deer, *(Cervus Elaphus.)* The philosophical instruments at the top, spectroscope, microscopes, and telescopes, need no word of explanation. The Cromlech, flint arrow-head, and stone hammer point to pre-historic Archæology ; the Cromlech represents the magnificent monument still standing near the village of Clynnog, in Carnarvonshire. The cap stone of this Cromlech is profusely dotted over with the enigmatic "cup-markings ;" the original sketch for this outline was made by the writer from the actual structure in August last. The botanical vasculum, the geological hammers,'anemometer, ground thermometer, barometer, and rain gauge point to the respective studies in which these instruments are used. The Bee *(Bombus terrestris)* is introduced as a typical British Insect to represent Entomology, and the Wild Rose, *(Rosa canina,)* and Cowslip, *(Primula elatior,)* are given to indicate the Phanerogamous section of Botany. The Actinophrys, *(Actinophrys Eichornii,)* on the right points to the Rhizopoda, and the Ferns and Fungi beneath are representatives of Cryptogamic Botany. The Apteryx, *(Apteryx Australis,)* and Octopus, *(Octopus vulgaris,)* represent rare and curious animals, and at the same time point to Ornithology and the Mollusca. The Ichthyosaurus at the base is a representative of animals long extinct, and now found in a fossil condition only.

As there is always an interest attached to the method of doing things, it may not be out of place here to say that the design, (with all its defects,) was drawn direct on the box-wood block, and engraved at once, without a slip, false line, or alteration. Many readers of the "Midland Naturalist" will probably be self-taught men, who busily follow industrial occupations every week-day. It may therefore interest such readers to know that the writer of these lines never had any teacher, either artistic or scientific, other than he always found supplied to him by close observation, careful reading, experience, and constant perseverance.

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—GENERAL MEETING, November 6th. The PRESIDENT, Mr. Edmund Tonks, B.C.L., in the chair. Dr. W. HINDS read a short paper on the "Physical Character of Seeds," referring to the form, beauty of markings of the testa, style, and deposition of the embryo; the indication and inferences to be derived from the presence of perisperm, and especially as to comparative and absolute size of albuminous and exalbuminous seeds. The aim of nature in furnishing certain seeds with characteristic appendages was also commented upon. The paper was illustrated by microscopical and other specimens.

BIOLOGICAL SECTION.—November 13th.—Dr. W. HINDS presiding. Mr. W. B. Grove, B A., gave some remarkably interesting notes on the "Botany, Geology, and Physical Geography of the Cheshire and Lancashire Coasts," illustrated by geological diagrams and a series of carefully preserved botanical specimens. These formed a very characteristic flora of the above coasts. Among others were *Psamma arenaria*, *Festuca uniglumis*, *Carex extensa*, *Viola Curtisii*, &c. A discussion followed.—Mr. J. BAGNALL exhibited a number of rare Warwickshire plants, collected in a rich lias quarry, near Bidford and Exhall, and read notes as to the distribution of these plants in the country and throughout the world, together with the origin and signification of their names, and a short account of some of the older botanists by whom these names were first instituted. Among other plants were *Linaria spuria*, *Anagallis cerulea*, *Picris hieracioides*, &c.—Mr. JOHN LEVICK exhibited in the microscopes selections of water from a prolific pond, near Perry Barr, in which were abundant *Volvox globator*, *Actinophrys sol*, and other creatures of great interest.

BIOLOGICAL SECTION.—December 11th.—Dr. W. HINDS presiding.—Mr. E. W. BADGER read a paper on "Abnormal Ferns," by Mr. E. J. Lowe, F.R.S., of Nottingham, which will be found printed at length at page 5. An animated discussion followed. A vote of thanks was awarded to Mr. Lowe for his valuable and interesting communication.

GEOLOGICAL SECTION.—October 30th.—Mr. Heming, of Redditch, read a paper on "Agates," collected from the drift in the neighbourhood of the Lickey. The greater part of the gravel which yields the agates comes from the Moseley cutting, and some isolated patches usually capping slight hills. All these gravels are characterised by hollow nodules of iron ore. Mr. Heming made some remarks on what he held to be the origin of some irregularly marked agates, viz., the chert of the Carboniferous Limestone. The paper was illustrated by many beautiful polished specimens of pebbles.

GEOLOGICAL SECTION, November 27th—Rev. H. W. Crosskey, M.A., F.G.S., presiding. Mr. S. Allport, F.G.S., showed specimens of Volcanic Agglomerate and blocks of Porphyritic and other Pitchstones, from the Wrekin; and Spherulitic, Pitchstone, and Perlite, from Lea Rocks, also near Wellington. These rocks have been described in the *Quarterly Journal of the Geological Society*. They are chiefly remarkable as being the first glassy rocks of Palæozoic age which have been anywhere found. The blocks of Pitchstone occur in certain of the higher beds of the Agglomerate, and are of considerable size, from 14 to 18 inches in diameter. Mr. Allport gave a description of the Volcanic rocks which form the central axis of the Wrekin, and exhibited some beautifully-prepared microscopical sections, illustrating his remarks.

GENERAL MEETING, December 4th.—Mr. S. ALLPORT, F.G.S., presiding. Mr. Levich read a paper on "The Hydra," describing its mode of reproduction, and its stinging organs, and made some interesting remarks upon its habits, and the manner in which it seizes its prey. The paper was illustrated by several specimens under the microscope, amongst which were the stinging organs, and a specimen of *H. Vulgaris* with ova attached. The same evening Mr. W. R. Hughes, F.L.S., read a paper on "The Spicules of Sponges." After referring to the vexed question of the animality of sponges, which had been satisfactorily settled in our day, both by the physiologist and the chemist, he described the mode of life of the animal. The manner in which earthy matter, calcareous or siliceous, was secreted, in order to give strength and consistence to the tissues, was then alluded to, and the various offices performed by the spicula—connecting, prehensile, defensive, tension, and retentive, were described. The spicula themselves, which are of the most varied and beautiful kinds, resembling spun glass, extend from the simple pin-shaped to the elaborate cruciform and anchorate forms as seen in the *Hexactinellidæ*, and are amongst the choicest objects in the cabinet of the microscopist. Between two and three hundred of these forms had been described by the late Dr. Bowerbank, the historian of the British *Spongiadæ*, and several new and beautiful forms which were alluded to had been added by the deep sea explorations of H.M.SS. Lightning, Porcupine, and Challenger. The paper was illustrated by a series of very beautiful diagrams executed by Miss Hadley, one of the members of the society, and by many specimens from Mr. Hughes's cabinet. One of the diagrams exhibited an Anchorate spiculum, enlarged 22,000 diameters. Mr. Wright Wilson, F.L.S., exhibited specimens of the *Euplectella aspergillum*, or Venus's flower basket, and of the *Hyalonema mirabilis* or glass rope sponge, and also, as a contrast, specimens of spun glass in further illustration of the paper.

BURTON-UPON-TRENT NATURAL HISTORY AND ARCHÆOLOGICAL SOCIETY.—October 31st, *soirée;* papers by Mr. J. T. Harris, the Rev. C. F. Thornewill, M.A., and Mr. C. Perks. November 13th, paper by Rev. W. W. Fowler, M.A.; subject, "The Colorado Beetle." November 27th, paper by Lawson Tait, Esq., F.R.C.S.; subject, "Insectivorous Plants," an abstract of which will appear in the "Midland Naturalist." December 11th, paper by Rev. T. F. Fenn, M.A.; subject, "Holiday Rambles."

NOTTINGHAM LITERARY AND PHILOSOPHICAL SOCIETY.—NATURAL SCIENCE SECTION.—The following papers were read:—December 5th, "On the Geology and Mining History of Coal," by Mr. J. Bilbie. December 12th, "On the Oldest Welsh Rocks," by Mrs F. M. Ward. December 19th, "On Teredos, or Wood-boring Mollusca," by Mr. B. Sturges Dodd.

NOTTINGHAM NATURALISTS' SOCIETY.—November 28th. Meeting at the Corn Exchange, Thurland Street. Mr. Shipman read a most interesting paper, entitled "Some New Features in the Geology of East Nottingham," the first half of which appears in our current number. (See p. 18.)—December 5th. Meeting at the Museum, Wheeler Gate. Mr. B. S. Dodd read a paper on "Algæ," dealing with their habitat, structure, economy in nature, &c., and also the readiest way of preserving them as cabinet specimens. The paper was illustrated by numerous well-mounted specimens from the Channel Islands.—December 19th. Meeting at the Museum, Wheeler Gate. A rough "Sketch of the Geology of Nottingham and the District" was given by Mr. C. T. Musson.

OSWESTRY AND WELSHPOOL NATURALISTS' FIELD CLUB.—This Society made four excursions during the summer of 1877—the first in the neighbourhood of Montgomery, a very beautiful district, abounding in ancient remains, camp, tumuli, castles, &c., and a good field for botany and geology. The next excursion was along the Dee from Overton, through Wynnstay Park to Ruabon. The third was to the Breidden, rich in botanical treasures, but it being rather late in the season, only *Sedum Forsterianum* was found. The last excursion was to Wenlock and Buildwas Abbey, and the Wrekin. The only other plants of any rarity which have been found this summer, are *Inula Helenium* and *I. Conyza*, *Scabiosa Columbaria*, *Sedum Telephium*, *Linum Augustifolium*, and *Utricularia Vulgaris*.

STROUD NATURAL HISTORY SOCIETY.—The second meeting for the present session was held on the 13th November. There was a large attendance. Mr. J. E. Dorington, president, in the chair. A short paper was read by Dr. Partridge, F.R.M.S., "on the application of the microscope to scientific inquiry."

The meeting then resolved itself into a conversazione, and an exhibition of microscopic objects, &c. Mr. Allen, of Bath, Secretary to the Postal Microscopic Society, lent an antiquated form of instrument for exhibition, and also sent some excellent slides and MS. containing beautiful drawings by Tuffen West, Hammond, Winderhill, &c. On December 11th, at a numerously attended meeting, the President in the chair, J. H. Taunton, Esq., C.E., read an important and interesting paper on "The enlarged use of compressed air in recent engineering construction;" Dr. Bond, of Gloucester, exhibited a telephone in working order, and described its construction and mode of use; and Mr. Holland exhibited various liassic specimens from the bone bed, near Westbury.

TAMWORTH NATURAL HISTORY, GEOLOGICAL, AND ANTIQUARIAN SOCIETY.—The annual meeting was held December 17th. After the statement of accounts and the report had been read, the President (Mr. R. W. Nevill) delivered a valedictory address, in the course of which he reviewed the social changes which have taken place during the last quarter of a century, mentioning briefly, but clearly and forcibly, the more important of them. He next pointed out that the progress of science during the same period had been even greater. Reference was then made to some of the many important investigations now occupying the attention of our leading men of science; and to the recent discovery of the telephone by Professor Bell. After thanking the members for their attendance, Mr. Nevill proposed for his successor as President the Rev. Brooke Lambert; the motion was seconded by Mr. W. Lucy, and carried unanimously. The Committee, Treasurer, (Mr. H. Thring,) and Secretary, (Mr. W. G. Davy,) were then elected. The meeting was afterwards occupied in examining a telephone, which was exhibited and successfully worked.

Answers to Correspondents.

F. T. M. "Mathematical Problem."—We have submitted your question to two able mathematicians—one a Senior Wrangler who has made optics a special study—who agree in stating that in the present state of our knowledge it is unanswerable.—We shall be glad to be favoured with your promised contributions.

MELICERTA RINGENS.—In answer to H. M.'s enquiry, we refer him to an advertisement on the cover of this month's issue, in which he will see that he can obtain for a mere trifle from Mr. Thomas Bolton, of Hyde House, Stourbridge, specimens of this interesting building Rotifer. Mr. Bolton has long been recognised in this locality as a most successful finder of rare Rotifers, Entomostraca, &c.

We have to thank many friends for encouraging communications. We have especially to thank Dr. W. Hinds for his excellent article on "The Chlorophyll-body and its relation to Starch;" Mr. W. G. Blatch for his interesting communication on "Entomological Books for Beginners," and Mr. C. T. Musson for his "Catalogue of the Land and Fresh Water Shells to be found in Nottingham and the neighbourhood," for all of which we hope to find room in the number for February.

We have much pleasure in printing the following resolutions, unanimously agreed to at the last meeting of the Birmingham Natural History and Microscopical Society:—Resolved—That the Secretary be requested to send a copy of the first number of the "MIDLAND NATURALIST" to all the members of this Society, accompanied by a circular calling their attention to the journal, and expressing a hope that they will subscribe. Resolved—That this resolution be communicated to the other Societies in the Union, in the hope that they may be induced to take similar measures to bring the "MIDLAND NATURALIST" before the notice of their members.

PASSAGES FROM POPULAR LECTURES.

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

No. 1.—THE MEANING OF "SCIENCE."

Let us consider what we understand, and what we ought to understand, by the word "Science." The word itself is simply the Latin word *Scientia*, stripped of its Roman toga and put into an English dress. Its original meaning is "knowledge," and the Romans used it in its widest sense, as including all manner of facts and propositions which were known or supposed to be known. But in later times its meaning has been restricted. The domains of art and of literature have been struck out from the domain of science. In our modern view science deals with principles, art with practice. Science enquires about the laws of matter and mind, art applies these laws in the production of results. To ascertain the laws of animal life and of inherited qualities is science; to improve the breed of sheep and cattle by the application of this knowledge is art. But the domain of science is still very wide, and is further broken up by modern analysis into such sections as "pure science," dealing with abstract ideas; "physical science," investigating nature mathematically; and "natural science," studying the laws of life. Yet there is another analysis which requires to be made, and which seldom *is* made by those who speak of science in a popular manner. Science, we say, means "knowledge:" but what do we understand by "knowledge?" Under cover of this word are commonly confounded two very different states of mind, and the confusion has led to many serious results.

If we say that we *know* there is light in this room, and that we *know* the light is produced by the gas, we are speaking of two quite different kinds of knowledge, only one of which has any right in a strict sense to be called knowledge at all. The other is not knowledge but *belief*.

We *know* that there is light in this room; but we do *not* know that it is produced by burning gas; we only *believe* that it is.

Mark the difference. Knowledge is that of which the mind has direct perception. Belief is that state which the mind arrives at from the balancing of evidence.

That there is light here is not a matter of inference, or judgment, or opinion; it is not a conviction arrived at from weighing evidence; it is the simple perception of a sensation. There can be no possibility of denying it. It is true knowledge.

But to say that the light is produced by gas is to refer to a judgment —not a direct perception. We do not perceive the gas. It is far away from us. We argue in our minds "what produces this light? Is it the sun? Is it the moon? Is it candles? Is it gas?" We consider, and balance the evidence, and conclude that the probability of its being gas far outweighs all other suggestions. A conviction or belief is the result. But this is not true knowledge, and it has nothing like the certainty of true knowledge.

We never can be sure that all possible evidence, upon any subject whatever, has come before us; nor that we have equally and impartially weighed all the evidence we had. How do we know, for instance, that the gas-company are not trying an experiment to-night, and using something which is *not* gas after all? We may have had the firmest belief that the light was produced by gas and yet find that we were wrong.

Every belief is open to contradiction, and liable to change. As long as a real belief exists at all it has the same force with us as if it were knowledge, but it is essential to our progress to remember the clear distinction between them, and to keep the mind open and attentive to fresh evidence, because it may at any time bring us nearer to the absolute truth.

We *know* that we exist; that we feel pleasure and pain; that two and two make four; that the whole is greater than its parts; that there are such things as light and darkness, warmth and cold; that the rainbow is curved and coloured; that our cat has four legs, and our brother only two. These are all direct perceptions of truth, whether derived from the senses or from reason. But we only *believe* that we shall exist at any future time; that certain acts always produce pleasure and others always pain; that we could go to a grocer and buy a pound of sugar for fivepence; that the earth is spherical and revolves round the sun; that *every* cat has four legs, or every man only two. These are inferences, judgments, not perceptions, liable at any moment to be contradicted and proved false.

At present there is an immense amount of confusion in popular language, and even in scientific language, between propositions of these very different kinds. Almost any one would say in popular conversation, "Oh, you *know* that a cat has always four legs;" and few scientific writers would hesitate to say "we now know that the sun is about 92,000,000 of miles distant from the earth." Both statements are incorrect in calling that *knowledge* which is really *belief*. Probably a time will come in which greater precision of language will be demanded; when belief will be as clearly distinguished from knowledge as art now is from science.

Every student of science should cultivate such precision as one of his most precious instruments in the investigation of nature. For man's attempts to pick her locks are still supremely clumsy. He needs to make his keys a thousand times more delicate than any which he uses now before they will pass the wards of nature's inmost sanctuaries.

SOME NEW FEATURES IN THE GEOLOGY OF EAST NOTTINGHAM.

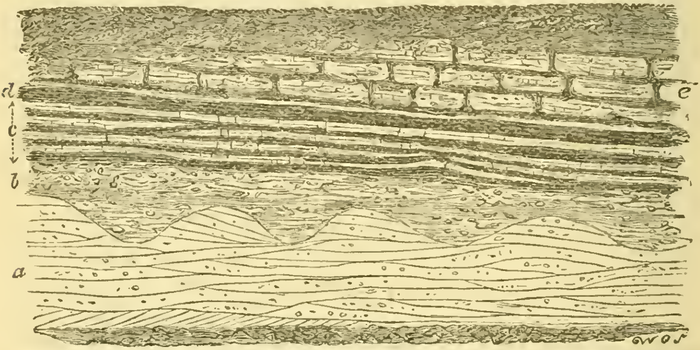
BY J. SHIPMAN, ESQ.

(Continued from page 20.)

Not the least important respect wherein my map differs from the Government map is the much less area covered by Upper Keuper marl. The Geological Survey supposed that one effect of their two faults was to throw in between Lower Keuper a patch of Upper Keuper extending from Cranmer Street to Red Lane—that is, the space between the two faults. If their supposed curved fault had really existed I believe this would have been correct; but, as it is, the Upper Keuper, of which the Reservoir Hill consists, is cut off on the north side by No. 2 fault, and does not come in again till the ground rises to form Mapperley Hills. Then they mapped the Hunger Hills as being to a great extent composed of Upper Keuper. This is not so, however. The flat-topped appearance of these hills is caused, apparently, by a bed of sandstone, three or four feet thick, seen also in the cliff of Lower Keuper on Coppice New Road; and the Upper Keuper may be traced by the sudden rise of the ground, its more rounded contour, and by its finely laminated character and bright red colour, as contrasted with the purplish and dull red of the highest beds of the Lower Keuper.

We come now to the most interesting feature of all that may be said to be new in the geology of this part of Nottingham. Running along the boundary line separating the Lower Keuper from the Bunter (f2) on the new map you will observe a narrow band coloured blue. That is the conglomerate forming the lowest bed of the Keuper in this district. It was seen at short intervals along the boundary all round the double tongue of Bunter in the St. Ann's Valley; and, although tolerably persistent, it is sometimes represented by a mere string of pebbles. The tracing of this conglomerate along the base of the Hunger Hills and round the opposite side of the valley to where it was cut off by No. 2 fault in Dame Agnes Street fairly did away with the theory of the curved fault; for, according to the Survey map, this valley ought to have been in Lower Keuper. The best exposures of this conglomerate were in Turner Street and on Hunger Hill Road, the section in Turner Street having the advantage of showing a perpendicular section, while on the Hunger Hill Road it had to be studied during the process of excavating. In Turner Street its greatest thickness was 22in., and it there consisted of rounded and partially rounded pebbles of all sizes up to boulders five or six inches long, consisting for the most part of quartz and quartzite, with a few bits of brown magnesian limestone, volcanic ash, basalt, greenstone, chert, slaty rock, and Coal Measure rock, the whole being firmly compacted together by lime and magnesia and oxide of iron, the latter giving it a strongly ferruginous aspect. Such is its compactness, indeed, that navvies who happen to have to excavate it have learnt to dread it, and affirm it to be the toughest rock they ever met with. It rested in the shallow cavities of an eroded surface of the Bunter, sloping to the east at an angle of about 5°, and was surmounted by first about 18in. of coarse mottled sandstone, then beds of finely-laminated brown and light olive-green sandstone, with thin partings of red marl. At its outcrop on the top of the low rounded hill of Bunter on Hunger Hill Road, the conglomerate, which, with its associated beds, formed a band at the surface about 50ft. broad, had much the same composition as in Turner Street, only there was more chert and a good deal of white limestone in lumps and ground-up, there being also calcite in minute crystals, and as a thick coating to some of the pebbles; it was about eight inches thick, and covered by first a thin bed of greenish grit, cemented into cakes by calcareous matter, then by an irregular series of beds about three feet thick, consisting chiefly of unconsolidated white (bleached) sand, false-bedded, and streaked with pale green and yellow, with occasional strings of pebbles enclosing lenticular beds of sand, of a ferruginous colour. The whole, though very irregularly bedded, had a general inclination to the north-east, passing under the Keuper. When a perpendicular section of these beds was exposed further under the Keuper, they presented a peculiar variegated wavy appearance, being streaked with red, yellow, and pale green. I was struck by the remarkable resemblance between these beds and the raised beaches I had seen on the sea shore, the only difference that I could perceive being the complete absence of any traces of life. Among the pebbles forming the conglomerate at this spot, I found what appears to have once formed the extremity of a sea-worn pinnacle of greenish fine-grained (Silurian ?) sandstone, such as may be seen at the present day along coasts where Silurian or Cambrian rocks are exposed. That this was its origin seems to me to be indicated by its peculiar water-worn aspect, and by the lateral grooves along the lines of stratification.

A very instructive section has lately been exposed in Ford Street, nearly along the dip of the Keuper.* The conglomerate was here seen just before it crops out, occupying cavities in a gently sloping plane of the Bunter. The pebbles of the conglomerate blended with the overlying sandstone and marl, and the variegated beds swelled out slightly in the direction of the outcrop. The accompanying woodcut is from a sketch taken on the spot.



JUNCTION OF KEUPER AND UPPER BUNTER, FORD STREET, NOTTINGHAM.

e. Thick-bedded soft brown, yellow, and light green sandstone, with red and green finely-laminated marls (Lower Keuper.)
d. Ferruginous band (6in.)
c. Soft sandstone, streaked with green, red, and yellow.
b. Conglomerate, forming base of Lower Keuper (f5), filling eroded cavities in the Bunter (f2), 20in.
a. Bunter sandstone, yellow, "false-bedded," with a few pebbles.

In this section the Keuper *appears* to dip to the south, the true dip, however, being south-east.

The conglomerate was twice passed through in Dame Agnes Street during the excavations for the culvert, caused by a fault, as shown in section No. 1, and was there found to be divided into two strings of pebbles by a lenticular mass of coarse greenish-white sandstone about 4ft. thick. I met with a similar development of sandstone at the base of the Lower Keuper at the bottom of the new road through Patchitt's Park from the Reservoir to Red Lane, about 5ft. of unconsolidated yellow sandstone, streaked with red, and passing up into soft red marl, coming immediately above the conglomerate. The most easterly spot where I have seen the conglomerate is near the Westminster Abbey Inn, where the pebbles were embedded in a coarse red sand overlaid by greenish-gray marl. It has been met with as far east, however, as the first brickyard on Carlton Road, where it was penetrated after passing through 105ft. of Lower Keuper. The only localities where this conglomerate may now be seen to any advantage are in Calcutta Street, where the brown sandstone cropping out of the sloping ground from above the Bunter is studded as thickly as it will hold with pebbles, forming a band 22ft. across, with a thickness of about 3ft.; and in Red Lane, where it is seen encrusting the old surface of the Bunter. Although this section was carefully examined by Aveline, and described in his "Memoir on the

*This section has been opened out since the reading of the paper, and is, therefore, new; but it only bears out the views I had arrived at previously, and exemplifies, on a small scale, something of the character of the unconformity as shown by the more extensive and elaborate exposures of the junction now (Jan.) being made at Nottingham.

Nottingham District," (Sheet 71, N.E.,) he either did not observe this conglomerate at all, or mistook it to belong to the Bunter, for he mentions a less important conglomerate, about 16ft. higher up in the Keuper, but says nothing about the conglomerate at the bottom. This second conglomerate is well exposed in the section in Turner Street, also in the open ground at Belle Vue Terrace, at the top of Calcutta Street. Its maximum thickness is 12in., and it consists of small white and pink sub-angular quartz pebbles, flakes of fine red marl, pebbles of pink and white limestone, fine-grained light green sandstone, and bits of igneous rock embedded, in one spot in calcareous fine yellow sand, in another in calcareous greenish-white sandstone. Indeed, I found quartz pebbles distributed more or less throughout the lower beds of the Keuper sandstone along Blue Belle Hill.

With regard to the origin of the conglomerate forming the base of the Keuper, it is, of course, well not to attempt to draw conclusions in geology from too limited an area. There can be no doubt, however, that in this conglomerate, with its associated irregularly-stratified beds of sandstone, we have the remains of an ancient sea-beach—the shore of the sea in which the Keuper sandstone and clay were deposited. The pebbles composing the conglomerate are all such as may be seen in the underlying Bunter; the partially consolidated sandstone is easily recognised as Bunter sandstone that has been bleached, then re-deposited, and subsequently tinged with colouring matter. We know that the Bunter sandstone formed the land surface over a large part of England during what was probably a long interval, while the Muschelkalk of Germany was being deposited. Thus the conglomerate probably represents a great break in time in this part of England; and the fact that the plane of Bunter on which the conglomerate rests is inclined at a greater angle than the dip of the Bunter, as far as that dip can be ascertained, leads me to infer that *the old Bunter land was gradually submerged from an easterly direction*, during which the pebbles which probably more or less covered the land-surface came to be re-deposited and cemented with carbonate of lime and magnesia, and partially interstratified with bleached sand derived from the receding shore line.

FRESHWATER LIFE.—1. ENTOMOSTRACA.

BY EDWIN SMITH, ESQ., M.A.

[*Continued from page* 17.]

Passing to the second order, which is named *Copepoda*, we select for description the well-known *Cyclops quadricornis*. A lively female specimen, let us suppose, with egg-sacs attached, is, after repeated attempts with the dipping-tube, at length safely landed in the live-box. What is she like? We observe that the carapace is made up of many parts corresponding to the segments of the body. Four segments compose the thorax, the first, with which the head is consolidated, being very large. The abdomen counts six rings, and terminates in a forked tail. Standing out conspicuously from the head are two pairs of antennæ, each of the larger being made up of numerous joints, and all four armed with bristles. The mouth has a pair of strongly toothed mandibles, besides a first and second pair of foot-jaws, between which and the antennæ the breathing function appears to be divided. There are five pairs of feet, the four pairs useful for locomotion springing from the four divisions of the thorax. Each foot is itself double, and all are thickly furnished with bristles. The first segment of the abdomen is small, and carries a fifth pair of feet, modified in both sexes to subserve the reproductive process. In the male the next two segments are distinct; in the female not. The larger antennæ of the male swell out about the middle, and make a hinge-joint behind the swelling, peculiarities wanting in those of the female. The adult female, in the breeding season, carries two external ovisacs, fastened one on each side, near the base of the abdomen. They must not be confounded with the true ovaries, which are internal. They are only a temporary shield, secreted by the female around each bundle of eggs at the time of laying them, and are ruptured and finally shaken off when the eggs are hatched. Lastly, one eye placed in the front of the head serves as the single organ of vision. It is often of a brilliant ruby colour, especially in young specimens.

As in most other genera so in this, the females are much more numerous than the males. The fact is no doubt connected with another peculiarity, which has been termed parthenogenesis. One impregnation enables a female Cyclops to go on laying successive batches of eggs for life. And the female progeny are themselves fertile, though carefully isolated as soon as born; and so on for several generations. The rate of increase of some species of Entomostraca is enormous. According to Jurine it is quite possible for a single female to be the progenitor during one year of many millions of young. But, practically, the rate of increase is checked by various aquatic enemies, the vast majority of the young being simply born to be eaten. There are few more interesting spectacles under the microscope than the hatching of a brood of Cyclops. When the time draws near the little things are seen all huddled together in a cluster, each in its separate pocket of the ovisac, peeping through the membranous veil with bright ruby-coloured eye. You single out one for special observation, and feel a growing interest as you watch the repeated struggles of the tiny prisoner, its final escape, and its first joys of liberty, as it darts away in the surrounding water, with the jerky, zigzag motion of its parent. Nor is it less interesting afterwards to note from day to day the changes of form and successive moultings by which the adult state is reached. Three moultings take place before the animal is perfect, and capable of producing its species.

Nearly related to Cyclops, and not much unlike it in appearance, is *Canthocamptus*, found abundantly in the ponds about Nottingham. As it is rather small, the best way to secure a specimen for examination is to place a portion of the gathering in a shallow dish, and look it well over with a pocket lens. A small dipping tube, made as follows, will be found useful:—One end must be drawn to a blunt point with moderate aperture, the other inserted into a short piece of india-rubber tubing, sealed air tight at the free extremity. The length of the glass part may be about two inches. Press the india-rubber between thumb and fore-finger, dip into the water, and by removing pressure at the right moment the object is sucked up into the tube, whence it may be expelled by once more pinching the india-rubber. The two commonest species of Canthocamptus are *C. minutus* and *C. furcatus*. In the female I have often found a curious reddish structure coming off from the sixth body segment. It is of a hard and horny nature, but its use is not known. Closely allied to the preceding is *Diaptomus castor*, easily recognised by its inferior antennæ, which are fully as long as the entire body. I have found it amongst algæ in stagnant drains.

Animals belonging to the first two orders of Entomostraca have comparatively few branchiæ, and these attached to the appendages of the mouth. Animals belonging to the remaining two orders have many branchiæ, and these attached to the legs, which are often numerous.

The latter are sometimes grouped together under the common designation of *Branchiopoda*, or the gill-footed division. To that division we now proceed.

To the third order, the *Cladocera*, belong the various species of Daphnia and its near relations. Let us first examine a full-grown Daphnia, preferably one of the larger species, say *D. pulex* or *D. vetula*. We see a body composed of two parts, the head terminating below in a sort of beak, and a thorax and abdomen, the two last enclosed in a nearly transparent carapace. In *D. pulex* the carapace tapers off behind in a long dagger-shaped point. In *D. mucronata* it bears two long spines at the posterior corners. In *D. vetula* it is lopped off bluntly and slantingly forwards. In *D. reticulata* it is marked with a network of lines over its surface; and in *Acroperus harpæ* these lines resemble the strings of a harp. Below the beak are a pair of exceedingly small antennæ, so small that they may be easily overlooked. Springing, as it were, from the neck, we see a pair of very large branched antennæ. These are the principal organs of locomotion. The eye consists of twenty crystalline lenses, or fewer, and is turned about on a cushion of appropriate tissue by two sets of muscles. This coarsely compound organ may be regarded as foreshadowing the highly perfect compound eye of insects. Just behind the eye may be seen the brain. At the junction of the head and body near the base of the beak, is situated the mouth, which opens into a short gullet, and that again into a roomy stomach with its two cæca; and then follows a straight intestine, which finally curves downwards towards the tail. Only the first segment of the body is adherent to the carapace, the rest moving quite freely between the valves. Ample room is thus afforded on the back of the animal for the accommodation of its eggs after they are laid; and there, accordingly, the eggs are carried about in a bundle till they are hatched. The tail, which terminates in two hooks, is used as a rudder and propeller. Its motions are very vigorous. If you look through the shell at that part of the body which succeeds the neck, you will notice an oval-shaped organ, which keeps regularly dilating and contracting. This is the heart. From its anterior extremity springs an artery, and on opposite sides of the heart are two slits which receive the blood from the surrounding cardiac chamber, and close up at each contraction while the blood is urged forwards. There are five pairs of legs, employed for other purposes than swimming. When the animal is at rest, they create currents in the water, and so bring food to the mouth. The first and second pairs are used as organs of prehension. The third and fourth pairs mainly subserve respiration, for which they are well adapted by their branchial plates fringed with numerous filaments. I have already remarked upon the extraordinary fecundity of many of the Entomostraca. The Daphniæ are no exceptions to the rule, and present similar phenomena of parthenogenesis. The development of the embryo may easily be watched through the thin carapace, and is, of course, extremely interesting. The first organ to show itself is the eye; on the fifth day from laying, the young Daphniæ come out, and then go through their series of moultings. One great advantage of the moulting process to the Entomostraca is, that they are thus able to rid themselves of troublesome infusorial parasites, which often lodge upon the carapace in great numbers, and seriously retard the movements and depress the vitality of their host. Bunches of *Epistylis* are very common upon Cyclops and Daphnia. Towards the approach of winter, the Daphniæ have the remarkable habit of enveloping eggs in a special casing between the outer and inner layer of the carapace. This casing, which is developed on the back of the mother, has been called the *ephippium*, from its fancied resemblance to a saddle. It will easily be recognised by the microscopist. When the skin is cast, this structure is cast along with it; and, floating on the water, preserves the eggs through the cold season, till they are hatched by the returning warmth of spring.

In July, 1870, I found in a shallow pool on the turfy soil of Lindow Common, Cheshire, a good many examples of one of the Daphnia family, which, from its long bristles, bears the name of *Macrothrix*. My specimens corresponded to Baird's description, except that a particular bristle mentioned by him was wanting in my capture. I had possibly chanced upon a new variety. The superior antennæ are of considerable size, hanging from the beak like two flat swords, with a broad, straight-edged extremity. While watching an example in the live-box, what was my astonishment to observe some of the parts suddenly become double. One after the other, the hinder segment, its hooked spines, the beak, superior antennæ, and so on, appeared double; and it became evident that I was the fortunate witness of the moulting process. I at once mounted the whole affair in glycerine, and my Macrothrix now lies side by side with its cast-off skin.

One other family of the Cladocera should be mentioned, if only because it contains *Chydorus sphæricus*, a very common species in our stagnant ponds. The *Lynceidæ* (for so the family is called) may be recognised by a black spot situated in front of the eye, and looking not much unlike a second eye, which, however, it is not. The intestine, moreover, makes one complete turn and a half. To the same family belong *Eurycercus lamellatus* and *Acroperus harpæ*, both of which occur in this neighbourhood. The latter is fond of resting on the top of the water, moored by its antennæ to a bit of weed; or a cluster of them will collect round some floating leaf or sprig, and lie motionless in the warm sunshine as if asleep.

Of the last order, *Phyllopoda*, we shall cite only one example, *Cheirocephalus diaphanus*, or the Fairy Shrimp. I have not yet seen it alive, but those who have speak with enthusiasm of its singular beauty. The male is especially gorgeous. With regard to anatomy, the body is destitute of a carapace, and is divided into many segments, affording great freedom of movement. The male has a remarkable pair of inferior antennæ, employed essentially as clasping organs. Those of the female are simpler, being shaped like a broad sickle. There are two stalked eyes, each composed of an immense number of lenses, showing a further advance towards the insect type. Its young, however, has but one simple eye, placed centrally in front of the head. This is represented in the adult by a dark blind spot. No fewer than eleven segments compose the thorax, to each of which is attached a pair of branchial feet, of a broad and leaf-like form. The tail consists of two broad appendages; and both feet and tail are thickly beset with plumose hairs. Extending from the head to near the tail may be discerned about eighteen or nineteen small hearts, or quasi-hearts, placed end to end and all moving together. The female possesses a single external ovary, from which, at the proper time, from 100 to 400 eggs are jerked out in succession during twenty-four hours. When hatched the young undergo a series of moultings and changes of form before they finally resemble their parent.

We have now completed our illustrations of Freshwater Entomostraca. I shall not at present enter into any description of the marine kinds. Specimens of their empty carapaces, particularly of the Ostracoda, may be found in the sand of our coasts, and will often occur to the searcher after foraminifera. I have thus obtained examples of *Cythereis* and *Cythere*. I have also taken, near Penmaenmawr, a good many *Cetochilus*, a rather striking form resembling Cyclops.

The Entomostraca have played an important part in the life-history of the globe from the earliest epoch to the most recent. They have been well represented through untold ages from Cambrian times to the present day. Their remains, especially of the Ostracoda and Phyllopoda, occur in all formations, and in some are so abundant as to give a peculiar foliated character to the rock containing them.

A few books of reference may not be unwelcome to the student. Before all the very complete manual of the British Entomostraca by Dr. Baird, published by the Ray Society; then the portions bearing upon the subject in Professor Huxley's "Anatomy of the Invertebrate Animals," and Professor Nicholson's "Zoology and Palæontology;" lastly, the splendid monographs on the fossils of the group by Professor Rupert Jones, the Rev. H. W. Crosskey, and others, published by the Palæontological Society. With such help, the systematic study of our old friends, the so-called water-fleas, will be found replete with interest.

THE CHLOROPHYLL-BODY AND ITS RELATION TO STARCH.

BY WILLIAM HINDS, ESQ., M.D., ETC., ETC.,
PROFESSOR OF BOTANY, QUEEN'S COLLEGE, BIRMINGHAM.

In the year 1865 I read a paper to the British Association for the Advancement of Science, an abstract of which was printed in their Transactions, to show the relation which existed between the chlorophyll-body and the starch granule. At the present time the views of some of the most eminent botanists of Germany appear to me to be, to a certain extent, approaching to the conclusions to which I have referred. What these conclusions are it is my purpose to show.

If we refer to the great English botanists of twenty years ago, we shall find them describing chlorophyll as a "vital secretion" *sui generis* or independent body.

One of our great authors of that period, who wrote on this subject, thus expresses himself in his Introduction to Botany* :—"Chlorophyll is a 'vital secretion,' and comprises 'coloured granules' of a 'spheroidal and irregular figure.' They 'consist of a semifluid, gelatinous substance, which seems to be a coagulum of the fluid contents of the cells.'"

Nägeli states that the parent cells of chlorophyll "are only half the size of starch, and that "they occur in company with starch grains."

In 1851 Mr. J. S. Quekett delivered, at the Royal College of Surgeons of England, a course of lectures on Histology, and on the subject of chlorophyll occurs the following :—"The green colour, so universally present in plants, is due to a more or less solid material contained in cells, and termed chlorophylle, or green vegetable wax." It consists of minute spherical or oval particles.

Dr. J. H. Balfour, in his Manual of Botany, 1860, page 11, states that "Chlorophylle, or the green colouring matter of plants, floats in the fluid of cells, accompanied by starch grains. It differs from starch in being confined to the superficial parenchyma, and in being principally associated with the phenomena of active vegetable life. It has a granular form, is soluble in alcohol, appears to be analogous to wax in its composition, and is developed under the agency of light."

* Lindley, fourth edition, page 138.

These quotations will serve to illustrate the confusion which existed formerly, and which even now exists in many minds as to the relation which the two bodies bear to each other.

In the paper to which I have alluded, I endeavoured to show, contrary to the then received view, that starch granules and chlorophyll bodies were really the same bodies, chlorophyll granules being merely and essentially starch granules pigmented, or coloured, on some part or parts of their surface, of a green colour, by the action of light; that it was a chemical product rather than a vital secretion, or not in a fuller sense than starch was; and that, if the starch granule were not a living entity, as is the protoplasm, whence and by which it is produced, neither was the so-called chlorophyll granule, inasmuch as the colour could be produced by light *without growth*, or without any indication whatever of vital action. As proof of this I exhibited then, as I have over and over again subsequently, potato tubers in which chlorisation or pigmentation had occurred, or a coating of green given to the surface of the peripheral starch granules, wherever exposed to light, and a certain temperature. This light need not be the sun's direct rays, but it must be accompanied with a certain temperature in order that the chemical process shall take place. This may be easily proved. Clean potato tubers may be placed on a table, and be exposed to the direct rays of the sun, in a room the temperature of which does not exceed 40° to 45° Fah., and, if examined in a week or more, it will be found that no chemical, or no appreciable chemical change has taken place, and no pigmentation or chlorisation has been effected. Repeat this experiment in a room with a temperature of 62° Fah., and in a week the surface exposed to light will have been densely chlorized, and without direct sun-light. Extend the exposure during a few more days, and the effect will be more intense. If, now, a small portion of the substance of this green peripheral matter be scraped off and mounted in water and examined by the microscope, it will be seen that in the short space of a few days the starch granules will have been converted into what are termed chlorophyll bodies or granules; but in reality showing, inferentially, that there is no such substance at all as a chlorophyll-granule as distinct from the starch grain. It may be added that, if exposed to light and a proper temperature, granules of starch are pigmented or chlorized more or less, so soon as they are secreted, or take on substance, as seen in leaves and other organs primarily exposed to light. Hence, uncoloured starches are known to inhabit the parts of plants excluded from light, as pith, rhizomes, subterranean stems, and fruits protected by bracts impenetrable to light.

I quote one short passage from the article alluded to, and must further refer the reader to the report itself.* "During several years of close examination of vegetable tissue, the author has found the attempt to divide these two substances (starch and chlorophyll) into two distinct bodies a source of perplexity; and, after a series of experiments and investigations, he arrived at the conclusion that these two series of granules must be considered fundamentally the same, one series being merely coloured or chlorized."

I shall now quote one or two short passages from the latest German authorities, to show views more or less approximative to those expressed by me in 1865, and that the tendencies of the most recent scientific opinion are certainly in this direction.

Sachs† states that "with extremely few exceptions, *grains of starch*‡

* Report of British Association, 1866, page 81.

† Julius Sachs, 1875 translation, page 46.

‡ The italics are my own.

arise in the homogeneous solid substance of the chlorophyll bodies." They are at first visible as points, gradually increase in size, and finally may so completely fill up the space of the chlorophyll grain that the green substance is represented only by a fine coating on the mature starch grain ; even this coating may, under certain circumstances, disappear."

The history in brief of the chlorophyll body, and, allowing for variations, the result of varying conditions and circumstances, would seem to be that the starch granule is first separated from the protoplasm by the ordinary vital processes ; and then, according to conditions and circumstances, either becomes pigmented and assumes the condition of chlorophyll, or else remains, as it does usually when excluded from light, an unpigmented granular body, and, growing by intussusception into the perfect, enveloped starch grain, with its ordinary physical characters of hilum and concentric markings, and having in this state its known and recognised chemical characteristics. This view receives some confirmation from the following passage from Rosanoff. * "The formation of the grains of the chlorophyll is not always contemporaneous with that of its colouring matter; they may be at first colourless, (as in *Vaucheria* and *Bryopsis*, according to Hofmeister,) or yellow (in the case of leaves of Monocotyledons or Dicotyledons imperfectly exposed to light or in the process of development,) and may afterwards become green."

Of course it must not be assumed by any means that no pigmented red, (Rhodospermeæ, &c.,) green, or yellow matter occurs except in the form of regular granules, for amylaceous products are known and acknowledged to be often amorphous. The acknowledged chlorophyll pigmented matters and particles too are also known to occur sometimes in "bands, stars, or irregular masses." In fact there is no limit to this informality, variation, or irregularity; moreover, light itself can be dispensed with in some cases. In Angiosperms light is understood to be essential to pigmentation or chlorisation, but fern-leaves and the cotyledons of Gymnosperms will become pigmented without light.

The conclusions which I first made known in 1866, and which I may here partly reproduce, were that the almost universal green of nature is essentially amylaceous, and can, therefore, supply fuel, at least in the matter of food, to animals. Though partly decolourised in dried grass, the same amylaceous principle is yet present. The nutritive properties of hay, which can of itself support animal life, can scarcely depend on the cellular tissue alone, and certainly not exclusively on the small proportion of nitrogen contained, nor on the fruits which, in the minor grasses, are insignificant. On the other hand, amylaceous matters are known to be intensely nutritive, as affording one main element of animal food, and not only so, but those parts of plants in which this proximate principle is concentrated are nutritive in proportion to the amount of that concentration.

THE RAINFALL OF 1877.

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

Incomplete and imperfect as it must needs be from the early date of its publication, and from the fact that our staff of observers is as yet not fully organised, still the main features of the Rainfall of the past year in the Midland counties may be gathered from the table which we print below. In it the stations are grouped in counties, and the fall at a few other localities is given at the end for the purpose of comparison. For the

* See translation Sachs, page 49.

third year in succession the general rainfall over this district has been considerably above the average. Heavy rains in January, following similar downfalls in December of 1876, produced frequent floods. On January 3rd a steady and continuous downpour proved the maximum fall of the year in the eastern and east-central counties, and wet and cold weather continued to the end of April. May was also a cold month, but in June we had a remarkably fine and pleasant period, rainfall everywhere in England below the average, and falling on eight to ten days only. A heavy storm on July 14th (accompanied by electrical disturbances) caused the maximum fall in the western and west-central Midlands, over three inches falling in the twenty-four hours at Haughton Hall, Shifnal. August was wet, September about the average, but October was rather a fine month, followed, however, by frequent rains to the end of the year.

Station.	Observer.	Total fall. Inches.	Greatest fall in 24 hours. In.	Date.	Number of rainy days ·01 or more fell.
Norton-in-Hales, Salop......	Rev. Fred. Silver	39·59	1·65	July 14	132
Burford House, Tenbury....	Lord Northwick	28·69	—	—	—
Adderley Rectory, Salop	Rev. A. Corbet	38·52	2·82	July 14	219
Larden Hall, Much Wenlock	Miss F. Rouse Boughton	35 97	1·44	July 14	218
Leaton Vicarage, Shrewsbury	Rev. E. V. Pigott........	32·39	1·35	Sep. 2	214
Woolstaston, Salop	Rev. E. D. Carr..........	44·75	1·44	Aug. 15	232
Haughton Hall, Shifnal	Rev. J. Brooke	34·99	3·04	July 14	212
* Tenbury (Orleton)	T. H. Davis, Esq.........	33·35	0·92	July 14	225
St. John's, Worcester	G. B. Wetherall, Esq. ..	29·76	1·06	July 15	184
Tamworth	W. Arnold, Esq.	30·54	1·85	July 14	196
Alstonfield Vicarage	Rev. W. H. Purchas	48·48	2·23	July 11	191
Wolverhampton	Geo. J. C. Broom, Esq...	29·79	—	—	—
Burton-on-Trent............	C. U. Tripp, Esq.........	31·89	1·91	July 14	216
Coventry....................	J. Gulson, Esq...........	31·41	1·32	July 14	198
Bickenhill, near Birmingham	Rev. W. R. Capel........	32·54	1·37	July 14	204
Coundon	Col. Caldicott	32·11	1·28	July 14	205
Fernslope, Belper	J. G. Jackson, Esq.......	38·08	2·21	July 14	231
Trent College, Derbyshire ..	C. U. Tripp, Esq.........	22·74	1·07	Jan. 3	184
Matlock Bath	R. Chadwick. Esq., jun.	46·52	1·80	July 15	195
Stony Middleton, Sheffield ..	Rev. U. Smith	46·79	2·98	Jan. 3	175
Hodsock Priory, Worksop ..	H. Mellish, Esq.	31·27	1·49	Sep. 2	208
* Mansfield..................	R. Tyrer, Esq.	34·83	1·51	Jan. 3	244
Nottingham	Meteorological Office....	29·94	—	—	—
Bruntingthorpe, Leicester ..	Rev. F. H. Bridges	28·72	—	—	—
Syston, Leicestershire	Jos. Hames, Esq.........	25·02	—	—	—
Leicester, Town Museum ..	W. J. Harrison, Esq.	25·94	0·87	April 9	197
Leicester. Belmont Villas ..	H. Billson, Esq.	25·80	0·87	April 9	197
Market Harborough	S. W. Cox, Esq...........	29·28	—	—	—
Coston, Melton Mowbray....	Rev. A. M. Rendell	28·68	—	—	—
Waltham....................	Mr. E. Ball	28·67	—	—	—
Harston (Grantham)........	F. Beasley, Esq.	29·12	—	—	—
Springfield, Peterborough ..	H. Whitwell, Esq.	21·67	—	—	—
Kettering	John Wallis, Esq.	27·41	—	—	—
Northampton, Sedgebrooke	C. Markham, Esq.	29·23	1·09	Jan. 3	210
Northampton	H. Terry, Esq.	27·05	1·03	Jan. 3	187
Castle Ashby, Northampton	R. G. Scriven, Esq.......	26·69	1·08	Jan. 3	198
Tickencote, Rutland	W. Hayes, Esq...........	24·61	1·47	Jan. 3	182
Oxford	Meteorological Office....	29·00	—	—	—
Cambridge	Meteorological Office....	26·47	—	—	—
Dover	Meteorological Office....	34·12	—	—	—
* Cirencester................	J. Bravender, Esq.	37·15	1·45	July 14	191
Yarmouth	Meteorological Office....	28·35	—	—	—
Louth	T. W. Wallis, Esq.	31·18	1·66	Sep. 2	—
Boston	W. H. Wheeler, Esq.	26·14	1·28	Jan. 3	194
York	Meteorological Office....	33·19	—	—	—
* Seathwaite, Borrowdale ..	Mr. T. Birkett	180·40	4·78	Sep. 12	244
Valentia, S.W. Ireland	Meteorological Office....	65·09	—	—	—
Altarnun Vicarage, Cornwall	C. U. Tripp, Esq.........	78·11	1·79	Aug. 26	236

* From Symons' Meteorological Magazine.

THE DISTRIBUTION OF THE GENUS *ROSA* IN WARWICKSHIRE.*

BY JAMES E. BAGNALL.

"Yon rose-buds in the morning dew,
How pure amang the leaves sae green."
Burns.

The beauty of the English wild rose is such that even the most unscientific wanderer through our country lanes instinctively gathers, examines, (doubtless superficially,) and naturally loves it. But a wild rose is a dog rose to the casual observer and nothing more. If I were to tell these non-botanical collectors into how many species, varieties, and forms, critical botanists have split up the genus, and that one of my greatest pleasures has been that of hunting up these forms, they would probably think me in a fair way for a lunatic asylum. Unattractive as such studies must naturally be to the uninitiated, to me they have a charm I cannot express, and I would any day cheerfully walk many miles to see a rare rose or a rare bramble.

When I first commenced the study of the family, I had only the fifth edition of Babington's Manual as a text book, which, excellent as it is in other points, scarcely seemed satisfactory in its treatment of this genus; hence it was that I hailed with pleasure the appearance of Mr. J. G. Baker's valuable monograph of the genus *Rosa*, published in Vol. XI. of the "Proceedings of the Linnean Society, 1869," (page 197.) Being thus provided with a good and complete guide, I recommenced the study of the roses of Warwickshire.

The sandy soils and neglected hedges of many parts of the county seem to favour both the growth and variability of the wild rose, and I soon found abundant materials for study. But before commencing to study this difficult genus in the field I obtained from the Rev. A. Bloxam a fairly complete fasciculus of the British roses, and during the winter of 1869-70 I carefully examined these, comparing each with the descriptions given in Mr. Baker's monograph. The knowledge thus obtained has served me much in my subsequent work. During the years that have since elapsed I have visited and collected specimens in nearly every available Warwickshire district, and the specimens collected have all been carefully compared with my type specimens and the descriptions in the monograph.

Many of the districts south of Warwick I have visited in company with my friend, Mr. H. Bromwich, an excellent botanist, who has paid special attention to this genus, and has worked with great success most of the country around Warwick. In the neighbourhood of Harboro Magna, near Rugby, I have had the company, guidance, and instruction of that learned and veteran botanist, the Rev. A. Bloxam, who is Rector of the village. In my notes I quote some of Mr. Bloxam's old stations, near Atherstone, a district worked by him in former days. The following list may, therefore, be considered as the result of the Rev. A. Bloxam's, Mr. H. Bromwich's, and my own observations, extending over many years. It is, I believe, a fairly complete list of the Warwickshire roses.

The nomenclature and classification adopted is that of Mr. Baker's monograph, in which he divides the genus into five primary groups, viz.: 1, Spinosissimæ; 2, Villosæ; 3, Rubiginosæ; 4, Caninæ; and 5, Systylæ.

* Abstract of Paper read before "The Birmingham Natural History and Microscopical Society."

The Caninæ, which Mr. Baker considers to be only varieties of one species, are divided into three series, and each of these series into several varieties, by means of their fruit characters, the margination and clothing of their leaves, &c. My space is too limited to allow all these details to be noticed, and I can only refer the student who wishes to make a special study of the genus to Mr. Baker's excellent monograph, or to Dr. Hooker's "Student's Flora of the British Islands."

In all cases in which I have seen and collected specimens in the stations cited I have indicated it by this sign (†); where I only possess or have seen dried specimens, thus (‡). The initials A. B. and H. B. after a locality indicate that the plants have been found in those stations by the Rev. A. Bloxam or Mr. H. Bromwich, as the case may be; in all other cases the localities given are from my own note book.

Group 1.—Spinosissimæ.

Rosa Spinosissima, *(L.)* Local. Arrow, near Alcester †, Billesley †, Hazeler †, Oakley †, H. B., near Warwick.

Var. *b*, a form with aciculate fruit and peduncles is rare. Chesterton Wood ‡, H. B., Little Alne †.

R. involuta var. Sabini, *(Woods.)* Rare. Oakley ‡, H. B., Chesterton Wood ‡, H. B.

Var. Gracilis, *(Woods.)* A more robust form occurs, rarely, which Mr. Bromwich refers to this variety; to me it seems only a local form. Tachbrook †, H. B.

Var. Doniana, *(Woods.)* Rare. Woodloes †, H. B., near Warwick, lane from Hampton to Meriden †, near Allesley ‡, (T. Kirk.)

Group 2.—Villosæ.

R. Mollissima *(Willd.)* Rare. Grove Park †, near Hatton, Star Lane †, near Claverdon, lane from Solihull to Sharman's Cross †, Atherstone Road, near Over Whitacre †, Oakley †, H. B. The Warwickshire plant seems to be var. cærulea, (Woods.)

R. Tomentosa, *(Sm.)* A very variable plant, closely approaching the above through some of its varieties.

Var. *a*, Subglobosa, *(Smith.)* Seems to be a frequent form in the county. Sutton Park †, Anstey †, Packwood †, near Exhall †, Chesterton Wood, H. B. A very hairy glandular form occurs in Arrow Lane †, Tybourn Lane, near Umberslade †, Coleshill Heath †.

Var. Deseglisei, *(Bor.)* Mr. Bloxam's fasciculus from Rugby ‡, is a form with eglandular sepals, and leaves thinly hairy above. I find a similar form at Rowington † and Monkspath †.

Var. Cuspidata, *(Bieb.)* Bloxam's fasciculus, Atherstone ‡, is a form with small narrow acute leaves, with open compound serrations, and strongly glandular beneath. I also find it by Yarningal Common †.

Var. Scabriuscula, *(Smith.)* Tachbrook, H. B., ‡, Trickley Coppice †.

R. Sylvestris, *(Woods.)* Rare. Near Harboro Magna, A. B., ‡, Chesterton Wood, H. B., ‡.*

Group 3.—Rubiginosæ.

R. Rubiginosa *(L.)* Rare. Near Billesley, H. B., Bentley Heath †, Crackley Wood, H. B.

R. Micrantha, *(Smith.)* Local. Oakley †, H. B., Ladies' Wood, Ragley †, Whowporridge Lane †, near Shustoke †, lane from Coleshill Heath †, lane from Anstey to Arley Station †.

Var. Briggsii, *(Baker.)* A cultivated plant in the Churchyard at Harboro Magna †.

* Mr. T. R. Archer Briggs refers the plant from this station to *R. scabriuscula.*

R. Pulverulenta, *(M. Bieb.)* Rare. Field in Cathiron Lane, and by the railway crossing, both near Harboro Magna †, A. B.
Var. Billietii, *(Puget.)* Allesley ‡. Introduced here by Rev. Mr. Bree, from near Bidford.

Group 4.—Caninæ.

" Series 1, Ecristatæ. *Leaves* eglandular beneath. *Sepals* reflexed after the fall of the petals, deciduous before the fruit (which ripens late) changes colour."

*" Leaves glabrous on both surfaces. Peduncles not bristly."
R. Canina, *(L.)*
Var. 1, Lutetiana, *(Leman.)* A frequent variety. Marston Green †.
Var. 2, Surculosa, *(Woods.)* Rare. A more robust form, with numerous flowers in a cluster. Exhall †, Arrow Lane †, Marston Green †.
Var. 3, Sphærica, *(Gren.)* Rare. A form with leaves more rounded at base, and globose fruit. Dosthill †, near Moor Hall, near Sutton †.
Var. 4, Senticosa, *(Ach.)* Rare. Near Knowle Station †, Coleshill Heath †.
Var. 5, Dumalis, *(Bechst.)* A very frequent variety.
Var. 6, Biserrata, *(Merat.)* A more glandular form, with open very compound serrations, apparently rare. Exhall †, Harboro Magna †.

** "Leaves glabrous above, hairy on veins beneath. Peduncles not bristly."
Var. 7, Urbica, *(Leman.)* A frequent variety. Solihull †, &c. A small, neat-leaved form, with oblong, (not globose) fruit, occurs in lane from Stonebridge to Coleshill †. A form with glaucous leaves, wedge shaped at base, near Hampton † and near Langley †.
Var. Arvatica, *(Baker.)* Local. Lane out of Baker's Lane, near Knowle †, Hampton-in-Arden †, Curdworth Bridge †, Baulk Lane, Berkswell †, Drayton Bushes †, lane from Minworth to Water Orton †, Harboro Magna †, A. B., Rowington Green †. A small-leaved form in Sutton Park †.

*** "Leaflets more or less hairy on both surfaces. Peduncles not bristly."
Var. 10, Dumetorum, *(Thuill.)* Local. Near Middleton †, Haywoods †, Doe bank, near Sutton †, Hampton-in-Arden, near Patrick Bridge †, Baker Lane, near Knowle †, Marl Cliff, near Bidford †.
Var. 11, Pruinosa, *(Baker.)* A form with glaucous, doubly serrate leaves. Rare. Near Springfield House, Over Whitacre †.
Var. 12, Incana, *(Woods.)* A more pubescent, glandular form. Rare. Pinley, near Hatton †.
Var. 12a, Obtusifolia, *(Desv.,)* Local. Lane to Beausal Common †, Solihull †, Marstone Green †, Baulk Lane, Berkswell †, Bradnocks Marsh, near Hampton.
Var. 13, Tomentella, *(Leman)*, Local, but not rare. Near Solihull †, Hampton-in-Arden †, Atherstone †, Hartshill †, Kingswood †.

**** "Peduncles more or less bristly and glandular."
Var. 14, Andevagensis, *(Bast.)* Local, but wide spread. Pinley Green †, Lane at Myton †, Whewporridge Lane, Solihull †, Golden Cross Lane, Exhall †, near Castle Bromwich †.
Var. 15, Verticillacantha, *(Merat.)* Frequent. This form I have found in every district, Sohihull, &c.
A form having sepals glandular on the back is more rare. Cold Comfort, near Alcester †, and in lane from Stonebridge to Coleshill †.
A small, neat-leaved form, leaves like those of sepium, and sepals glandular on back occurs in Sutton Park † and near Shustoke †.

Var. 16, COLLINA, *(Jacq.)* Rare. Over Green, near Curdworth †.

Var. 17, CÆSIA, *(Smith.)* Local. Whewporridge Lane, Solihull †, lane at Pinley †, Harboro Magna †, A. B., Over Green †, Water Orton †.

Var. 19, DECIPIENS, *(Dumort.)* Rare. Near Harboro Magna †, A. B., Doebank, near Sutton †. Neither of the Warwickshire forms have the glandular sepals of the type.

"Series 2, Subscristatæ. Leaves eglandular beneath. Sepals ascending after the fall of the petals, not deciduous till after the fruit (which ripens early) changes colour."

Var. 20, REUTERI, *(Godet.)* Rare. Near Shelly Farm † and in Lane to Sharman's Cross, both near Solihull †, near Mancetter.

Var. 21, SUBSCRISTATA, *(Baker.)* Rare. Pinley, near Hatton † H. B., Hampton on the Hill †, Old Park, near Warwick, H. B., ‡.

Var. 24, CORIIFOLIA, *(Fries.)* Rare. Over Green, near Curdworth †, Minworth †, Atherstone Road, near Nether Whitacre †.

Var. 25, WATSONI, *(Baker.)* Rare. Ashend, near Middleton †.

"Series 3, Subrubiginosæ. Leaves glandular beneath on the midrib and principal nerves only (not on the surface as in *R. rubiginosa.*)"

Var. 27, BORRERI, *(Woods.)* Rare. Woodloes, near Warwick †, H. B., Baulk Lane, near Berkswell†.

Var. 26, MARGINATA, *(Wallroth.)* Rare. Meadows near Blythe Bridge †, and near Shelly Farm †, Solihull.

Group 5.—SYSTYLÆ.

R. SYSTYLA, *(Bast.)* The typical plant has not yet been found in the county.

R. GALLICOIDES, *(Baker.)* Chesterton Wood, near Warwick †, H. B. A remarkable form, not recorded from any other British station.

R. ARVENSIS, *(L.)* Frequent. Marston Green †, Sutton, &c. †.

R. BIBRACTEATA, *(Bast.)* Rare. Near Hatton Station †, Baulk Lane, Berkswell †, Chesterton Wood, H. B.

R. SETOSA. Chesterton Wood †, H. B. A singular variety, approaching *Gallicoides, (Baker.)*

Review.

The Voyage of the "Challenger."—The Atlantic: A preliminary account of the general results of the exploring voyage of H.M.S. "Challenger," during the year 1873 and the early part of the year 1876. By Sir C. WYVILLE THOMSON, Knt., LL.D., D.Sc., F.R.SS.L. & E., &c., Director of the Civilian Staff of the "Challenger" Exploring Expedition. 2 vols. Published by the authority of the Lords Commissioners of the Admiralty. London: Macmillan and Co. 1877. Price 45s.

THESE handsome, interesting, and instructive volumes are the latest contribution to the history of deep-sea investigation. They follow in natural sequence the author's former work, "The Depths of the Sea," which gave an account of the general results of the dredging cruises of the "Lightning" and "Porcupine," 1868-69-70, the scientific work of which was under the direction of Sir Wyville Thomson, Dr. Carpenter, and Mr. J. Gwyn Jeffreys. These volumes in like manner deal with the Atlantic portion of the more recent voyage of H.M.S. "Challenger."

It must be borne in mind that these two volumes are only a preliminary instalment of the authoritative account of the general results of the "Challenger" voyage, and that years may yet elapse before the complete results can be published. From the address of Sir Joseph Hooker, at the recent anniversary of the Royal Society, we learn that the publication of the biological results of the Expedition have been arranged for by the Lords of the Treasury in communication with the Council of the Society, and the munificent sum of £25,000 placed at Sir Wyville Thomson's disposal for bringing them out with a completeness and in a form worthy of the expedition and the nation. Sir W. Thomson has, with the approval of the Council and the Government, chosen for his collaborators the ablest living specialists, and this irrespective of their nationality. Our own country has, with but few exceptions, supplied entirely competent and willing workers in most of the departments, while their association with such naturalists as Agassiz and Hæckel cannot fail to be gratifying to themselves and assuring to the public.

The primary object of the expedition was, as our readers are aware, to explore the conditions of the deep sea, and the staff consequently took every possible opportunity of making deep-sea observations, and in these volumes the results achieved are recorded with such care and exactitude as to make them most valuable and instructive to men of science, and yet so pleasingly and with so much that may be described as of a popular character, as to make the volumes available for, and enjoyable by, those who read mainly for pleasure. The dredgings were made in the greatest depths, and also from time to time in shallow water in the most remote regions, and thus many undescribed animal forms were acquired; collections of land animals and plants were likewise made on every available occasion, and consequently naturalists of all kinds will find in these pages matter of interest to them.

From the time when the "Challenger" left Sheerness, on December 7th, 1872, to her arrival at Spithead on 24th May, 1876, she traversed a distance of 68,890 nautical miles, and at intervals about 120 miles apart 362 observing stations, of which nearly 200 were in the Atlantic, were established. The observations made at each of these were, as far as circumstances would admit, the following, after the position of the station had been ascertained:—1.—The exact depth was determined. 2.—A sample of the bottom, averaging from 1oz. to 1lb. in weight, was obtained. 3.—A sample of the bottom water was secured for physical and chemical examination. 4.—The temperature was determined. 5.—Generally a fair sample of the bottom fauna was obtained by dredge or trawl. 6.—The fauna of the surface, and of intermediate depths, was examined by the use of the tow net. 7.—A series of temperature observations were made at different depths from the surface to the bottom. 8.—Samples of sea water were obtained from different depths. 9.—Atmospheric and other meteorological conditions were carefully observed and noted. 10.—The direction and rate of the surface current was determined. 11.—At a few stations an attempt was made to ascertain the direction and rate of movement of water at different depths.

Of the many points on which the expedition has thrown light, we can only select a few for this notice. Many of our readers will, no doubt, recall the discussions which have taken place as to the origin of the portion of sea-bottom covered with what is known as "globigerina-ooze," or "modern chalk," which consists usually of a creamy surface layer, made up of little else than the shells, most of them almost entire, of *Globigerina*, *Pulvinulina*, and *Orbulina*, with a relatively small proportion of finely divided matter, consisting chiefly of coccoliths and rhabdoliths, and a still smaller proportion of the spines and tests of radiolarians and fragments of the spicules of sponges, &c. Below this layer occurs another, an inch or two in thickness, somewhat more firm in consistence, in which most of the shells of all kinds are more or less broken up, and their fragments cemented together by a calcareous paste, the result of the complete disintegration of many of them, and beneath this a nearly uniform calcareous paste, coloured grey by decomposed organic matter, and containing whole and fragmentary shells only sparsely scattered through it (pp. 206-7, vol. I.) Mr. Murray, one of the naturalists of the expedition, paid great attention to the question of the origin of this calcareous formation. Very early in the voyage he formed the opinion that all the organisms entering into its composition at the bottom are dead, and that all of them live abundantly at the surface and at intermediate depths over the globigerina-ooze area, the ooze being formed by the subsiding of these shells to the bottom after death (p. 208, vol. I.) This, although not a new view, was a disputed one, Dr. Carpenter and Sir Wyville Thomson being formerly among those who thought that the evidence was conclusive that the foraminifera which formed the globigerina-ooze lived on the bottom. Sir Wyville (p. 210, vol. I.) now acknowledges that he was mistaken, and he is of opinion that it may "be taken as proved that all the materials of such deposits (with the exception, of course, of the remains of animals, which we now know to live at the bottom at all depths, and which occur in the deposit as foreign bodies) are derived from the surface." "Mr. Murray finds the closest relation to exist between the surface fauna of any particular locality and the deposit which is taking place at the bottom."

The voyage has made known to us a number of new and beautiful forms of Sponges. One of these, *Euplectella suberea*, a beautiful and singular addition to these forms of European fauna, is figured at page 139, vol. I. It belongs to a very special group of sponges called the HEXACTINELLIDÆ, because the siliceous spicules throughout the family appear to be six-rayed. It is an old family abounding in many graceful shapes in the beds of chalk and greensand of the south of England, but until lately the fossil "ventriculites" were supposed to be extinct, and the discovery of their descendants living in the modern chalk beds of the Atlantic was one of the most interesting of the many corroborative evidences in favour of the view of the "continuity of the chalk."

The expedition has much enlarged our knowledge of deep sea fauna. It has introduced us not only to new sponge forms but to numbers of new crustaceans, corals, sea urchins, star fishes, bryozoa, and fishes. The observations on the "Gulf-stream" and the fauna of the "gulf weed" (*Sargassum bacciferum*) are particularly interesting.

During such a protracted voyage opportunities for landing on shore were always gladly made use of, and some of the descriptions of what was seen on these occasions will, we have no doubt, be among the most attractive portions of the narrative to general readers. We may point out the description of the Bermudas Islands, and the formation and characteristic peculiarities of coral reefs as a good specimen of Sir Wyville's descriptive powers. The geology of the Bermudas is sketched slightly, but with much precision. Some curious particulars are given of a "Sand-glacier" at Elbow Bay, on the southern shore of the main island. The sand has entirely filled up a valley, and is steadily progressing inland in a mass five and twenty feet thick. It is covering up cottages, and has overwhelmed a cedar wood. The only way of stopping it artificially, says our author, is to cover it with vegetation. If planted in large numbers and tended and watered for a time it seems that oleanders and the native juniper will grow in the pure sand, and if they once take root the motion of the sand ceases. Some native plants, which form a peculiar vegetation, sending out enormously long runners or roots—such as *Ipomœa pes-capræ* and *Coccoloba uvifera*, and the crabgrass *Agrostis virginica*—then take hold of it and it becomes permanently fixed. The outer aspect of the sandhill of course slopes downwards towards the sea, and whenever its progress landward—its growth—has been arrested the tendency of the incoherent mass is to travel back again by gravitation and the action of rain ; accordingly it is not unusual to be told that one of these *coulées* is gradually disappearing.

Among the more original and striking results of the expedition is the conclusive proof that "the conditions of the bottom of the sea to all depths are not only such as to admit of the existence of animal life, but are such as to allow of the unlimited extension of the distribution of animals high in the zoological series, and closely in relation with the characteristic faunæ of shallower zones" (page 203, vol. I.) Our readers will scarcely need reminding that until within recent years the general belief was that beyond a certain very moderate depth in the ocean, organic life entirely ceased, and all was death and darkness.

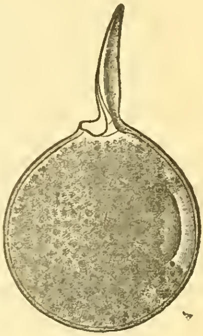


Fig. 3.

The two volumes are illustrated by nearly 300 woodcuts of first-rate excellence, many of them we feel inclined to think unsurpassable. By the courtesy of Messrs. Macmillan and Co. we are enabled to

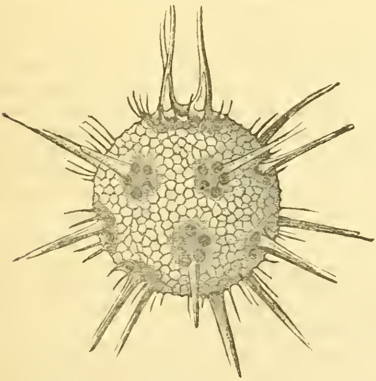


Fig. 4.

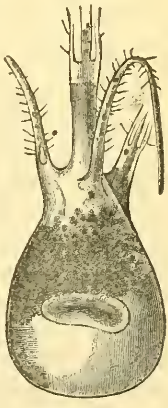


Fig. 5.

present our readers with three specimens of them. They are all forms of the new order "Challengerida," "the only new group," says Sir Wyville Thomson, "of higher than generic value which has come to light during the Challenger Expedition." Figure 3 represents the type genus *Challengeria*, magnified 400 times. Figures 4 and 5 represent forms of the Challengerida. This order has apparently hitherto escaped observation. These forms are extremely minute, although some of them are nearly the size of the smaller Radiolarians, which they approach in certain features. About thirty species have been met with during the Challenger Expedition. There are numbers of charts, showing the routes and observing stations, tables of temperature and other meteorological information, a contour map of the Atlantic, and an exquisite vignette portrait of Sir Wyville Thomson, engraved by Mr. C. H. Jeens. Author, Artists, and Publishers are to be congratulated on the results of their several labours, and we venture to think that the volumes will attain a deservedly wide and enduring popularity.

E. W. B.

History of the Societies in our Union.

I.

THE DUDLEY AND MIDLAND GEOLOGICAL AND SCIENTIFIC SOCIETY AND FIELD CLUB.

The Society under its present name was established in 1862, but for twenty years previously a somewhat similar one, called the Dudley and Midland Geological Society, had been in existence.

When the Society took its present form Geological investigation was receiving much attention all over the country, and it was natural that its practical application should be recognised as of the greatest importance to a district so geologically interesting and mineralogically important as the South Staffordshire. Upwards of 500 members were soon drawn together, many of whom received at the early meetings those first impressions of the Sciences, and the impetus to enter on their study with earnestness, which has since yielded valuable results to themselves and others. Mr. John Jones—afterwards of Middlesborough—was the first Honorary Secretary, and rendered the Society most important help.

In 1865 the British Association visited Birmingham, and the Dudley Society, by their valuable aid, greatly added to the interest of the meeting.

In 1866 there was a notable Exhibition at Dudley, which afforded great pleasure and varied instruction to large numbers of visitors. The Earl of Dudley lent his pictures by old masters, and there were good and carefully selected collections of specimens of local arts and manufactures. A handsome profit remained, after the payment of expenses, which was devoted to the purchase of Fossils for the Museum. During this period, the members of the Society occupied much time in conducting the scientific Clubs, attracted by the Exhibition to Dudley, to the many places of geological interest in the neighbourhood, and were so much engaged in this way that little time was left for the ordinary work of reading papers and discussion.

In 1867, a Mine Agents' Association, which afterwards became the South Staffordshire and East Worcestershire Institute of Mining Engineers, originated out of the desire of many of the members of this Society to have frequent opportunities of visiting collieries and works, and to see the practical application of scientific knowledge. Similarly, in 1869, a somewhat kindred organisation grew into existence at Wolverhampton—the South Midland Institute of Civil, Mining, and Mechanical Engineers. Between both these bodies and the older Society, out of which they may be said to have grown, the most friendly feeling has always existed.

A brief but interesting record of the proceedings of the Society is published annually. Two volumes and four parts of the third volume, 1862-1876, have at present been issued, and others are to follow. The Society possesses a Museum very rich in fossils and other Geological specimens, and a good library of scientific books.

During the summer months numerous Field Meetings are held, and increasing interest is manifested in them. They are arranged so as to embrace not only places of Geological interest, but also ruins, interesting churches, and other buildings, places of historical celebrity or natural beauty; and also afford opportunities for the collection of botanical, entomological, and microscopical specimens. Occasionally during the winter months papers are read and discussed at the periodical meetings of the members held at Dudley.

The Society now numbers 14 honorary members, together with the Presidents and Secretaries of the various other societies in the neighbourhood, and 158 ordinary members. The subscription is 10s. 6d. annually. The funds are in a flourishing condition.

For the first two years the President was Lord Lyttelton. From 1864 to 1870 the Earl of Dudley was President; and since that time the Presidents have been:—Professor Ramsay, 1871; E. F. Smith, Esq., 1872; Rev. J. H. Thompson, 1873; William Madeley, Esq., 1874; Charles Cochrane, Esq., 1875, 1876, and 1877.

Mr. John Jones was Honorary Secretary for six years; Mr. W. Madeley, for five years; in 1873, Mr. E. Terry; and since 1874, Mr. E. B. Marten, Pedmore, near Stourbridge.

The practical benefits which have flowed from this Society are thoroughly realised and valued throughout the South Staffordshire Mining District, and its beneficial influence is felt over a still wider area.

Correspondence.

Black-backed Gull.—A fine specimen of the black-backed gull was shot at Allesley, near Coventry, in December last, having doubtless been driven inland by a storm. Its plumage was a dull white, mottled with greyish brown, and no black about it except the bill. This shows that it was an immature specimen, as it acquires the black back from which it derives its name at the age of four years.—John Gulson.

Water-fowl.—With the advent of winter various water-fowl have again visited, for brief periods, the larger sheets of water around Birmingham. At the Edgbaston Reservoir, Mr. Wyatt informed me that several Herons (*Ardea cinerea*, L.) have been seen within the last few weeks; as also a fine flight (forty-six) of a duck which I presume to be *Mareca Penelope*, L. During December, Mr. Dixon, of the Lower Grounds, Aston, records the arrival, on the pools of that place, of several Little Grebe, (*Podiceps minor*, Lth.,) as many as four being observed at one time. —A.M.B.

Mildness of the Season.—On Christmas Day last, I gathered in my garden, at Moseley, Worcestershire, (500 feet above sea level, subsoil gravel,) a very respectable out-door posy, consisting of several sorts of chrysanthemums, three kinds of roses, mignonette, pansies, violets, primroses, polyanthuses, clematises, Christmas roses, (*Helleborus niger*,) yellow jasmine, wall flowers, and ten-week stocks. I do not remember ever before gathering so many tender flowers in a situation so exposed, so late in the year.—E. W. B.

Mounting.—There is one question to which I have tried in vain to get an answer, but which may, perhaps, meet with a reply, through your pages. Some years ago, I believe, the accomplished microscopists of the Birmingham Natural History Society gave a series of lessons on mounting of various kinds to the younger members. In these I was not privileged to share. My question is, would not a second series be useful now? There must be many fresh members, and among them some, like myself, who would be glad of a little help in this portion of their studies; a help which there are many well qualified to give, who would, I doubt not, be glad to give it, when they know that the desire for it exists.—NEO-MICROSCOPICUS.

CONCHOLOGY.—During a geological excursion of the Natural Science Section of the Nottingham Literary and Philosophical Society, I found *Helix cantiana*, together with *Helix ericetorum*, on the sides of a railway cutting, in the Great Oolite Limestone, at Kingscliffe, Northamptonshire. The cutting is on the new line being made between Melton Mowbray and Kettering. I do not know whether it has been noticed in that neighbourhood before.—At Easter, 1876, I found (during a walk from North Rode, Cheshire, across the hills to Buxton) some dozen or more specimens of *Limnæa truncatula*, in a pond. They were, as far as I could see, its only living occupants. The sides and bottom of the pond were coated with a yellowish rusty matter, which looked like oxide of iron. I thought the fact rather remarkable. During the early part of 1877 I found just the same thing occurring in a pond by the road side, about a mile out of Mansfield on the way to Edwinstowe. But in this case, there was no rusty deposit. Again, close to Nottingham, this same mollusk occurs in a ditch, along with *Physa hypnorum* (plentiful) and a small *Pisidium*, and very rarely indeed *Limnæa peregra* (the spire of the latter being much elongated, and finely tapered, and the body whorl of the shell smaller than is usual.) Is it customary to find this mollusk (*Limnæa truncatula*) unassociated with any other species? Perhaps some of your readers could inform me. In none of the cases was it plentiful.—C. T. M., Nottingham.

VOLVOX GLOBATOR.—On a hill, near Redditch, are two ponds, some 300 yards apart, the overflow of the upper of which runs into the lower. On Christmas-day, 1875, *Volvox globator* was found in extraordinary profusion in the lower pond, where it continued in abundance during the following January, but soon after disappeared. In the upper pond, though at no time so numerous, specimens were found as late as March. Search was made for them frequently during the remainder of the year without success. As it appeared to the writer remarkable that they should occur in such numbers in the winter, he was induced to examine both ponds on Christmas-day, 1876, and on several occasions during January and February, 1877, but not a *Volvox* was visible. Nor did any put in an appearance till July, when they were observed in the upper pond only, though subsequently they were sparingly met with in the lower. Incessant rain during the winter months had made the water very turbid, and possibly this state of things did not favour their development. On the 6th January, 1878, *Volvox* was again found in considerable numbers, though not in profusion, in the upper pond, nearly all the specimens being young. They continue to flourish, and with them occur abundance of that beautiful rotifer *Conochilus volvox*, which has been constant in that pond throughout the year.—S. S. R., Redditch.

LONDON NOTES BY AN OCCASIONAL CORRESPONDENT.—Such of us, and we were a larger audience than usual, as attended the meeting of the Linnean Society, on January 17th, had a great treat in hearing and seeing Professor Owen and Dr. Darwin, both, in consequence of feeble health and advancing years, being very rare visitors on one evening to the learned societies. The Professor's paper on a missing link (just found) between the existing Marsupials and some early forms of (now) fossil life, was of great importance, but too technical for its scope to be indicated in a paragraph. Mr. Francis Darwin, a most worthy follower in the steps of his great father, read a paper on the results of feeding *Drosera rotundifolia*, which sets at rest the question of digestion and absorption in plants. After quoting *inter alia* the researches of Mr. Lawson Tait, he told us he had filled six soup plates with moss in water, and planted them last June with as many plants of Drosera as they would hold. Each plate was then superficially equally divided by a piece of wood, (a slip of zinc in a previous experiment having killed the plants,) and the whole of the plates were exposed to precisely similar conditions as to light and air, and covered with the (now historical) gauze frame to prevent the access of insects. In July Mr. Darwin commenced and continued to feed all the plants on one side of each plate with roast beef, (*raw* meat kills,) in morsels weighing only 1-50th of a grain, taking great care none should fall into the surrounding moss and serve as manure. *This* is the result, and its accuracy is unquestioned :—The fed plants were individually and collectively larger, heavier, and greener, they threw up more flower stems which bore each a larger number of flowers, and a greater number of larger seeds, the proportion in weight of the seeds on the starved as compared with the fed side being as 100 to 379·7. Dr. Masters remarked that there could *now* be no doubt as to the absorption through leaves, and that the whole present theory of plant growth, involving largely the entire system of vegetable physiology, must be reconsidered, probably entirely changed. There was no attempt to contradict Mr. Darwin's facts, which are accepted by some of the greatest naturalists in the world, and another great era in change is imminent.—Dr. Darwin is so like M. Rajon's etching of Mr. Ouless' portrait, that I heartily commend that grandest of the etchings of this century to your readers.—The loss of Mr. Andrew Murray, the Entomologist, is much greater than will be at once seen. His services to the Horticultural Society, and to the entomological collection at Bethnal Green are incalculable, and as an acquaintance or friend all who knew him deeply deplore him. He told me only a month ago that his second volume on Economic Entomology was in the press; but who will complete the series I do not know.—W. J. S.

On Accuracy in the Use of Scientific Terms.—I have read with considerable interest the first article in your (may I say *our)* new Journal, on "Abnormal Ferns." The importance and value of this contribution, as an incentive to the practical study of vegetable development, has induced me to offer a few friendly remarks on one point, which the *composition* of this article suggests. It is this: Assuming that the "Midland Naturalist" is intended to have a direct bearing on the progress of Science, all the articles it contains should be written, not *merely* in an attractive style—which should always be aimed at—but with rigid scientific accuracy as to the *terms* employed by its contributors. Confusion in terms leads to confusion of thought; and *vice versa*. The employment of entomological and other zoological terms—having a very specific meaning—to describe, or illustrate, simple botanical processes of growth, for which there are true botanical terms, equally expressive and far more accurate, appears very likely to mislead a young enquiring naturalist. Now, these remarks have been suggested by a few illustrations, used by the author of the paper referred to, in his otherwise very valuable and instructive article. In speaking of the fertilisation of ferns, certain "spiral filaments" are described as having "*swarmed* about the pistillidium in numbers," as though they were a collection of independent individuals, clustering together like a swarm of bees! Again, in the next paragraph, these filaments are spoken of as being "tossed into the air," and by landing in certain "cups" are said to "fertilize the plant in its *caterpillar stage*, and thus enable it to put on its *butterfly life* or fronds." Now the phrase "caterpillar stage," suggests one of the most *definite* and *peculiar* stages of insect development. So peculiarly *animal;* so utterly unlike anything to be found in the vegetable kingdom is it, that its use in such a connection as that referred to must be misleading to any reader not thoroughly acquainted with the subject. The "caterpillar stage" in an insect's life is that in which the entire body is almost filled with a capacious stomach; and the creature—endowed with a voracious appetite—eats, and eats with a greedy persistence, until its skin becomes too tight for the rapidly growing body, and at length splits, and is cast aside—like a schoolboy's "old clo"—to be replaced by a more roomy investment! The caterpillar stage, moreover, is one in which *no reproductive* organs appear; so that, altogether, the simile is a most unfortunate one as descriptive of the silent and gentle changes which are everywhere observable in the vegetable world. Once more, the term "Animalcules," as quoted by Mr. Lowe from Count Suminski's paper, and applied to these "spiral thread-like bodies" is equally inappropriate. I regret very much having to make the foregoing criticisms, and beg to assure the Editors, and the justly well-known author of the paper referred to, that my only object in doing so is to further the best interests of our new publication by requesting at the outset, from future contributors, a more careful selection of terms used in all scientific papers.—Samuel H. Parkes, King's Norton.

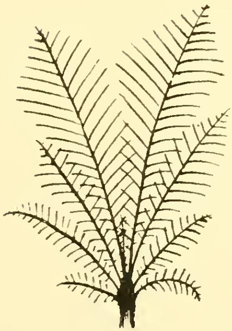
A Hybrid Fern.—Mr. Lowe, in his paper upon "Abnormal Ferns," says that "*very rarely* a hybrid species may be produced" by the crossing of two species; but the examples he gives relate in each case to species of the same genus. In Phanerogamous plants hybrids between closely allied genera are known to exist, and we might expect that this would also be the case with Ferns. I have lately met with an instance in which this hybridisation seems to have taken place. About two years ago, my brother, Mr. T. B. Grove, of Eastbourne, sowed a mixture of spores of *Blechnum corcovadense*, and *Lomaria gibba*. Both of the plants from which the spores were taken were well grown, with stems about three feet high. Two fronds made their appearance from this sowing in advance of the rest, and were carefully transplanted. The other seedlings were normal, but these two, after throwing up at first fronds very similar to those of *L. gibba*, gradually changed their character. The pinnæ increased in breadth, the fronds became longer and more erect, and they have now produced fertile fronds intermediate between those of the two supposed parents. The differences may be thus enumerated: I am of course describing average plants. *L. gibba* has a *spreading* crown of *numerous* barren fronds, the pinnæ of which are under half an inch broad, with a few small *blunt* teeth. The fertile fronds, springing from the centre, are very much *contracted*, of a light green colour at first, covered on the under side almost *completely* by the sori. *B. corcovadense* has a much *smaller number* of barren fronds, which are nearly *erect*, and considerably longer, and have the pinnæ more than three-quarters of an inch broad, with a *spinulose*-serrate, or almost dentate edge. The fertile fronds are fewer and longer still, of a pinkish colour at first, quite *uncontracted*, the pinnæ being as broad as those of a barren frond, and the sori only occupying the *central* line. The supposed hybrid has a few external fronds small and *spreading*, with narrow pinnæ, very like those of *L. gibba*, but the succeeding fronds become longer and more *erect*, with pinnæ over half an inch broad, and a serration which is intermediate between *blunt* and *spinulose*. The fertile fronds are more numerous than in *B. corcovadense*, not so long, and *rather contracted*, the pinnæ being scarcely over half the breadth of those of the barren fronds, and the sori occupying about *half* of the under surface. The colour of the young fronds also is intermediate between the pink of *Blechnum* and the lively green of *Lomaria*. I have before me three fronds of about the same age, from plants grown under similar circumstances.

Plate A.

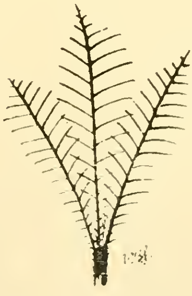
Produced by A Pumphrey's Patent Autographic Process.

To face Page 52.

Lomaria gibba.



Lomaria hybrida (!)



Blechnum corcovadense.

Outline Sketch of Ferns.

The frond of *L. gibba* is eleven inches long, and four broad; of the hybrid thirteen inches long, and five broad; and of *B. corcovadense* twenty-six inches long and seven broad. The spores of the hybrid are smaller and more irregular in shape than those of *B. corcovadense:* some of them have been sown, and are now in the prothallus stage. A well known fern-grower, who has seen the plants, said that he obtained a very similar hybrid, about six years ago, between *L. gibba* and *B. brasiliense*, (a species allied to, if not identical with, *B. corcovadense*,) which he exhibited at a meeting of the Royal Horticultural Society under the name of *L. hybrida*. He has since lost it. The correctness of his explanation was, of course, disputed at the time, but this independent production of what is nearly the same species seems to confirm it very strongly.—W. B. Grove, B.A.

Gleanings.

The British Association.—It is expected that the meeting for 1879 will be held at Sheffield.

A Course of Instruction in Zootomy by Professor Huxley, assisted by Mr. T. J. Parker, is announced as in preparation, and will be published in parts, by Messrs. Macmillan and Co.

The Great Meteor of Nov. 23rd.—Capt. G. L. Tupman has been investigating the path of this remarkable object. In *Symons' Meteorological Magazine* for January, he writes:—"I have made out its path very satisfactorily from a great many fairly accordant observations. It began as an ordinary shooting star, ninety (nautical) miles high, five miles north of Derby, became wonderfully brilliant fifty miles over Liverpool, and burst at the height of twenty-six miles, fifteen miles N.N.W. of Great Orme's Head. From no less than twenty-five estimations of its duration, the velocity was between eighteen and nineteen miles per second."

The "Times" and Meteorology.—The energy of the *Times* in publishing daily a map showing the principal elements of the weather at six p.m. on the preceding evening was specially noticed in the evidence given before the Royal Commission on Meteorological Observations, whose report (Blue Book, 1877, price 2s. 4d.) should be studied by all who are interested in the progress of meteorology. The publication now before us (The *Times*' Register of Events in 1877) is another step in the same direction. One page is given to each day. In a narrow column on the right-hand side we have the leading British and Foreign events printed in bold capitals. On the left-hand is a map showing the condition of the weather over these islands at eight a.m., together with the "Remarks" of the Meteorological Office thereon. At the end of each week the curves of the self-registering instruments at Kew Observatory are given. Useful and full summaries of the Parliamentary Session and the year generally are given at the end of the volume. We would suggest that another year the publication should be deferred (if necessary) for another week or so, that the averages and totals for the year (barometric pressure, temperature, rainfall, &c.) might be added.

Ilford Fossils.—The very fine collection formed by the late Dr. Richard Payne Cotton, F.G.S., has, we learn from *Nature*, been bequeathed to the Museum of Practical Geology, London. It contains 246 specimens of vertebrate remains. A very perfect lower jaw of the beaver (*Castor Europæus*), with some well preserved bones of the *Elephas primigenius*, the *Rhinoceros leptorhinus*, and the *Bos primigenius*, are among the gems of this valuable collection.

Geology.—An interesting boring for coal is now going on close to the eastern suburbs of the town of Leicester. In 1876 a bore-hole at this spot reached a depth of 750ft., entirely in the Keuper marls and sandstones, but stopped at this point in consequence of the boring rods breaking and stopping up the hole. The Diamond Rock Boring Company have now contracted to go down to a depth of 1,200ft., but, in our opinion, the question will be settled at a less depth than this. The proximity of the ridge of Palæozoic Rocks, which runs southwards from Charnwood Forest by Enderby, Sapcote, &c., is an important factor in the question. Desford marks its western edge, so that if the ridge, or the rocks (inferior to the coal-measures) which rest upon it, extends eastwards beneath the Trias for eight miles, it will be an effectual bar to the finding of workable coal-seams in this locality.

Aquaria.—Mr. W. A. Lloyd, of the Crystal Palace Aquarium, is engaged in writing a practical book on Aquaria, for which he has long been collecting materials. Writing on the subject, he says:—"My illustrations will be numerous, original, and unusual, consisting mainly of views, plans, and sections of many aquaria, and of the various kinds of machinery employed in them to circulate the water, and will include also all the portraits I can find of those who did early and good aquarium work. Among these I should like to have a portrait of Mrs. Anne Thynne, who, in London, in the year 1846, maintained the earliest known marine aquarium on the compensating principle, with plants and animals balancing each other. Any hints or references to early books, or pamphlets, or prints, or pictures, or photographs, will be very acceptable. Among other things, I much want access, temporary or otherwise, to two aquarium guide books to two now non-existing aquaria, one in Vienna, dated about 1860, and one in Copenhagen, about 1873-74. I shall be very grateful for any properly-authenticated details in MS., or any references to such as have been published, on the maintenance of any animals, ranging from sponges to fishes, both marine and fresh water, under the conditions proper to aquaria. Any loans made to me will be punctually and thankfully returned."

Smithsonian Institution, Washington, U.S.—The annual report for 1876 has lately been issued. It contains a statement by the director, Professor J. Henry, on the work and progress of the Institution, and a report from Prof. S. F. Baird on the Centennial Exhibition. Then follow biographies of Gay-Lussac, and that scientific monarch, the present Emperor of Brazil; articles on the Kinetic Theories of Gravitation; Revolutions of the Crust of the Earth; Asteroids between Mars and Jupiter; and several ethnological articles, altogether forming a handsome volume of some 500 pages. The report and other publications of the Institute are, we believe, presented to Societies who send copies of their reports and transactions to the agent for the Smithsonian Institute, Mr. W. Wesley, 28, Essex Street, Strand. Another important feature in the work of this valuable Institution is that it undertakes to receive books, specimens, &c., from any part of the world for American Societies and Museums, and transmits in return any exchanges which may be desired. During the year 1876 no fewer than 4,853 packages were received from abroad, and some 13,000 parcels sent out. These have been carried free of cost by the various Atlantic Steamship Companies, and thus carriage from any part of the United Kingdom need only be paid as far as London.

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—General Meeting, December 18th, 1877.—Mr. J. F. Goode read a paper on the "Planet Mars," in which he especially alluded to the recent "opposition," as having been of more than ordinary interest from the close proximity of the planet to the earth; the varying distances from which he explained being occasioned by the ellipticity of its orbit. The various features of Mars, as seen through the telescope, were discussed, and a description given of its continents and seas; its snowy poles analagous to those of the earth, its period of rotation on its axis, duration of seasons, and other interesting phenomena, were severally alluded to. Mr. Goode mentioned that the discovery of two satellites by Professor Hall, of the Washington Observatory, had rendered the recent "opposition" particularly interesting. These satellites, he stated, are very small, and are visible only by means of the most powerful instruments, under very favourable circumstances.

CHELTENHAM NATURAL SCIENCE SOCIETY.—On 15th December, 1877, a public meeting was held, at which it was resolved to form a Natural Science Society in Cheltenham. A committee was appointed, and a secretary *pro tem.* Rules, &c., have since been framed. January 18.—First general meeting, at which it was resolved that the society be called "The Cheltenham Natural Science Society," that Dr. T. Wright, M.D., F.G.S., be president, and Colonel H. Basevi honorary secretary. The report of the committee was unanimously adopted, and the rules as added to and altered passed. The ordinary meetings will be held on the 3rd Thursday in each month, April to October inclusive.

NORTHAMPTON NATURALISTS' SOCIETY.—January 7th, a paper "On Beetles" was read by Mr. E. B. Pressland.—January 15th, a paper on "Photography" was read by Mr. H. Manfield.

NOTTINGHAM NATURALISTS' SOCIETY. — January 2nd, Annual General Meeting, when Mr. A. H. Simpson was elected president; Messrs. H. Blandy and J. Morley, vice-presidents; Mr. C. Wheatley, treasurer; Mr. C. T. Musson, hon. secretary; Messrs. W. Foster, W. Morley, R. Wix, R. T. Higham, T. Bull, and J. S. Radford, the committee; and Mr. L. Lee, assistant secretary and librarian.—January 9th was spent as a microscopical evening.—January 16th, the President delivered the Annual Address.

STROUD NATURAL HISTORY AND PHILOSOPHICAL SOCIETY,—January 8th, Mr. J. T. Fisher delivered a lecture on "The Spectroscope in relation to Stellar and Solar Physics," illustrating some of his remarks by a number of photographs.—January 24th was an extra meeting, at which Mr. C. Playne read a paper on "Water as a Motive Power."

TAMWORTH NATURAL HISTORY, GEOLOGICAL, AND ANTIQUARIAN SOCIETY.—On January 7th, Mr. Samuel Spruce, F.G.S., read a paper entitled, "Geological Notes on the Trip to Clent Hills," which he illustrated by plans and diagrams, showing the various strata between Birmingham and Hales Owen. Mr. Spruce showed that the Clent Hills are composed of new red sandstone, and not trap, as erroneously supposed by Hugh Miller and others. He also compared the trap of the Rowley Hills with that of Dosthill. The formation of the Clent Hills

Mr. Spruce believes to be due to denudation, while the Rowley Hill and Dosthill are of volcanic agency. This latter view, he contends, is borne out by the fact of the coal measure at Dosthill lying so near the surface, having been lifted up during an eruption by the lava, which forms the Trap Hill.—On January 21st Mr. Thomas Cooke read a paper on "The Feudal Times," in which he traced the history of feudal tenure, customs, &c., from the Saxon to the Tudor period.

WEST LONDON ENTOMOLOGICAL SOCIETY.—At a meeting held on January 4th, Mr. Silcock exhibited some pupæ of *A. grossulariata*, which is a very rare occurrence, as this species usually passes the winter in the larvæ state. Underneath the currant trees on which the pupæ were taken he found many hybernating larvæ. It was resolved that this society should take part in the forthcoming "Great National Entomological Exhibition," to be held at the Royal Aquarium, Westminster, during the present month.—E. H. MAYCOCK.

Hints to our Contributors.

Write plainly.

Write on one side of the paper only.

Write all names legibly in printed characters, and spell them correctly.

Forward communications as early as possible, so that proofs may be sent for revision.

Original observations should be vouched for by the writer's signature or initials, and address.

Communications should be as brief as possible consistent with clearness.

Exchange.

EXCHANGE.—I have for exchange Vols. XI., XII., XIII., XIV. of Monthly Microscopical Journal, and five Parts of Vols. I. and II.; The Geological Record for 1875; Reports of the Smithsonian Institute, 1873 to 1876; Commonplace Book of John Milton (Camden Society, 1876); Presidential Addresses to the Geological Society, Forbes 1854, Portlock 1858, Ramsay 1863, Smyth 1867, with Proceedings of Royal Society 1866; Geological Survey of United States, Annual Reports 1867 to 1869; and Survey of Wyoming, by Hayden.—WANTED.—Geological Magazine; Science Gossip; Vols. I. to XIV. of Geological Society's Journal; Transactions of Local Societies; or any good Scientific Books.—Apply to Flint-flake, *Herald Office*, Birmingham.

Answers to Correspondents.

Our Walsall correspondent's lines are not suitable for our pages.

We have to express our thanks for many appreciative and encouraging letters, some of them containing useful hints, which have been or will be acted upon.

We shall be glad to receive communications from the members of Natural History Societies in any part of the kingdom.

We cannot undertake the return of rejected papers, unless accompanied by a stamped addressed cover.

PARASITES OF MAN.*

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

I feel sure I need not apologise for bringing under the notice of workers in Science a list of the human Entozoa and Ectozoa. No complete and trustworthy record, brought down to the present time, exists. In view of rendering my list less bald than a mere catalogue of species would inevitably prove, I shall append a few particulars relating to the synonymy of each parasite, its larval condition, and the organ or tissue of the host it usually occupies. Omitting the Protozoa, I confine my attention to the following six parasitic groups :—1. *Trematoda ;* Flukes. 2. *Cestoda ;* Tapeworms. 3. *Nematoda ;* Roundworms and Threadworms. 4. *Acanthocephala ;* Thorn-headed worms. 5. *Insecta ;* including all such dipterous, aphanipterous, and hemipterous insects as are either wholly or partially parasitic. 6. *Arachnida ;* including all those trachearian forms, such as the mites and their allies, which are often vulgarly and erroneously termed scab, or itch-insects. Such is the bill of fare that I have now to offer, and, should it be found presentable and useful, it is proposed to follow it up at some future time by the publication of similar lists relating to the parasites of the horse and other domesticated animals.

As I cannot have the pleasure of reading these papers personally to the Section, and as I am desirous of making them as generally interesting to the members as the subject will permit, I have requested my friend, Mr. W. R. Hughes, to communicate the papers, and to exhibit some specimens † on my behalf. The slides and preparations from my cabinet will be chiefly illustrative of the more remarkable forms of Entozoa enumerated in the lists.

TREMATODA.

1.—*Fasciola hepatica*, Linnæus.
- Synonymy.—*Distoma hepaticum*, Retzius and Ramdohr; *Planaria*, Goeze.
- Larval state.—An armed Cercaria; not yet distinguished. Free ciliated embryo conical.
- Intermediate Host.—Not known. Probably a fresh water snail.
- Remarks.—The common liver fluke of Ruminants has been found at least fifteen times in the human body.
- Literature.—All standard works on Helminthology (Leuckart, Davaine, Küchenmeister, Dujardin, Cobbold.)

2.—*Distoma lanceolatum*, Mehlis.
- Syn.—*D. hepaticum*, Zeder and Rudolphi ; *Dicrocœlium*, Dujardin and Weinland ; *Fasciola*, Bloch ; *Planaria*, Goeze.
- Larvæ.—Cercaria, form unknown. Free ciliated embryo globular.
- Int. Host.—Not known. Probably a fresh water snail.

* Read before the Microscopical Section of the Birmingham Natural History and Microscopical Society, February 19th, 1878.

† The specimens exhibited were, the common fluke, *(F. hepatica,)* the lancet-shaped fluke, *(D. lanceolatum,)* the large human fluke, *(D. crassum,)* the Chinese or McConnell's fluke, *(D. sinense,)* the conjoined fluke, *(D. conjunctum,)* the minute Egyptian fluke, *(D. heterophyes,)* and Bilharz's fluke *(B. hæmatobia.)*

Remarks.—Has thrice been found in man. Infests the liver.
Lit.—All standard works, especially that of Leuckart.

3.—*Distoma crassum*, Busk.
Syn.—*D. Buskii*, Lankester; *Dicrocœlium*, Weinland.
Larvæ.—Unknown.
Int. Host.—Not known. Probably a species of oyster.
Remarks.—Infests the duodenum. Found at least thrice in man.
Lit.—Cobbold; Synops. of the Distomidæ in Linn. Proceed., 1860; *Idem.*; Obs. on the large fluke, with notes of two cases in which a missionary and his wife were the victims; Linn. Soc. Proc., Vol. XII. (zool. div.;) and in The Veterinarian, 1876.

4.—*Distoma sinense*, Cobbold.
Syn.—*D. spatulatum*, Leuckart.
Larvæ.—Unknown.
Int. Host.—Probably a fresh water mollusk.
Remarks.—Infests the liver of Chinese. Discovered by Professor McConnell.
Lit.—McConnell; *Lancet* for August, 1875; Macgregor; *Glasgow Medical Journal* for January, 1877.

5.—*Distoma conjunctum*, Cobbold.
Syn.—None.
Larvæ.—Unknown.
Int. Host.—Probably a small mollusk.
Remarks.—Infests the liver. Originally found by me in an American fox (1858,) and subsequently by Lewis in pariah dogs (1872,) and afterwards by McConnell in man (1875.)
Lit.—Cobbold; Synopsis (*l. c.*) 1859; Lewis; Govt. Rep., Calcutta, 1872; McConnell; *Lancet*, Feb., 1876.

6.—*Distoma heterophyes*, Siebold.
Syn.—*Fasciola*, Moquin-Tandon; *Dicrocœlium*, Weinland.
Larvæ.—Unknown.
Int. Host.—Unknown.
Remarks.—Infests the intestine. Only once found. Discovered by Bilharz, at Cairo, 1851.
Lit.—All standard works, more particularly that of Leuckart.

7.—*Distoma ophthalmobium*, Diesing.
Syn.—*D. oculi humani*, Gescheidt; *D. lentis*, Von Ammon; *Dicrocœlium*, Weinland; *Monostoma*, Nordmann; *Festucaria*, Moquin-Tandon.
Remarks.—Several times found in the eye, but as all the specimens were sexually immature, the species, as such, is of doubtful authenticity.
Lit.—All standard works.

8.—*Tetrastoma renale*, Delle-Chiaje.
Syn.—None.
Remarks.—Supposed to infest the kidney. Discovered by Lucarelli in 1826.
Lit.—Delle-Chiaje, Elmintografia Umana, 1833.

9.—*Hexathyridium pinguicola*, Treutler.
Syn.—*Hexastoma*, Cuvier; *Linguatula*, Lamarck; *Polystoma*, Zeder.
Remarks.—Only once detected. It was lodged in a small tumour of the size of a nut.
Lit.—Treutler; Obs. path. anat. ad helm. corp. humani, 1793.

10.—*Hexathyridium venarum*, Treutler.

Syn.—To the genera given above, add *Hexacotyle*, Blainville.

Remarks.—Said to have been found on four occasions; by Treutler once, by Delle-Chiaje twice, and once by Follina. Infests the blood.

Lit.—As above; and in general treatises.

11.—*Amphistoma hominis*, Lewis and McConnell.

Syn.—None.

Larvæ.—Unknown.

Remarks.—Infests the intestine. Twice found; in the first instance by Dr. O'Brien, of Gowatty, and Dr. Curran together.

Lit.—Lewis and McConnell; in Proceed. of the Asiatic Soc. of Bengal, 1876.

12.—*Bilharzia hæmatobia*, Cobbold.

Syn.—*Distoma hæmatobium*. Bilharz; *Gynæcophorus*, Diesing; *Thecosoma*, Moquin-Tandon; *Schistosoma*, Weinland.

Larvæ.—Cercaria unknown. Free ciliated embryo cone-shaped.

Remarks.—Infests the veins, especially the portal system of blood vessels. Frequent in Africa.

Lit.—In standard works; the details being chiefly from Bilharz, Griesinger, Harley, and Cobbold. See also Sonsino; Sugli ematozoi come contributo alla Fauna entoz. egiziana; Cairo, 1877; and in Arch. Gén. de Méd., for June, 1876.

[TO BE CONTINUED.]

ON THE STUDY OF THE MOSSES.

BY JAMES E. BAGNALL.

Meek creatures! the first mercy of the earth, visiting with hushed softness its dintless rocks; creatures full of pity, covering with strange and tender honour the scarred disgrace of ruin—laying quiet finger on the trembling stones, to teach them rest. No words, that I know of, will say what these mosses are. None are delicate enough, none perfect enough, none rich enough. How is one to tell of the rounded bosses of furred and beaming green,—the starred divisions of rubied bloom, fine-filmed, as if the rock spirits could spin porphyry as we do glass,—the traceries of intricate silver, and fringes of amber, lustrous, arborescent, burnished through every fibre into fitful brightness and glossy traverses of silken change, yet all subdued and pensive, and framed for simplest sweetest offices of grace? They will not be gathered, like the flowers, for chaplet or love-token; but of these the wild bird will make its nest, and the wearied child his pillow.

And, as the earth's first mercy, so they are its last gift to us: when all other service is vain, from plant and tree, the soft mosses and gray lichen take up their watch by the head-stone. The woods, the blossoms, the gift-bearing grasses, have done their parts for a time; but these do service for ever. Trees for the builder's yard, flowers for the bride's chamber, corn for the granary, moss for the grave.

Ruskin's "*Modern Painters.*"—*Vol. V.*, *pp.* 102-3.

A walk through green fields, country lanes, or woods, is rendered more enjoyable, and I believe more conducive to healthy exercise, if we have some special study to call us there, than such a walk would be if indulged in for the mere sake of what is termed a constitutional. For it is well to have something that will for a time enable us to forget the every day cares of a busy life, and nothing is so likely to do this as some pursuit that not only engrosses the attention but also gladdens the eye, that calls forth healthy thought, educates the observing faculties, and stimulates us to take a certain amount of invigorating exercise. To any person with ordinary enthusiasm, interest, and industry, the study of the mosses will yield all this and more.

Too frequently these plants are neglected by even professed botanists. The investigation of them is considered to be too difficult, or too tedious, and often too expensive. That there are difficulties connected with the study all must admit, but none that a little patience and industry will not surmount; the tedium of the study would evaporate after the first few hours' examination of these beautiful organisms, and the expense after the first outlay need not be more than a little extra wear and tear of one's shoe leather.

To say that the study of these plants is interesting would be trite, for everything in beautiful nature is interesting, but the "dim world of weeping mosses" is wondrously interesting; so varied in structure, in form, in mode of growth, in colour, covering the bosom of their mother earth with a green, velvety mantle when the cold winds of autumn and winter have robbed the trees of their beautiful foliage, and the nipping frosts have chilled into death their lovely sisters, the flowering plants, clothing with beauty the wayside bank, clinging with a tender embrace to their high-born kinsman the forest tree, bedecking with a thousand fairy urns the old ruined wall, covering with beautifully mingled masses of feathery *Hypnum*, tufted *Bryum*, or hoary *Tortula*, of every shade of green, the rotting thatch of the ruined cottage, filling the treacherous bog with pale green *Sphagnum*, or beautiful tussocks of noble looking *Polytrichum*, flourishing amid the unpleasant odours of the poison breathing marsh, and climbing slowly, but surely, from the lowest valley to the snow line of the great mountain!

And were we to follow them in their daring scramble, and note them well, we should see that the mosses are not only countless in numbers, but multitudinous in varieties and species; the moss flora of our own islands alone numbering about 140 genera and nearly 600 species, besides varieties without end. A superficial observer would probably be astonished if he were to have pointed out to him the varied species to be found upon a few square feet of a bank "with bright green mosses clad," because to him a moss is a moss and nothing more; and yet in such a limited area twenty or more species may often be found; and many a district that at first sight seems able to yield but a poor moss flora may by a little diligence be proved to be quite prolific. A limited district of some 3,500 acres has yielded the writer nearly 130 species of these plants, all of them beautiful and some of them very rare.

Then it must be remembered that mosses are easily preserved, usually retain their special characters even when dried, may be prepared for the herbarium, and packed in comparatively small compass, and may be examined at any time; for, however shrivelled they may have become by long keeping, a few minutes' soaking in tepid water will restore them to most of their former beauty, their lovely leaves again expand, the minute cells of which they are built are again filled with fluids, and with the aid of the microscope all their details may be made out as readily as though they had been gathered but an hour ago, so that for real and minute study this may truly be called a fireside one.

For the sake of those who would wish to commence the study, but lack the knowledge how to begin, when and where to seek their plants, and how to distinguish them when found, these hints have been written, and I shall endeavour, as clearly as I can, to supply a few elementary lessons in moss collecting, &c.

Before beginning to collect certain aids are required: these are few and simple. First, a bag or satchel of some kind for stowing away specimens as they are gathered. One of the canvas bags with a strap to sling over the shoulder, such as are now offered from a shilling upwards, will be serviceable and sufficient. Some pieces of good strong newspaper six to nine inches square will be required to wrap up each specimen separately as gathered. These papers should be numbered previous to starting out, using ink rather than pencil, for the mosses will often be wet and pencil marks are then easily obliterated. In order to keep the tufts of moss clean and distinct too many should not be put into one paper. When the paper is filled and folded the number of the package should be entered in the collector's note book, with remarks as to habitat, locality, and date. Such, for instance, as this:—"No. 1. Marly bank, Tythall Lane, near Solihull. Formation, Keuper Marl. Feb. 9th, 1878," and such other particulars as it may be well to remember.

And here I may observe that at first it would be advisable to collect those mosses only which have their fruit fully matured, and then, when these have been carefully examined and their distinguishing characters mastered, barren specimens may be collected; for many of our rarest British mosses are more frequently found barren than fruiting, and they must not, of course, be neglected. As soon as home is reached each of the packages should be opened, and if time serves roughly examined. If not, they should be placed in the opened papers on the floor of a room where they will be undisturbed, and allowed to get thoroughly dry. It will be advisable at the same time to place a slip of paper with each package containing a copy of the notes from note book. When the specimens are dry they may be again wrapped up and put by for an indefinite time for future examination. If the mosses are allowed to dry in the unopened papers just as they are gathered they will be nearly certain to become mildewed, and will be very unsightly and useless, and thus the trouble of collecting will have been taken in vain.

All these details may seem to make the preliminary work very tedious to the beginner, but he will soon get over any irksomeness he may at first feel, and he will be rewarded by his specimens being saved in good condition.

A pocket lens will be required for the examination of the plants in the field, one having a power of about ten diameters, *i.e.*, about one inch focal length, will be found serviceable, and if with two powers, *i.e.*, one inch and half-inch, still more so. These lenses, fitted in horn cases, may be obtained from any of our local opticians at from 1s. upwards, the price varying according to the finish of the article. If the School Microscope mentioned below is obtained, one or more of the lenses supplied with it may be made to do service in the field; but, if so used, should always be carried in a small chamois leather bag to protect from scratches.

It is advisable to acquire the habit of constantly using a lens, making out by its aid all the details possible, such as the position of the leaves on the stem, general characters, &c., noticing whether they are straight, curved, falcate, and so on, and their direction when dry. This latter character is often a ready guide to nearly allied species. For instance, two mosses common on wall tops, *Bryum capillare* and *B. cæspiticium*, differ materially in appearance when dry, the former having the leaves remarkably twisted, the latter having them straight and imbricated. Many other like cases might be cited.

A good text book will, of course, be indispensable. There are several to select from, published at various prices. For instance, Stark's "British Mosses," having twenty coloured plates, is offered for 5s.; but this is not to my thinking a satisfactory book, the descriptions being too vague to be useful; still, many of the more frequent mosses may be made out from it. Berkeley's "Handbook of British Mosses," with twenty-four coloured plates, costs 21s. new, but may frequently be obtained second-hand for about 14s. The great fault of this work is that the nomenclature is not in all cases that most generally adopted, and the author gives no synonyms. This, I think, is a serious fault, as it leaves one in uncertainty as to the name adopted by other authors. Of cheap books the one I prefer is C. P. Hobkirk's "Synopsis of the British Mosses," which costs 7s. 6d. The only fault is the absence of plates. It is so handy in size that it may be carried in the pocket without inconvenience, contains excellent descriptions of all our British mosses, and the classification adopted in it is excellent. But the best text book is Wilson's "Bryologia Britannica." It contains excellent illustrations of all the mosses described in the volume, giving figures of many of the minute details. The descriptions are admirable, being those of one of the best bryologists our country has produced. Any student who makes good use of this work will find that most of the difficulties surrounding this study will be rapidly overcome. This is a somewhat expensive book, costing 42s. with the plates uncoloured, or 84s. with the plates coloured. The uncoloured edition is to my thinking quite as useful as the more expensive one. I should certainly advise the student to get this volume as his text book.

Of course a microscope will be almost, if not quite, indispensable. These instruments, as everyone knows, are very varied in price, a first-class microscope being an expensive luxury, though there are in the market excellent instruments at most moderate prices. But a great amount of good work may be done with a cheap microscope—in fact, a great deal of the best work that has been done for science has been done with comparatively inexpensive instruments.

The most useful cheap instrument I know is Field's School Microscope, a very compact little instrument having three simple lenses which, separate or combined, give a magnifying power of from five to forty diameters. This, with the simple lenses, live box, needle, and other appliances, costs 10s. 6d.; a compound body may be added for 2s. 6d. extra. This will give powers of from twenty to eighty diameters. It is well to have this compound body at first, as the cabinet is then made of sufficient size to hold the compound body and all the other apparatus. For an additional 2s. 6d. a Wollaston doublet may be added; and, as this lens is a combination of plano-convex lenses placed in such a manner and of such a focus as to reduce chromatic and spherical aberrations, for 15s. 6d. it is possible to possess a microscope nearly achromatic, giving a power of 120 diameters, which is sufficient for almost all the work which the young botanist will have to do. All my own earliest work in mosses was done with this instrument, and I believe I learned more by its aid than I have ever done with the more expensive instruments I have since used. As a simple microscope it will always be useful for dissecting and mounting purposes, and I can say with confidence that the student who has acquired all the knowledge of structure that this cheap little instrument will place within his reach will have gained such an insight into the moss world as will enable him to determine with a little patience the most difficult of mosses.

CASTLETON: ITS EXTINCT FAUNA AND PHYSICAL SURROUNDINGS.

BY THE REV. W. H. PAINTER.

It was upon one of the few fine mornings at the end of August that I stood upon the edge of the high land overlooking the Vale of Hope, and looked down upon Castleton. Before me, in the far-off distance, were the hills in the direction of Sheffield that appeared to form the eastward termination of the vale, while on my left appeared the sharp peak of Win Hill, the more rounded summit of Lose Hill, and, very close to me, the precipitous side of Mam Tor, of which more anon. Then on my right were seen the road gradually winding up the hill-side to Tideswell, the grey ruins of the ancient stronghold of the Peverils, and the bleak moors which characterise that part of Derbyshire.

The exact spot where I stood to view the Vale of Hope was a remarkable one. It was just on the edge of the great plateau of mountain limestone. Behind me stretched that formation, before me lay the Yoredale Rocks overlying the same. These rocks, which take their name from the valley of the Yore, or Ure, in Yorkshire, where they are most fully developed, are beautifully exposed in the steep escarpment of Mam Tor, or the Shivering Mountain. Here they will be seen to consist of alternate layers of sandstone and shale—the latter being impregnated with oxide of iron. In some of the nodules of impure limestone I found, in examining them upon the occasion of a former visit, cavities filled with dried bitumen, and several specimens of a species of *Modiola* and *Goniatites reticulata.*

Upon the opposite site of the road, the western, is the famous Windy Knoll Quarry—the scene of the labours of several farmers, of some students of Owens College, Manchester, and last, but not least, of Mr. Rooke Pennington. This quarry is remarkably situated. It is near to the most northern point of the mountain limestone of Derbyshire, and in the direct line of route from the Cheshire plains to the Vale of Hope. To quote the words of Mr. Pennington in the "Quarterly Journal of the Geological Society for May, 1875," "the Yoredale beds dip northwards: a fault runs close to the spot. The line of division between the mountain limestone and the overlying rocks runs, roughly speaking, to S.E. and S.W. of this quarry." But that which has served to render this quarry famous has been the discovery of a fissure filled with the remains of extinct animals. Certainly, it *has* been a remarkable place. I say it *has been*, for when I visited it, last August, all trace of it, with the exception of a few splinters of bones, two specimens of the tarsus, and one of the humerus of the Reindeer, had disappeared; the rock having been blown down, and the bones taken away.

It would appear as if this fissure lay in the track of animals making their way from the Cheshire valleys and plains to the Vale of Hope, and that connected with it was a swampy pool, to which they went to drink; that the weak ones stuck fast in the mud, from which they were unable to extricate themselves; that whilst in this predicament they fell an easy prey to bears and wolves, whose bones, in their turn, became mingled with those of their victims. The bones found in this fissure were of all parts of the animals:—The bison *(Bison priscus,)* the reindeer *(Cervus tarandus,)* the grisly bear *(Ursus ferox,)* the wolf (*Canis lupus*,) the fox (*C. vulpes*,) the hare (*Lepus timidus*,) the rabbit (*L. cuniculus*,) and the water-vole (*Arvicola amphibia*.) Before passing on we must notice the remarkable bed of elastic bitumen which is found here, overlying a mass of mountain limestone, on the south side of the quarry. Besides this a great mass of limestone on the north side of the quarry has become so saturated with the bitumen that when placed in a fire it burns with a clear, bright flame. In this last-mentioned limestone I found an internal cast of *Euomphalus Dionysii*, two species of *Productus*, two of *Athyris*, one of *Spirifera*, and a beautiful specimen of *Conocardium minax*.

Leaving this interesting quarry we proceed to the Blue John Mine in Traycliff. This mine is the grand depository of the amethystine or topazine fluor spar, locally called "Blue John," to distinguish it from "Black Jack," or zinc ore. This substance is composed of lime and fluoric acid, the most penetrative and corrosive of any acid known; the blue colouring matter being oxide of manganese. Descending by a flight of steps, a narrow confined passage is reached, that winds between the rocks. From the roof of this passage stalactites are pendant, whilst in the sides crystals of carbonate of lime glisten. After descending for a short time, the variegated cavern is reached—a large chamber, said to be upwards of 100 feet in height. But this is not the only large chamber that has been discovered through the labours of the miners. Some distance from this cavern is the one called "Lord Mulgrave's Dining Room"—a large cavity about 150 feet in height, and 60 feet in diameter. But the most beautiful of all the chambers is that called the "Crystallised Cavern," a large dome-shaped cavity, the height of which is estimated at 100 feet, and whose sides are adorned with numerous stalactites, that sparkle like stars when it is lighted up.

Another of the Peak mines is the Speedwell Mine, the gallery of which was originally excavated by a company of proprietors in search of lead ore. Access to the interior of this mine is obtained by descending about 104 steps, then by proceeding in a boat along a level or tunnel, the result of the miners' operations, to the Grand Cavern, a vast vaulted chamber, fashioned by natural forces in the heart of the mountain, the height of which has never been ascertained, but is supposed to exceed 500 feet, since rockets capable of ascending 450 feet have been sent up and have exploded and thrown out their coruscations as fully as if they had ascended beneath the vault of heaven. On one side of this chamber is an abyss which has never been fathomed. On the day that I visited it a vast body of water was pouring into it from some of the old workings, which precipitated itself into the chasm with the noise of thunder. This was owing to the rain having fallen almost incessantly for some days, as in the usual course of things visitors are able to throw stones down and hear them bound from side to side for some minutes.

The greatest of all the Peak caverns is the "Peak Cavern," or "Devil's Hole," the approach to which is through a ravine by the side of the stream which issues from the cavern. At the termination of this ravine there is a magnificent natural arch in the solid rock, 120 feet wide, and 42 feet high. The mode of progress in this cavern was formerly by a boat for short distances, but latterly, for the convenience of visitors, passages have been made by blasting the rock. After proceeding for some distance a large chamber, called the "Grand Saloon," is reached, about 220 feet square, and in some places 120 feet in height. Leaving this apartment by means of a steep and rugged pathway, the "Chancel" is reached, and then descending by another path the visitor arrives at the "Devil's Cellar." The other large chambers in this cavern are "Gloucester Hall" and "Great Tom of Lincoln," the latter being so designated from its having a regular concavity in the roof resembling the form of a bell.

On the eastern side of the Castle Hill runs Cave Dale, a rocky glen, in which the mountain limestone is well exposed. The approach to this narrow defile has rather a forbidding aspect, the entrance being by a cleft in the hill-side not more than five feet wide. Passing this the dell widens out and gradually ascends for about a mile. As the visitor ascends towards the summit he passes on his way a singular column of toadstone, not unlike in appearance to the basaltic columns of the Giant's Causeway, and obtains lovely views of the old keep of the Castle and of the hills separating Edale from Hope Dale. In this dale the geologist will meet with a rich variety of fossils. *Cardiomorpha oblonga*, *Rhynchonella pugnus* and *pleurodon*, *Terebratula hastata*, *Spirifera glabra*, *Conocardium minax*, and species of *Nautilus* may be found.

Cave-hunting in this dale has been carried on successfully by Mr. Rooke Pennington. He discovered some time since underneath the keep of Peveril Castle a small cave, which has furnished a few articles, showing that it had been occupied by man at various periods from the (so-called) Neolithic age down to a comparatively recent period. Amongst the relics obtained were a shilling of Queen Elizabeth's reign; pieces of old-fashioned pots of a later reign, mingled with bits of "rude pre-historic pottery;" bones of the Celtic Short Horn (*Bos longifrons*,) goat (*Capra hircus*,) and hog. Of animals not connected with man there were many teeth and bones of the fox (*Canis vulpes*,) badger (*Meles taxus*,) and a skull of the water-rat (*Arvicola amphibia*.) Of implements, &c., there was a tooled piece of stag-horn, an iron spike, two flints, a piece of jet, part of a bone comb, and a magnificent bronze celt. There was thus a distinct proof of this cave having been used, first, at some remote period as a place of sepulchre, by the presence of human teeth and a fibula; and, secondly, at a more recent period by the indications above-mentioned, as well as by the discovery of an antler of a red deer, half-sawn through and then broken off, and the bones of a dog and of a hog.

Another notable place in the neighbourhood of Castleton is the "Winnats" or Windgates, a narrow defile between lofty limestone cliffs, through which the high road to Manchester formerly ran. Exceedingly wild and grand is the appearance presented by this pass; on each side stupendous piles of mountain limestone rise to a great height, with their summits split and rent into a variety of forms, some assuming the shape of ruined castles; in some places huge, buttress-like masses protrude into the road, whilst in others lie shattered fragments of rock which, having become detached from the hillside above, have been hurled down, and are seen scattered abroad in wild profusion; whilst at the lowest part of the defile a gigantic pile of rock, round which the road winds, appears to close in the ravine.

Opening out from Hope Dale are numerous other dales of great loveliness, as Edale, &c. The origin of these may be traced to denudation, the action of water having, in the course of ages, swept away the Yoredale shale where it occurred, leaving the harder rocks which form the hills *in situ*. To this cause the origin of most of the undulating scenery of Derbyshire must be attributed, streams that descended from the heights having first undermined the softer strata and then carried them away. Good examples of the action may be seen on the lower flanks of Kinder Scout, and notably at Mam Tor; and where only the lower limestone beds occur it is not to be doubted that water has been the chief agent in excavating the dales—first by cutting out subterranean channels for itself, as in the case of the before-mentioned caverns, and then, the roof of the cavern having fallen in, by gradually widening it, and so converting a cave into a ravine. Similar instances of this kind of action I have also met with at the base of Ingleborough, in Yorkshire.

The district of which Castleton is the centre is one in which the student of the marvels of creation will find much to instruct and interest him. Here he will find a record of some of the changes to which our globe has been subjected at the hands of Him who by His Almighty fiat said "Let the waters under the heavens be gathered into one place and let the dry land appear;" who has settled the bounds of the different animals inhabiting the same, and who has fitted it for the welfare and happiness of man, the last and greatest of His productions.

PROFESSOR EDWARD FORBES AND HIS COUNTRY.

BY ROBERT GARNER, F.L.S.

Since any district or hunting-ground which is appropriated to the study of natural history loses much of its productiveness and interest if it does not embrace a portion of the seaboard, or, at any rate, if there is no occasional excursion made with the object of studying marine zoology and botany, the following paper relating to one portion of the Isle of Man may not be out of place in the "Midland Naturalist," especially as its coasts, together with those of North Wales, are more easily accessible to Midlanders than any others, and the island is especially rich in all marine productions, whether botanical or zoological.

When the writer of this paper saw for the first time the still-regretted Naturalist whose name occurs at the head of it, he could not fail to be struck with his intellectual appearance, juvenile look, expressive eyes, and somewhat truant hair. This was in 1839, as he spoke in his section at the meeting of the British Association at Birmingham, the year and place, we think, which gave birth to the Red Lion Club, consisting of himself and other congenial spirits. His then auditor, who was also his senior, little expected that so many years after his death, (which took place in 1854,) circumstances which may be termed fortuitous would bring it about that himself, with tastes not very different from those of poor Forbes, should become acquainted with the family estate, and be domiciled for a time at the homestead which belonged to him; also hear his praise from the worthy old Manxman who accompanied him in his rambles and dredgings; to whom, as to all with whom he had intercourse, he became much endeared. The old man recounted, amongst other things, with what glee Forbes found a rare *Arca (tetragona)* in the mud which filled the valves of a *Modiola;* his *gourmandise* in respect to the raw mollusks of the scallops, (called *tanrogans* by the natives;) his long and lithe fingers allowing nothing to escape them; and the interest he took in a beetle which the narrator brought to him—three-spined, and which burrowed in the roads—probably a *Typhæus* or bull-comber, (Anglice.)

Edward Forbes was born at Douglas, in 1815, and was consequently but thirty-nine at his death. His mother was the heiress of Corvallo and Ballabeg, near Ballaugh. He was of a stock not only adventurous, but speculative, on the male side. In the wreck of the family estates, which had become involved previous to his succession to them, he only succeeded in saving a portion—that above alluded to. The old parish church is close at hand, a mile at least from the village, but is now a disused and picturesque edifice; the surrounding enclosure contains one of the Runic memorial stones so general in the island; but a more interesting stone, at least to the naturalist, may be seen in the otherwise uninteresting modern church, a tablet raised in 1858, principally through the aid, we believe, of Sir R. I. Murchison and other scientific friends, to the memory of the professor, the inscription ending so—

His mother was a native of Ballaugh,
Here he spent many of his boyish days,
And on the sea-coast of this parish
He commenced his system of dredging.

His bust is also placed in the Court House at Peel.

He went up to London, when a young man, with the determination to become an artist, but his friends saw reasons to dissuade him from such a career, and, by so doing, the world may, perhaps, have lost a clever caricaturist, but probably not a painter. His tastes next led him to turn to geology and natural history; but at that time natural science was considered only as an appanage of, or a relaxation in the study of medicine, and, therefore, he had to go through the *curriculum* of the latter profession, which, however, he had little taste for. In producing his geological and zoological bias it is probable that his residence in Manx-land, and the natural features of that country, had an influence; and to these features we may further advert taking them in connection with himself. For more, perhaps, than any other man he made the natural history of his native island his study, though our late friend, Mr. Cumming, did much.

As regards his geological bias—the southern four-fifths, at the least, of the island are composed of metamorphic and Cambrian slates and other succeeding palæozoic rocks,and are more or less mountainous; the northern and lesser portion is of a very different formation—boulder clays and drifts resting on a foundation which is nowhere visible, and of problematic nature. The surface here is mostly a sandy plain, with an occasional bog or curragh marked by a curious and luxuriant vegetation; in some places, however, the sand forms many rounded hills, and, besides, many ancient mounds and other earth or stone works mark the surface. Thus, on the estate we have especially alluded to is an antiquity combining the stone circle with the earthen barrow—a mound of earth with its periphery supported by large quartz stones. The glacial deposits are found high up amongst the hills, and at a lower level, as displayed along the sea-cliffs, there are truly wonderful accumulations of gravel and fragments of rocks, without any stratified arrangement; larger boulders, too, are washed out of the clays in the valleys, or by other means perched on the hill sides; and such as are of white quartz have been used to mark boundary lines, or are often placed round ancient interments as already instanced. On Maughold Head, at about 300 feet of elevation, lies a large "erratic block" of greenstone, strongly marked with grooved and crossed lines. Above, and filling up the ploughed surface of the earlier accumulations, are horizontal deposits of sand, peat, and marine shells, the latter such as now live in the sea close at hand, but deposited higher than its waves can now reach. On this north-western part of the island, the coast is of a nature to disintegrate, the wind redistributing the sand into "broughs" or hills, imperfectly kept together by the growth of lyme-grass and mat-weed; at the extreme north—the Point of Ayre—the sands, probably thrown on shore by currents, are drifted by the same agency into parallel undulations or ridges, much like the waves of the sea—a truly barren waste, adorned with little but gorse, a plant, however, here not wholly despised, but chopped in windmills for fodder. North of Peel there is a narrow tract of old red sandstone forming the sea-cliffs, and of it the venerable cathedral of St. Germain is in part built; it is there strangely pitted and honeycombed, apparently by the action of the winds. The fragments of shells seen in the hardened sands in this part of the island are perhaps due to wind-drifts. It is in what we may term "Forbes's Parish" that the remains of the great deer or elk *(Megaceros)* principally occur, entombed below the peat of the curragh, and reposing on a bed of shell-marl of fresh-water formation, not much more than twenty feet above the sea level. These curraghs must be partly of recent and partly of pleistocene formation—to use Forbes's term; the latter, because when the elk lived here, its range could not have been so limited as it must have been if the isle were as we see it now.*

The curraghs are of interest in other respects, especially to the botanist. The *Osmunda* is the common fern. Willows, such as *Salix pentandra*, &c., *S. fusca*, and its many varieties, the sweetgale, the bog-bean, the marsh cinquefoil, milfoil, and several other rarer plants, also occur in them. *Pulegium vulgare* is common in wet clay, and on the dry, sandy road I found *Silene Anglica*, *Papaver Argemone*, several species of rose and sweetbriar, with, however, but one *Rubus (fruticosus.)* On a dry bank, near Jurby, was a remarkable potentilla, *(P. hirta,)* scarcely indigenous, though found also near Perth. How the plant got here it is difficult to conceive.

The landscape is somewhat drear, the church towers the most conspicuous objects. Little streams, originating in the marshes, with difficulty find their way to the sea, and enter it, like the Callane, between the sand hills, forming little coves, interesting from the numerous marine plants growing about.† It was in these streams and in the curragh that Forbes fished for Limnæi and Planorbes.

* In a specimen obtained by the writer, but broken below the snags, the measurement from the centre of the forehead to the extreme end of the right horn would be, in a direct line, 4ft. 6in.

† *Arenaria peploides, Pyrethrum maritimum, Cerastium tetrandrum, Eryngium, Glaucium, Beta maritima, Atriplex laciniata, Triticum loliaceum.* No plants or shells are recorded, except such as the writer noticed, unless otherwise notified.

By ascending one of the glens, south of Ballaugh, but still in that Sheading, (so called,) we are soon in a different kind of country—in the heart of the hilly part of the island, quite sub-alpine in character. Here the mosses are not low and flat, but commonly high and inclined, becoming constant feeders to the rivulets. They abound with the usual plants—*Drosera rotundifolia*, *Pinguicula*, *Anagallis tenella*, *Scutellaria minor*, *Hypericum elodes*, *Wahlenbergia*, *Aspidium Oreopteris*, *Lycopodia*, *Bryum punctatum*, and, no doubt, others. Frequent waterfalls are here formed, where the streams flow down their rocky beds, and especially where they leave the slate rock for the boulder clays, which the water more easily scoops out. Such is the case at the Spoogt-vane, a pretty cascade, situated in a retired amphitheatre, south of Ballaugh. It is less frequented than Rhenass or Glen Meay, and to some, therefore, perhaps as pleasing, though these are certainly romantic, the last even approaching the grand, where the river finally trends through the rocky ravine to the sea. There are the remains of a Treen Church in the wood, near the Spoogt-vane Cascade. The river abounds with a small dark-coloured trout.*

[TO BE CONTINUED.]

THE RAY AND PALÆONTOGRAPHICAL SOCIETIES: AN APPEAL.

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

As the principal object of our Union is to promote the study of Natural History, I venture to bring before its members the claims which these admirable Societies have to their sympathy and support.

Perhaps no better illustrations could be given of the successful combination of numbers in effecting results, which are equally beyond the reach of private means on account of their costliness, and of public enterprise on account of the risk and uncertainty of sale, which many of the publications—mostly of a technical nature—would involve.

It is, therefore, not too much to say that, except for the existence of these Societies, many most valuable works in Natural History—on which the talented authors have devoted years of labour as well as much expense—would never have been published.

Having, at the request of my friend, Mr. Wm. Mathews, jun., M.A., F.G.S., (who held the office of local honorary secretary to both Societies for upwards of twenty years,) undertaken to succeed him in the duty of collecting the subscriptions and distributing the volumes, and thus feeling more than an ordinary interest in the welfare of the Societies—this circumstance must be my apology for introducing the subject to the notice of the members of our Union, many of whom are doubtless more familiar than I am with the splendid works which they have issued.

* I gathered *Hypericum androsæmum*, and *Hieracium sylvaticum* below the fall; and at Glen Meay, *Vicia sylvatica* and *Erodium maritimum*.

The Ray Society was founded in the year 1844, and "had its origin in a wish expressed by the late Dr. Johnston, of Berwick, to some of his scientific friends that some means could be devised for printing such works in Natural History as stand in need of extraneous assistance to secure their publication." Many of the honoured pioneers who constituted the first Council—names then and since celebrated in almost every branch of Natural History—have passed away, but some happily survive. Among the latter may be mentioned Professors Babington, Balfour, Busk, and Owen, the Rev. M. J. Berkeley, and Sir P. de Malpas Grey-Egerton, Bart. The first officers were—President, Professor Bell; Secretary, Dr. Lankester; Treasurer, Dr. Bowerbank; and Auditors, Messrs. E. J. Quekett and Robert Warington. The number of members was 225, the subscription being one guinea each. The first annual meeting was held on 2nd October, 1844. Since that date the number of members has increased to more than 400 at the present time, and a sum of about £22,700 has, during the thirty-three years that have elapsed, been expended in the publication of thirty-three Standard Works or Monographs in various departments of Natural History. It would be interesting to append a list of these, but space will not permit, nevertheless, I cannot refrain from mentioning the Monographs of the Nudibranchiate Mollusca, by the late Messrs. Alder and Hancock; the Cirripedia, by Dr. Darwin; the Spongiadæ, by the late Dr. Bowerbank; the Oceanic Hydrozoa, by Professor Huxley; and the Fresh Water Polyzoa and Tubularian Hydroids, by Professor Allman, (for the last of which the Royal Society's Gold Medal has recently been awarded,) as being among the most elaborate and costly works that have ever been issued. To give an idea of the liberal way in which these works are produced it may be interesting to mention that the cost of the publication of the last named work—without, of course, a single farthing being paid to the learned author—inclusive of paper, printing, engraving, colouring, and binding was £900.

The following volumes of this Society are nearly ready, viz., *Spongiadæ*, Vol. IV., *Aphides*, Vol. II.; and the *Copepoda*, Vol. I.; and many other interesting works, are contemplated.

It is probable that the success which attended the establishment of the Ray Society may have induced geologists to wish for a similar organisation for the publication of works on palæontology, which scarcely came within the scope of the operations of the former Society. For this they had not long to wait. "The Palæontographical Society was established in the year 1847, chiefly through the exertions of the late Dr. Bowerbank, for the purpose of figuring and describing the whole of the British Fossils, and has since that period issued thirty-one quarto volumes, containing 8,552 pages and 1,259 quarto plates, and has described 4,623 species of British Fossils, illustrating the plants, corals, echinodermata, crustacea, mollusca, fishes, reptilia, mammalia, &c., of the geological formations." Like the elder Society, the Palæontographical has lost many of its original members who formed the first Council. Those who survive are Professor Bell, Sir P. de Malpas Grey-Egerton, Bart., Professor Prestwich, and Mr. Alfred White. The first officers were:—

President, Sir H. De la Beche; Treasurer, Mr. Searles V. Wood; Secretary, Professor Morris; and Auditors, Messrs. A. G. Melville and J. Tennant. The first list contained 362 subscribers, who have since increased—notwithstanding losses, deaths, &c.—to nearly 500 at the present time, and the amount expended in Monographs during the thirty years of the Society's existence has been £21,200. The plan of publication is similar to that adopted by the Ray Society. Each subscriber of one guinea is entitled to receive a quarto volume, containing from forty to fifty quarto plates and necessary letter-press. It is not found practicable, on account of the comprehensive character of the Monographs, to issue annually one *complete* work at a time, and consequently as many as six *parts* of various Monographs have sometimes been included in the volume. These may be collected and bound together subsequently or the series may be left in chronological order as issued, easy reference being had to any Monograph in particular from the comprehensive indices prepared by the Secretary. In the volume for 1878 there will be eight parts, including two new subjects—the Liassic Ammonites and the Fishes allied to the modern Ceratodus; the completion of an old Monograph—that on the Merostomata; and a particularly interesting treatise on the relation between the Pleistocene mammalia and those of the present historic periods together, the estimated cost being £800. The following are among the more remarkable works published by this society:—The Carboniferous and Crag Foraminifera, the Fossil Corals, the Polyzoa of the Crag, the Echinodermata of the Oolitic and Cretaceous Formations, the Mollusca of the Crag, Eocene, and Great Oolite Strata; the Fossil Brachiopoda, the Fossil Merostomata, the Trilobites, the Belemnites, the Carboniferous Fishes, the Reptilia of the Liassic and Wealden Formations, and the Mammalia of the Mesozoic System, and of the Pleistocene and Crag Formations. The Council state in their last Report that "many years must elapse and many additional writers be enrolled ere the task of figuring the whole of the fossils of the British area be completed."

It has been attempted to be shown within the compass of this necessarily brief account what thorough good work the Ray and Palæontographical Societies are doing to advance the cause of Natural History. From the figures already quoted, it will be seen that an aggregate of more than *forty-three thousand pounds*, or an average of £1,300 per annum, has been expended by both Societies in little over thirty years, and this, be it remembered, has been purely voluntary, and without any help whatever from Government, but frequently supplemented by considerable pecuniary assistance from the talented authors, to whom the subscribers are indebted for the works themselves. It is evident that, with larger resources, the usefulness of both Societies might be greatly extended. At present, for each guinea subscription, the issue is one volume per annum, which might be increased to two if means justified the respective Councils, and thus the publication of many additional valuable works, some of which have appeared for years in the Prospectus, and then been withdrawn, could be undertaken. It would be a graceful act if every Society in our Union, not on the lists, would subscribe, as well as each working naturalist, individually. Everyone would find something to interest him in one or other of the Societies, and his influence, when once secured, would again influence others. Some of the earlier Monographs are out of print, and already fetch high prices in the second-hand booksellers' catalogues, and, therefore, upon the mere ground of "an investment" subscribers may rely that they will get their "money's worth." The number of subscribers within the area of our Union, a radius of eighty miles, is not more than thirty or forty to both Societies together; a very small number indeed, when we consider its wealth and the number of those who take an interest in Natural History. The subscriptions were due on 1st Jauuary last for the current year, so that each member now subscribing will be entitled to the forthcoming volume. Specimens of the recently published works may be seen at my office, 23, Union Street, Birmingham, where I shall be glad to receive the subscriptions of intending subscribers. The Rev. Thomas Wiltshire, M.A., F.G.S., 25, Granville Park, Lewisham, S.E., is the able Secretary to both Societies; and he will, I am quite sure, with his usual courtesy, give any further information that may be desired.

THE WEATHER OF JANUARY, 1878.

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

In the following columns we have the pleasure of presenting to our readers by far the most complete monthly return of the Temperature and Rainfall of the Midland Counties which has ever appeared in any publication. It embraces returns from about seventy stations, including three distant points—Carlisle, Ventnor, and Altarnun Vicarage, Cornwall—the returns from which will be useful and interesting for comparison with our own central stations. Many deficiencies, however, remain to be supplied, and we shall be pleased to give information as to description and cost of meteorological instruments.

The influence of the weather upon animal and plant life is a branch of the subject to which we would direct special attention, and we trust to receive many notes for February as to the time of opening of our ordinary spring flowers—Snowdrops, Primroses, the Speedwell, Hazel, Pilewort, *(Ranunculus ficaria,)* Dog's Mercury, and Coltsfoot for example. In this matter our readers generally could render important help.

Reverting to the weather of the first month of 1878, the figures we print below show unanimously that while the rainfall was below the average, the temperature, especially for the first three weeks, was decidedly above it. The maximum rainfall at nearly all stations was on the 27th, but only at Buxton (1·36 ins.) did it exceed one inch in depth. There are one or two returns in which a heavy fall is entered on the 28th, but this we suspect is caused by entering the rainfall to the day on which it was measured. The rain-gauge should be emptied daily at nine A.M., and the amount *entered to the preceding day.* The temperature desired is that in the shade at 4ft. above ground, (thermometers in a Stevenson's stand if possible.) If instruments are placed otherwise it should be noted on the form. We shall be pleased to forward forms for the purpose of recording observations to all who will help in the work of making this record of the weather of the Midlands as complete as possible, and all forms should be filled up and sent within the first week of the ensuing month to Mr. W. J. Harrison, Town Museum, Leicester.

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.	1·37	·73	28	11	55·0	22	22·0	31
SHROPSHIRE.									
Haughton Hall, Shifnal	Rev. J. Brooke	2·02	·73	27	16	55·0	21	23·0	30
Thorganby Villa, Shifnal	G. C. Broom, Esq.	1·88	·61	27	17				
Whitchurch	A. B. George, Esq., M.D.	2·66	·57	3	20		28	25·0	30
Woolstaston	Rev. E. D. Carr	2·86	·89	27	21	53·5	21	24·0	26
Leaton Vicarage	Rev. E. V. Pigott	1·85	·56	27	19	55·0	21	22·0	30
More Rectory, Bishop's Castle	Rev. A. Male	2·23	·59	27	21	53·0	2		
Larden Hall, Much Wenlock	Miss F. R. Boughton	2·33	·55	27	17				
Bishop's Castle	E. Griffiths, Esq.	2·19	·58	27	18	52·0	22	25·0	30
Cardington	Rev. Wm. Elliot	2·13	·64	27	16				
Adderley Rectory	Rev. A. Corbet	2·53	·63	27	24				
HEREFORDSHIRE.									
Whitfield	W. Wheatley, Esq.	1·42	·54	27	17			22·0	30
Burghill	T. A. Chapman, Esq.	1·48	·57	27	16	57·8	21	24·9	30
Stoke Bliss	Rev. G. E. Alexander	1·54	·62	27	16	55·0	21	24·0	30
WORCESTERSHIRE.									
Orleton, Tenbury	T. H. Davis, Esq.	1·83	·71	27	18	56·8	21	23·3	30
Blockley	R. B. Belcher, Esq.	2·04	·62	27	20				
West Malvern	A. H. Hartland, Esq.	1·96	·51	27	19	52·5	21	25·0	25
Pedmore	E. B. Marten, Esq.	2·03	·57	27	21	54·0	15	25·0	10
Stourbridge	Mr. J. Jeffries	1·94	·57	27	14	56·0	18 & 21	20·0	31
STAFFORDSHIRE.									
Barlaston	W. Scott, Esq.	3·15	·70	27	15	53·8	21	17·8	29
Amblecote	Mr. J. Robins	1·58	·55	27	16	56·0	26 & 28	24·0	31
Dudley	Mr. J. Fisher	1·90	·56	27	17	52·0	14 & 20	25·0	31
Sedgley	Mr. C. Beale	1·77	·56	27	16	52·0	21	28·0	31
Kinver	Mr. T. Bolton	2·06	·59	27	23	56·0	21	20·0	31
Walsall	Mr. W. E. Best	2·04	·53	27	21				
Grammar School, Burton	C. U. Tripp, Esq.	2·33	·58	27	21	55·0	21	22·0	30
Patshull Gardens	T. W. Dell, Esq.	1·92	·63	28	12	54·0	15	24·0	31
Weston-under-Lyziard R'tory	Hon. & Rev. J. Bridgeman	2·16	·63	27	23	53·0	21	23·0	30 & 31
Wrottesley	E. Simpson, Esq.	1·96	·68	27	16	54·5	22	20·8	30
Tamworth	W. Arnold, Esq.	2·03	·47	27	18				
Alstonfield Vicarage	Rev. W. H. Purchas	5·92	·92	7 & 14	15	51·8	21	17·0	25
Tean Vicarage, near Cheadle	Rev. G. T. Ryves	3·27	·75	27	21	54·0	21	24·0	30
WARWICKSHIRE.									
Coundon, Coventry	Col. R. Caldicott	1·92	·54	27	19	55·0	21	27·0	30 & 31
Coventry	J. Gulson, Esq.	1·83	·52	27	18	57·0	21	24·0	30
Bickenhill Vicarage	W. R. Capel, Esq.	1·90	·50	27	19	54·0	21	25·5	31
St. Mary's College, Oscott	Rev. S. J. Whitty	1·79	·52	27	20	54·4	21	23·4	30
Henley-in-Arden	T. H. G. Newton, Esq.	1·78	·55	28	11	55·0	21	25·0	30
Rugby School	Rev. T. N. Hutchinson	1·77	·53	3	19	55·0	21	25·0	30
DERBYSHIRE.									
Buxton	E. J. Sykes, Esq.	8·01	1·36	13	24	51·8	21	18·0	30
Brampton S. Thomas	Rev. J. M. Mello	2·28	·40	27	17	53·0	20	22·0	29
Stoney Middleton	Rev. U. Smith	3·71	·66	13	17	53·0	21	16·0	31
Fernslope, Belper	J. G. Jackson, Esq.	2·66	·62	27	23	55·0	21	26·0	25 & 30
Matlock Bath	R. Chadwick, Esq., jun.	3·86	·72	27	19	51·0	21	22·5	25
Linacre Reservoir, Ches'field	C. E. Jones, Esq.	2·05	·53	31	18				
Willesly Gardens, Cromford	J. Tissington, Esq.	3·43	·53	4	15				
Stuffynwood Hall	R. Rolfe, Esq.	2·01	·40	27	19	54·0	21	23·0	24
Old Hall, Spondon	J. T. Barber, Esq.	2·23							
NOTTINGHAMSHIRE.									
Hodsock Priory, Worksop	H. Mellish, Esq.	1·46	·35	27	14	57·4	21	23·1	30
Grove House, Mansfield	W. Tyrer, Esq.	1·97	·46	27	19	55·4	21	24·0	30
LEICESTERSHIRE.									
Foxton Locks	Union Canal Company	1·33	·41	3					
Loughborough	J. Giles, Esq.	2·12							
Belmont Villas, Leicester	H. Billson, Esq.	1·66	·50	27		55·8	21	27·5	31
Syston	J. Hames, jun.	1·73	·34	27	23	53·0	22	25·0	26
Kibworth	T. Macaulay	1·82	·52	27	22				
Waltham-le-Wold	E. Ball, Esq.	1·93	·52	27	14	52·0	21	23·0	25
Little Dalby Hall	G. Jones, Esq.	1·62	·48	27	15	54·0	21	21·0	18, 25, 26, 30, & 31
Town Museum, Leicester	W. J. Harrison, Esq.	1·57	·48	27	19	55·9	21	26·0	25
Market Harborough	S. W. Cox, Esq.	1·65	·48	27	14	53·0	21	22·0	30
Ashby Magna	Rev. E. Willes	1·61	·44	27	19	51·0	21	23·0	30
Coston Rectory, Melton	Rev. A. M. Rendell	1·82	·44	27	17	54·8	21	19·8	18
Belvoir Castle	Mr. W. Ingram	1·71	·42	28	16	56·0	22	23·0	30
NORTHAMPTONSHIRE.									
Towcester Brewery	J. Webb, Esq.	1·37	·46	27	16				
Castle Ashby	R. G. Scriven, Esq.	1·40	·40	27	15			24·0	11
Sedgebrooke	C. Markham, Esq.	1·32	·47	3	19	57·0	22 & 23	23·0	11
Croyland Abbey	E. Sharman, Esq.	1·80	·36	3	20			16·0	11
Kettering	J. Wallis, Esq.	1·53	·35	27	19	55·0	22	26·0	26
Althorp	W. F. Jakeman, Esq.	1·28	·42	3	16	54·0	21	23·0	10 & 31
Northampton	H. Terry, Esq.	1·18	·33	8	19	56·0	22	26·0	29
RUTLANDSHIRE.									
Burley-on-the-Hill	W. Temple, Esq.	1·31	·32	28	14	62·0	21	23·0	30
Tickencote	W. Hayes, Esq.	1·34	·29	27	11	52·0	21	24·0	18
OXFORDSHIRE.									
Radcliffe Observatory	Mr. J. Lucas	1·52	·51	3	17	56·4	21	25·1	30
CUMBERLAND.									
Spital Cemetery, Carlisle	Mr. T. Bell	3·00	·60	27	21	54·2	6	22·7	30
ISLE OF WIGHT.									
Ventnor Hospital	H. Sagar, Esq.	1·90	·42	27	15	57·6	15	31·0	31
CORNWALL.									
Altarnun Vicarage	Rev. G. Tripp	2·95	·80	26	14	55·0	26	21·0	12

REMARKS ON THE WEATHER OF JANUARY.

Haughton Hall.—Two inches of snow fell on 25th. Woolstaston. Early part of month very mild. Primroses in blossom in first week. Leaton Vicarage.—Cloudy and mild, with fogs, till 23rd. Snow and rain 24th to 26th, followed by severe frost to end of month. Bishop's Castle.—Rainfall about half the average of last five years. Burghill, Hereford. Barometer high, especially from 9th to 20th. Warm period, with high W.S.W. winds, on 21st and 22nd. West Malvern.—Mean Temperature, 38·8°. Barometer, 30·03. Barlaston.—Rainfall one-fifth of an inch above average. Patshull.—A very mild month. Burton.—First fortnight mild; the last cold and wintry, frequent snow. Skating on shallow pools on 31st. Trent in flood 28th and 29th. Weston-under-Lyziard.—Snow 23rd to 25th; snow, with rain, 26th and 27th. Lightning on 25th, between six and seven p.m. Tamworth.—Barometer on 12th reached 30·72in. Rainfall below the average. A good month for working on the land. Alstonfield Vicarage.—Snow fell early on morning of 23rd, and ground remained covered to end of month. Coventry.—A mild and open month, with some frosts after the 24th. Noticed the small bat flying about on several mild evenings. Rugby School.—Mean height of barometer for January 30·155 inches, (corrected for temperature and sea level.) Highest reading, (corrected,) 30·655 inches, on the 12th. Lowest reading, (corrected.) 29·424 inches, on the 25th. Bickenhill Vicarage.—A damp month, with hard frost on last three days. Heavy gale on 20th to 22nd. Brampton S. Thomas.—Temperature above the average. Rainfall about the mean for the last ten years. Snow fell on three days, but to no great depth. Gale on the 25th. Wild honeysuckle in leaf on the 4th. Buxton.—Dull heavy weather prevailed in earlier part of the month, and was succeeded by slight falls of snow. Thunder and lightning on evening of 23rd, followed by snow and frost. Belper.—Mean temperature on month was 39·3°. Linacre Reservoirs.—Rainfall about the average, but only half the fall of January, 1877. Stuffynwood Hall.—First half of month was mild. Snow on 22nd to 28th. Westerly gale on 21st. Spondon.—An unusually dull and damp month, with little sunshine. Worksop.—Warm until the 23rd. Snow fell on 24th. High winds on 15th and 16th, and 20th to 23rd. Syston.—Rainfall below the average, and just half that of January, 1877. Kibworth.—Rainfall below the average, but remarkable for the many days on which some fell. Waltham-le-Wold.—Very mild and open until the last week. Market Harborough.—Dense fog on 18th. High winds 20th to 24th. Snow on 24th. Ashby Magna.—Extremely mild month, except the last week. Coston Rectory.—Aconite in flower on the 5th. Snow on 10th and 25th. Gale on 20th and 21st. Belvoir Castle.—Temperature above the average. S. and S.W. winds on fifteen days; N. and N.W. winds on fifteen days. Vegetation was active during the greater part of the month. Violets, primroses, and daisies were in bloom, and Aconite blossomed on the third week. Rather sharp hoar-frost on the three last days of the month; ice two inches in thickness formed. Castle Ashby.—Rainfall unusually small for January. The average of the last five years is 2·42in. for this month. Sedgebrooke.—Snow 23rd to 25th. Westerly winds prevailed. Croyland Abbey.—Snow on 24th. Burley-on-the-Hill.—Mild and fine till 21st. Snow 26th to 28th. Radcliffe Observatory.—Drizzle or fog throughout the month. Snow fell on 10th and 25th, and sleet on 8th and 23rd. Ventnor.—Sea fogs on two or three days early in month. Barometer unusually high; reached 30·616 (uncorrected.) Slight fall of snow on 25th. Altarnun Vicarage, Cornwall.—The driest January but one (1876) in fourteen years, in consequence of prevailing N. and E. winds. Sharp frost 9th to 12th, and for last week of month.

A PRODUCTIVE POND.

At the recent conversazione of the Birmingham and Midland Institute, one of my correspondents, to whom I had sent some *Melicerta ringens* from here, introduced himself to me, and incidentally mentioned that he had found *Conochilus volvox* very abundant in a pond near Redditch. (See his letter, S.S.R., Redditch, in "Midland Naturalist," page 50.) As I had only seen this interesting rotifer once before, (at a *soirée* of the Quekett Club,) nor ever heard of its having been found in this neighbourhood previously, I gladly made an appointment to visit the pond, which I did on the following Saturday. I was much pleased on the first dip to find many specimens in my bottle, and I hastened, as time pressed, to carry home as many as possible. Of these I sent a bottle, containing nine groups, to a correspondent at Croydon, (a twenty-four hours' post,) of which only two groups survived the shaking of the journey, the individual rotifers, of which the groups consist, being so easily separated. After this I found my stock very rapidly disappeared, owing, (I attributed) to the number of larvæ and entomostraca which I had imprudently allowed to remain with the rotifers, and I, therefore, decided to pay another visit to Redditch. This time, as I was carefully examining the water at the pond side, I found a number of *Melicerta* on the duck-weed, of which I brought home a small quantity to my friend's house. It was a surprise to him, as he had, up to that time, overlooked it. As soon as he recognised the object, by the aid of his pocket lens, he called my attention to the large size of the pellets, of which the cases were built up. On reaching home I put the *Melicerta* under my compound microscope, and was surprised to see how marked a difference there was in the size and shape of the pellets as compared with those of the *Melicerta* I find in the pool here. The pellets of the latter have, where they project from the exterior of the case, a nearly hemispherical surface, whereas those of the specimens from Redditch appear to cover the case with small cones, nearly of the shape of sugar loaves; and on further examination I also see a great difference in the shape of the pellet cup, quite equivalent to the different shape of the pellets. I cannot help thinking this is a variety of *Melicerta* distinct from the one I have usually found. I have sent specimens to F. A. Bedwell, Esq., and to Dr. Hudson, for their opinion. Further examination of the duck-weed, from Redditch, showed me that it abounded with another rotifer I had never found before, *Cephalosiphon limnias*, figured by Dr. Hudson in the October, 1875, number of the "Monthly Microscopical Journal;" and curiously enough I also found a single specimen of what I call *Chætospira cylindrica*, which he figures in the same plate as *Archimedea (Chætospira?) remex*, and which he had found associated on the same weed *(Anacharis)* with the *Cephalosiphon limnias*. This infusorian I found here (the Hyde Pool) in August, 1872, on *Myriophyllum*, and it was named by Mr. W. Saville Kent, to whom I sent specimens, *Chætospira cylindrica*. I still further found on this duck weed, amongst other infusoria, many specimens of *Vaginicola decumbens* and *Epistylis natans*. Subsequently I found three *Tardigrada*, or water bears, diligently creeping about, and tugging away at the decaying portions of the *Lemna*. I cannot help saying I have seldom come across a locality of better promise to a naturalist taking any interest in pond life.—Thomas Bolton, Hyde House, Stourbridge.

A WINTER'S RAMBLE.

BY THE REV. JOHN CASWELL.

I have thought that it would prove interesting to put before the readers of the MIDLAND NATURALIST, and especially those who are fond of Botany, the results of a ramble in the neighbourhood of Birmingham during the first week of the new year. Several paragraphs had appeared in the newspapers of that week, calling attention to the fact that primroses and violets were already in flower. I notice also that a correspondent (E. W. B.) in the February number of the magazine gives a list of flowers gathered from his garden on Christmas-day last. The mildness of the present winter naturally led us to expect that the winter and early spring flowers would blossom sooner than usual; and, therefore, one was not altogether surprised to hear of primroses and violets having already appeared. But the addition given by E. W. B. is one worthy of notice, as it is evidence not only of a mild winter, but of a very mild autumn also; otherwise, such flowers as roses, stocks, mignonette, &c., would not be in blossom at this season of the year, as in the nature of things they are killed by the frosts and cold nights which usually characterise the autumn season. I therefore venture to add to the lists already given the plants I found in flower during the first week of January last. For some years I have made a ramble during that particular week, and always in the same locality, in order to note what plants were in bloom, as a record of the mildness or severity of the autumn and winter seasons, and for other reasons. Whilst in preceding years I have not found on an average more than twelve plants in flower in the district to which I limited my survey, this year I have recorded upwards of eighty British wild flowers, besides an unusually large number of garden flowers. The following is the list:—

Caltha palustris.
Helleborus fœtidus.
Capsella Bursa-pastoris.
Draba verna.
Cardamine hirsuta.
Barbarea vulgaris.
Sisymbrium officinale.
Cheiranthus Cheiri.
Sinapis arvensis.
Viola odorata.
Viola tricolor.
Lychnis vespertina.
Sagina procumbens.
Stellaria media.
Stellaria graminea.
Arenaria trinervis.
Cerastium viscosum.
Cerastium vulgatum.
Geranium sanguineum.
Geranium molle.
Geranium Robertianum.
Ulex Europæus.
Ulex nanus.
Vicia hirsuta.
Geum urbanum.
Alchemilla arvensis.
Spergula arvensis.
Sedum reflexum.
Chærophyllum temulentum.
Hedera Helix.
Galium aparine.
Sonchus oleraceus.
Crepis virens.
Leontodon Taraxacum.
Lapsana communis.
Carduus nutans.
Senecio vulgaris.
Bellis perennis.
Chrysanthemum Leucanthemum.
Matricaria Parthenium.
Matricaria inodora.
Anthemis nobilis.
Arbutus Unedo.
Ilex aquifolium.
Myosotis collina.
Veronica hederæfolia.
Veronica Buxbaumii.
Veronica agrestis.
Teucrium Scorodonia.
Ballota nigra.
Lamium album.
Lamium purpureum.
Lamium amplexicaule.
Primula vulgaris.
Armeria maritima, (in gardens.)
Plantago major.
Plantago Coronopus.
Polygonum aviculare.
Euphorbia Peplus.
Euphorbia helioscopia.
Buxus sempervirens.
Urtica urens.
Galanthus nivalis.
Luzula campestris.
Calluna vulgaris.
Erica cinerea.
Spergularia rubra.
Daphne mezereon.
Scleranthus annuus.

In addition to these, I have found several species of Rubus, Rumex, Cyperaceæ, Juncaceæ, and Graminoæ. This list will, I dare say, cause surprise to some, and perhaps doubt; but in all cases, except one or two, the specimens I gathered were very good ones, and would not have disgraced any collector's herbarium. I have not included plants found in bud, though I have taken a note of them, nor those in fruit, whose petals had evidently just fallen; but only those actually in blossom. I found them all within a few miles of Birmingham. I had not the opportunity to wander through Sutton Park, or doubtless some few others would have been added. Many of the localities where these plants were gathered are in exposed situations, and therefore one would have imagined it useless to look for them; and when we remember that in the Christmas week there had been several nights of sharp frost, and snow had fallen also, it is all the more surprising that so many different specimens should have been found. I am somewhat astonished that no list has appeared from the Southern Counties, which are so much warmer than our own Midland Counties; for, judging from a letter received from a friend in Devonshire, I should suppose that most of the summer flowers are still in bloom. He compares the Christmas week there to the Australian Christmas, and says that he gathered wild strawberries *(Fragaria vesca)* in abundance on Christmas-day. He also mentions that two nests with eggs had been found—the one a thrush's, the other a hedge-sparrow's. All these facts are certainly very interesting, and point to a most exceptionally mild winter.

Of the foregoing list some are plants that flower at this season of the year, and a mild winter only accelerates their flowering; some few others may be seen in flower all the year through; but by far the greater number are, so far as the experience of the last ten years allows me to speak, strangers to the late part of the autumn, and certainly to the winter. There are several absent that I have recorded in other years, such as *Ranunculus acris* and *R. sceleratus*, *Stellaria uliginosa*, *Erica Tetralix*, *Lychnis diurna*, *Nepeta Glechoma*, *Senecio Jacobæa*, &c., and, strange to say, I did not find *Potentilla Fragariastrum*, a very early little flower. Neither did I find *Tussilago Farfara*. The mild weather still continues, and I notice that the hazel and willow are blossoming, and the hawthorn leaves already appearing. Doubtless others of your correspondents can add a few more to the list I have given. I think the record would be worth the while; for careful observation may enable us, in course of time, to ascertain with something like accuracy in what manner and to what degree plants are affected by the weather. So far we notice that, whilst certain plants live through the autumn into the winter, under certain conditions of weather, others, that appear much hardier, do not; whilst, for example, *Ranunculus acris* or *Centaurea nigra* will be found sometimes in January, after a severe and cold autumn, yet when the latter season has been mild, and the winter also, they are not to be found.—St. Mary's College, Oscott, February 18th, 1878.

Correspondence.

Organised Work for Natural History Societies.—The existence of "The Midland Union of Natural History Societies" is a matter for congratulation. The desultory efforts and resultless labours of many students might possibly be directed and utilised to good purpose if the Council would undertake the work of organisation. May I suggest that one part of the duties of that body should be to draw out a scheme for combined labours? Why should not the "Midland Naturalist" publish from time to time the results of the systematised labours of the naturalists of central England? Why should not all the Societies in the Union be engaged in preparing for this purpose, and under the direction of a competent committee, a complete account of the flora, fauna, and geology of the Midland Counties? The work would be arduous and not easily done; but a proper division of labour, working within definite lines, for well-considered purposes, would find excellent occupation for many of our members, free from the charge of desultoriness. I feel sure this suggestion deserves thoughtful consideration, and I hope the Editors will invite communications, offering suggestions, from their many readers.—F. T. L. [We *do* invite such communications, and think F. T. L.'s remarks most valuable.—Eds. M. N.]

Freshwater Life.—Allow me as a subscriber to your journal to ask S. S. R., of Redditch, and other naturalists privileged to live near Midland ponds with such inhabitants as he describes, to help me to specimens. I will send bottles and pay all expenses with pleasure. But I live here in a district covered with glacial clay, which seems inimical to rotifer life. A paper of mine on *Melicerta ringens*, published in the "Monthly Microscopical Journal" for December last, brought me one of Mr. Bolton's (of Stourbridge) delightful little bottles. He still assists me, but I should be glad of extended help. To any gentleman who takes an interest in the subject, I shall be happy to send a copy of my paper on *M. ringens*. It may serve as lines to work on.—F. A. Bedwell, Fort Hall, Bridlington Quay, Yorks.

The Meaning of Knowledge.—I think Mr. Mott has unduly limited the meaning of the word knowledge. The verb "to know" is used to express two classes of cognition for which in many other languages two distinct verbs are used. Thus, we have in French *connaitre* and *savoir*, in German *kennen* and *wissen*, in Latin *novi* and *scio*. The first words of each of these pairs are used for knowledge acquired by means of the senses, and thus correspond nearly to the English "to be acquainted with" or "aware of;" whilst the others are used for knowledge obtained by the reasoning faculties, and signifies to comprehend or to know thoroughly.—C. J. Watson.

Accuracy in the Use of Scientific Terms.—It is necessary to say a few words in reply to your correspondent, although it is hardly possible to imagine that any student in Botany would, for one moment, suppose there could be anything animal-like (except in the one respect) in the two distinct existences of the same plant being likened to the two existences of an insect, (the caterpillar or butterfly.) Care was also taken to explain the exact meaning of the terms used. Animals and plants copy each other—some in one particular and some in another. The sea-anemone is an animal, and only takes its name from its resemblance (in one respect) to a plant. No one would think of confusing the Bee Orchis or the Butterfly Orchid with a Bee or a Butterfly; the Sunflower, Moonwort, or Windflower, with the Sun, Moon, or Wind; the Hare's-foot fern or Stag's-horn fern, with a Hare or a Stag; the Cats-tail, Dog-rose, Bull-rush, or Horseradish, with a Cat, Dog, Bull, or Horse. The Oak-fern does not bear acorns, nor the Holly-fern berries, nor the Beech-fern nuts. We might, also, enumerate Lady's-slipper, Harebell, Buttercup, Cowslip, Snowdrop, Iceplant, and many others. Perhaps it would have been better to have described these two distinct generations of fern life as—1st, the prothallium-state, and 2nd, the perfect-fern—the first as *sexual* and the second as *asexual*. With regard to the remaining passages, "the spiral filaments swarmed about the pistillidium in numbers," "these filaments being tossed into the air, and by landing in certain cups are said to fertilise the plant," and "these, from their activity, are called Animalcules;" they are the expressions used by Count Suminski and Mercklin, and have been copied and used by such authorities as Henfrey, Moore, &c., and therefore may again be used with impunity.—E. J. Lowe.

Preservation of Fungi for the Herbarium.—Would some of your readers kindly describe the best methods of preserving fungi?—C.T.M.

Entomological Club.—A London correspondent writes to us as follows:—"At a meeting held at the house of Dr. E. Hart Vinen, F.L.S., on the 30th January, Dr. Cobbold, F.R.S., communicated a notice of an interesting discovery made by Dr. Manson, at Amoy, China. It appears that the mosquito *(Culex)* forms the intermediate host of the *Filaria sanguinis hominis*, or microscopic filariæ living in human blood (hæmatozoa.) In the course of the evening it was stated that most of the worms found in insects were imperfectly developed entozoa. Filariæ from three to five inches in length had frequently been noticed in dermaptera and coleoptera; especially in *Forficula*, *Phosphuga*, and *Feronia*. Dr. Cobbold exhibited adult human Filariæ, *(F. Bancrofti,)* from Australia, and also a beetle, *(Passalus cornutus,)* known to be infested with a species of Ascaris in the mature state *(A. infecta.)* Many of the entomologists of the Metropolis were present at the meeting (Messrs. Pascoe, Dallas, Smith, Sheppard, Grut, and Stevens.) Other well known naturalists, including Drs. Murie and Ord, took part in the discussion. Dr. Vinen (whose fernery proved a great attraction to the botanists present) remarked, in the course of his observations, that notwithstanding the great age of the Club it exhibited no signs of decay."

Mosses.—A warm interest in these lovely plants has been created in my mind, from having had my attention recently awakened to their variety and great beauty by the sight of a collection made by a local botanist many years ago. I am quite amazed at their numbers and their individual beauty. I must confess an almost entire ignorance about them; but I am really most anxious to have my ignorance displaced by knowledge. Will one of the bryological readers of the "Midland Naturalist" do me and others, who may desire the information—I am sure there must be many such—a great kindness by writing a paper pointing out what steps we should take, and what books consult, in order to be able to discriminate the various English mosses. The instructions, to be really useful to myself, should commence at the very beginning. I sincerely hope some qualified botanist will undertake this labour of love, and that room for such paper may be provided by the Editors.—M. B. L., Coventry. [Our correspondent will see that his desires have been anticipated, and that our present number contains the first of a series of elementary papers on the study of the mosses.—Eds. M. N.]

A Curious Case of "Reparation."—Last November I was fishing in one of the pools on the border of Sutton Park, and caught a small pike weighing between two and three pounds. On getting him into the punt I noticed a singular hump on the back just in front of the dorsal fin. I took him home, and my doctor looking in next morning I asked him to examine into the cause. On laying bare the back bone we found that at some time or other, but not very recently, the bone had been absolutely severed, probably by a bite from another fish, and that a new formation of bone had taken place, thus slightly lengthening the spine, and forming a slight hump. Of course the spinal cord was not broken when the injury was inflicted, or the fish could not have survived. I am aware this is not an isolated case, as one if not two previous instances of a similar kind have occurred, but as it is certainly very rare it seems worth recording. The fish appeared to have been in no degree affected by the hump as to liveliness or strength. I had the portion of bone showing the abnormal growth cleaned, and presented it to Mr. Montagu Browne, Naturalist, Broad Street, Birmingham, who will, no doubt, be willing to show it to anyone interested.—Wm. Taylor, Edgbaston.

Preserving Fish.—A description of the best methods of preserving fish in a natural state for the cabinet, particularly fresh-water kinds, is much desired by an amateur collector.—T., Nottingham.

Magpie and Cuckoo.—The fact recorded by the Rev. O. M. Feilden as to the nesting of the Magpie is extraordinary, but requires more evidence ere we can accept as proved that which may have been evolved from a fortuitous chain of circumstances. Concerning the question as to that feathered mystery, the Cuckoo, it will I think have come under the notice of every observer, as of myself, that now and then a Cuckoo's egg is found under circumstances—such as in a nest situated in a brush-wood stack—which positively forbid the hypothesis that it could have been laid in the ordinary manner. In the *Field* of July 1st, 1876, an account is given of the finding of a Cuckoo's egg in a Flycatcher's nest in a hollow tree, the orifice being too small to admit the entrance of any bird so large as a Cuckoo. Again the same paper of July 15th, 1876, notices the discovery of a young Cuckoo in a Wren's nest, situated on the rafters of a shed, in such a position as to prevent the ingress of a bird any larger than its foster mother. That the Cuckoo must occasionally lay its egg first and then carry it in its bill, is, I think, partly proven by the fore-going instances, even without the testimony of a traveller—Le Vaillant (?) I think—who actually shot a South African Cuckoo in the act of carrying its egg in its bill. Morris and other authors mention—on apparently good authority—that the European Cuckoo (*Cuculus canorus L.*) also has been shot in the act of carrying its egg, and if so does not this prove the possibility of the introduction of the egg by the bill into nests difficult of access? Howbeit, the subject is one infinitely interesting, and well worthy of being worked out in the coming spring by the ornithological readers of the "Midland Naturalist."—A. M. B., Birmingham.

Gleanings.

The Wollaston Gold Medal of the Geological Society has just been awarded to Dr. Thomas Wright, F.R.S.E., F.G.S., &c., President of the Cheltenham Natural Science Society, (one of the societies forming the Midland Union of Natural History Societies,) in recognition of his detailed researches, continued for many years, on the structure, classification, and distribution of the *Fossil Echinodermata*, published by the Palæontographical Society, and for his other "Memoirs on the Jurassic and Tertiary Strata of England," contributed to the Geological and other kindred societies.

Professor Fries, of the University of Upsala, the well-known Swedish Botanist, died recently at the age of 83.

The Rev. Andrew Bloxam, M.A., Rector of Harborough Magna, died, we regret to have to record, on February 2nd, in his 77th year. He was one of the best botanists Warwickshire has produced. In an early number we purpose giving a memoir of his life and some account of his labours as a Naturalist.

The late Andrew Murray, F.L.S., has, for some years past, been known as a hard-working Entomologist, engaged in investigating the injury done to field and garden crops by insects. The tiller of the soil has not known how to meet his insect foes, and has even confounded friends with foes by not knowing the metamorphic phases through which insects pass. Connected officially with the Royal Horticultural Society, to whose scientific committee questions respecting damage to crops are often referred, Mr. Murray was so impressed with the general ignorance of insect life that he made suggestions to the Privy Council which led to the formation of a collection of economic entomology, under the direction of the Science and Art Department. This collection, now for some time past at the Bethnal Green Branch Museum, was intended by Mr. Murray as a type museum for instruction in agricultural districts. Its formation had occupied the greater part of his energies for years past, and his last few days at work were devoted to its completion. He died on the 9th January.

Thomas Vernon Wollaston.—This well known Entomologist died on the 4th inst., at his residence, Teignmouth. We copy the following from *Nature* :—"To students of British Entomology, Mr. Wollaston is best known by his early papers in the *Zoologist* and Stainton's *Entomologists' Annual and Weekly Intelligencer*, and by his revision of *Atomaria* in *Transactions of the Entomological Society*, 1877. He published many descriptive and analytical papers, almost exclusively on *Coleoptera*, in the above-named publications, the *Journal of Entomology*, and the *Entomologists' Monthly Magazine* ; but his *magnum opus* is the well-known 'Insecta Maderensia,' published in 1854, the results of his sojourns in Madeira, to which he first went in 1847. The acquisition of fresh material compelled him to write his 'Coleoptera Atlantidum,' an arduous, critical work of nearly 700 pages, followed in 1867 by the 'Coleoptera Hesperidum,' a valuable descriptive account of the species of the Cape Verde Archipelago, visited in 1866. His last contribution to geographical entomology, 'Coleoptera Sanctæ-Helenæ,' 1877, contains a multiplicity of unexpected developments."

Leicestershire Flora.—Many years ago Mr. T. R. Potter, of Wymeswold, projected a New History of Leicestershire. For this work the late Rev. Andrew Bloxam prepared and supplied to Mr. Potter a copious list of wild plants found in Leicestershire. The history was never issued, and it is unknown what became of Mr. Bloxam's MS. Was it sold, with other papers, after Mr. Potter's death? If so, to whom, and who is now the possessor of the papers? Any information on the subject communicated to the Editors of this magazine will be gladly received.

Aquaria.—It may be interesting to some of our readers to know that Mr. W. A. Lloyd, of the Crystal Palace Aquarium, is not only engaged in preparing the volume to which we referred on page 54, but is also writing a series of very plain and clear articles (which will probably extend to eight or ten) on the management of Aquaria for the *Englishwoman's Domestic Magazine*, (Ward and Lock.) The first appeared in the number for December last, and the second in the February number. The articles, though written mainly for the use of ladies, are, of course, equally adapted to anyone who may be desirous of understanding the how, why, and wherefore of Aquarium management.

West London Entomological Society.—At the weekly meeting of this society, on February 8th, Mr. J. Smith exhibited a very extraordinary variety of *L. conigera*, showing all the markings and colour of the upper wing on the left under wing, particularly the white central spot, which made it appear as if the under wing had been folded up on the upper one and taken the exact impression. It was taken at the Welsh Harp, near London, 1876, by the exhibitor.

Phenological Observations.—The Rev. T. A. Preston read an interesting paper on this subject before the Meteorological Society on December 19th, 1877. He stated that the order of flowering had been the same in 1877 as in 1876. Plants begin to flower first in the south-west of England, and thence in gradation up to the north of Lincolnshire. Damp appears to act more powerfully than cold in retarding the flowering of some plants. The year 1877 was an unfavourable one for vegetation generally. The bitter cold of May checked the growth of plants, and by the autumn there was little new wood, and that not properly ripened.

All observers who desire to aid in this interesting work should obtain the "Instructions for the Observation of Phenological Phenomena," (Williams and Strahan, price 6d.,) drawn up by Mr. Preston, which contains lists of Plants, Insects, and Birds to be observed, together with Rules, Approximate Dates, Remarks, &c.

Fossil Insects.—At the meeting of the Geologists' Association on January 4th, Mr. H. Goss read a paper on the fossil insects of the secondary period. Mr. Goss pointed out that nearly all the British specimens known are from the Purbeck beds and from the Lias. Some few have been found in the Wealden, and a few elytra of Coleoptera were recorded from the Kimmeridge clay, the forest marble, and the great oolite. Nearly all the other European specimens are from the Solenhofen slate of Bavaria, or from the Swiss Alps. The paper was a lengthy one and rich in detail, and will appear in the proceedings of the Association.

Our Union.—"The Birmingham and Midland Institute Scientific Society," "The Cheltenham Natural Science Society," and the "Evesham Field Naturalists' Club" have joined the Midland Union of Natural History Societies during the past month. The Union now includes twenty Societies. Societies which have not yet joined are invited to do so.

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—General Meeting, January 29th.—Mr. W. B. Latham read a paper on "Orchidaceæ, British and Exotic," in which he dwelt at some length on the treatment Orchids require under cultivation, their various kinds of inflorescence, habits, modes of fertilisation, &c. The paper was illustrated by diagrams and living plants. Mr. W. B. Grove, B.A., exhibited fronds of a fern, supposed to be a hybrid between *Blechnum corcovadense* and *Lomaria gibba*. Annual Meeting, February 5th.—The President, (Mr. Edmund Tonks, B.C.L.,) in the chair. The report gave an encouraging account of the present state of the society. There are 266 members, being an increase of thirty-one during the year. The report and treasurer's statement of accounts were unanimously adopted. Mr. Tonks was re-elected president, Mr. Walter Graham and Mr. Edward W. Badger were elected vice-presidents. The following re-elections were also made :—Mr. Charles Pumphrey, treasurer ; Mr. John Morley, secretary ; Mr. James E. Bagnall, librarian ; Mr. W. H. Cox and Mr. J. Levick, curators. Biological Section, February 12th.—Mr. W. R. Hughes, F.L.S., was elected chairman of the section, and Mr. A. W. Wills secretary for the ensuing year. Mr. J. Bagnall exhibited, on behalf of Mr. C. T. Parsons, an abnormal form of *Lentinus lepidus*; for Mr. Joseph Bragg a fasciated stem of common holly *(Ilex ;)* collected by himself, a fasciated state of *Picris hieracioides*, also a remarkable instance of phyllody in all parts of raceme and flowers of Foxglove *(Digitalis.)* Mr. Edmund Tonks exhibited and described a fine specimen, in good fruit, of the Gulf-weed *(Fucus natans.)* Mr. J. Bagnall exhibited, on behalf of Mr. Joseph Cotton, fine specimens of the seventeen year Cicada, *(Cicada septendecim,)* and read an interesting account of them, sent by Mr. J. F. Weston. Mr. John Morley exhibited, and gave a series of notes upon, a variety of *Scolopendrium vulgare*, var. *variabile*. A discussion on the hybridisation of ferns followed. Mr. Slatter exhibited a slide of *Nostoc verrucosum*. A vote of condolence with the widow of the Rev. A. Bloxam, of Harborough Magna, was unanimously passed.

BIRMINGHAM AND MIDLAND INSTITUTE SCIENTIFIC SOCIETY.—January 30th.—Mr. W. G. Fretton read a paper on "The Artisan, his Recreations and Hobbies." Mr. Fretton mentioned several artisans who, by steadfastly cultivating their hobbies, had become respectively celebrated ornithologists, botanists, geologists, and proficients in mechanical arts. February 13th.—Mr. T. F. Webb read a paper on "Electro-deposition."

NOTTINGHAM LITERARY AND PHILOSOPHICAL SOCIETY.—NATURAL SCIENCE SECTION.—January 9th.—Mr. J. Burton, F.R.M.S., read a paper on "Monads." The paper was based on the researches of Dallinger and Drysdale, and treated of the life history of several of these "forms" or genera. January 16th.—A paper on "Teredos or Wood-boring Mollusca," was read by Mr. B. Sturges Dodd, (and not as erroneously stated, p. 27, on December 19th, 1877.) January 23rd.—A paper was read by the Hon. Sec., Mr. I. Mosley, on "The Geological Structure of Derbyshire," illustrated by maps, sections, fossils, and rock specimens. January 30th.—General Microscopical Meeting.—The President of the Section, Mr. Edwin Smith, M.A., gave an interesting account of the construction and management of the microscope. Numerous objects were viewed under microscopes. February 20th.—Mr. E. Smith, M.A., read a paper on "The Geology of the Isle of Wight," which was illustrated by lantern views.

NOTTINGHAM NATURALISTS' SOCIETY.—February 6th.—"Notes on Collecting and Preserving Natural History Objects," by Messrs. C. Musson and L. Lee, illustrated by mounted specimens. February 13.—Microscopical Evening. Lecture on "Stomata; their forms and use," by Mr. L. Lee.

RUGBY SCHOOL NATURAL HISTORY SOCIETY.—February 9th.—First meeting this term. Mr. G. Jones, School House, was elected secretary. A practical paper on "Pupa-digging" was read by Mr. J. Lea, in which some of the ordinary maxims of the art were criticised in the light of practical experience. A paper was also read on "Humming Birds," illustrated by sketches. The Rev. T. N. Hutchinson exhibited the Telephone, giving a short explanation of the principle. Those present then tested the instrument by experiments, which were completely successful.

SEVERN VALLEY NATURALISTS' FIELD CLUB—February 19th.—The annual winter meeting was held at Bridgnorth. The following officers were appointed for 1878:—President, Mr. T. Martin Southwell; Vice-Presidents, the Rev. F. A. Mather, Mr. R. H. Colley, Mr. J. G. P. Smith, Mr. A. Mathias; Honorary Secretary, Mr. Rowland W. Ralph. The following Field Meetings were fixed:—Malvern, June 4th, 5th, and 6th; Hawkestone, July 2nd; Ellesmere or Welshpool, August 6th. A beautiful collection of New Zealand ferns was exhibited by Mr. Southwell.

TAMWORTH NATURAL HISTORY, GEOLOGICAL, AND ANTIQUARIAN SOCIETY.—February 4th.—Mr. W. Wright Wilson, F.L.S., M.R.C.S., delivered a lecture on "Light, its Sources and Effects," illustrated by well-executed diagrams. Interesting experiments were shown in connection with the lecture by Monsieur Morand.

Notices to Correspondents.

Communications received from S. L. M., Huddersfield, (thanks;) T. P., Stroud, (will appear in next number;) C., Nottingham, (anonymous communications not admissible.)

We have several articles and letters in type, which for want of space we are obliged to hold over till next month.

Copies of our prospectus, containing lists of contents of "Midland Naturalist" for January, February, and March, will be sent to any of our readers who will kindly undertake to distribute them among friends likely to become subscribers.

Notes on any Natural History subject are invited.

Communications, authenticated by name and address, should reach us before the 18th of the current month, and be addressed the Editors of the "Midland Naturalist," *Midland Counties Herald Office*, Birmingham.

THE BIRMINGHAM AQUARIUM.

BY W. P. MARSHALL, ESQ., M.I.C.E.

The first step towards the attainment of this desirable object (now about to be realised) was the appointment of a Committee of the Birmingham Natural History and Microscopical Society four years ago, to obtain information on the subject, with the view of promoting an efficient Marine Aquarium in Birmingham; the subject having been introduced by the President, Mr. W. R. Hughes, in an address at the annual soirée of the Society. This Committee, after procuring information from different Aquaria in this country and on the continent, sent a deputation to visit and examine the Crystal Palace Aquarium and the Brighton Aquarium, for the purpose of obtaining practical information about the requirements to be provided for, and specially to enquire into the two different systems of circulation and aeration of the water that are carried out at those places and the results of their working.

In the Crystal Palace Aquarium a constant circulation of the water is maintained night and day throughout the series of tanks, in connection with a large reserve of water in the store tanks, amounting to five times the contents of the show tanks; and the aeration is effected by means of small jets of water under considerable pressure, which are discharged into the top of each tank, and carry down mixed with the water of the jets a quantity of air, which is discharged in the form of countless myriads of bubbles, so minute that they float a long time about the body of the water in the tanks before rising to the surface, and thus present an enormous oxidising surface to the water; and, as a result, the whole mass has a bright, sparkling, almost effervescent appearance. In the Brighton Aquarium the aeration is effected by pumping air into the tanks through pipes of considerable size, from which the air issues in large bubbles that rise quickly to the surface; there is not any actual circulation of the water from one tank to another, and the quantity of water in the reserve tanks bears only a small proportion to that in the show tanks; the water can, however, be renewed, by pumping from the sea, but in consequence of the supply being taken from near the shore the water is exposed to mixture with sand and other detritus, and requires some time to become clear. In the Crystal Palace Aquarium the original supply of sea water for the tanks continues in use, and does not require any renewal, except to replace unavoidable waste, all that is needed being the addition from time to time of a small quantity of fresh water to compensate for the gradual loss that takes place from evaporation; the supply of sea water in the store tanks—which are kept in the dark to counteract the tendency to vegetable growth in the water—is so much greater in quantity than the contents of the show tanks, that the water after circulating through them becomes thoroughly restored to a fresh and healthy condition before returning to the show tanks in the course of the circulation.

The result of the examination and enquiry of the Committee was a recommendation of the Crystal Palace system, (which is the plan of

Mr. Lloyd, the Manager of that Aquarium,) in consequence of their finding the Brighton Aquarium not so successful, zoologically considered, as to the health and condition of the animals, and the clearness of the water in the tanks. The Crystal Palace Aquarium was found to be eminently successful in these respects, the most delicate animals being maintained in perfect health and almost free from those parasitic growths to which they are so subject in confinement, whilst the water in the tanks was beautifully transparent and brilliant. The action of the Committee resulted in a proposal to construct an Aquarium in the basement story of the Midland Institute Building, facing the Town Hall, and plans were prepared by the writer for this purpose under the advice of Mr. Lloyd, who was called in to examine and reported favourably upon the proposal. That proposal, however, had ultimately to be given up, in consequence of it being found impracticable to adapt the existing building satisfactorily for the desired object. The idea in this proposal had been to establish a Public Aquarium pure and simple, with appliances for scientific study and instruction, in close connection with the Public Library and Art Gallery, and supported only by a small admission charge ; the original cost of construction being intended to be materially reduced by the circumstance of adapting a portion of an existing building and thus avoiding the cost of erecting a new building.

It was strongly felt to be a very desirable thing for a Birmingham Aquarium to be established, and that the situation of Birmingham, in the centre of the country, far removed from any sea-coast, would cause a Marine Aquarium to be a special attraction there, and that it would be both a source of great pleasure, and an object of elevating character for the large population not only of the town, but also of the "Black Country" neighbourhood, who may be said to have a decided turn for Natural History objects as regards animals, birds, and cottage gardens. The Marine Aquarium, (as remarked by Mr. Hughes in a subsequent paper read before the Natural History Society,) "appeals to the two extremes of society—to the unlettered, who look with wonder and curiosity on strangeness of form and beauty of colour, and to the cultivated, who, from a higher point, regard with profound interest details of structure and affinities and analogies with beings of other times. No greater attraction, or means of intellectual recreation for the working classes of the town and neighbouring mining districts could be devised, because it would be so utterly different from any other existing exhibition, and so suitable as a relief and mental refreshment for those in crowded courts, to whom the sea, with its living wonders, is but a name. No cabinet collection of dried specimens can bring to view such instances, among a thousand others, as the graceful progress of the flat-fishes, or the weird form and muscular contractions of the Cuttle-fish ; no picture can rival in colour the markings of the Wrasse, or the living fire of the eyes of the Dragonet ; no library can give the student such a clear idea of the inhabitants of the sea from mere description, as can the contemplation of the actual living beings themselves. As a utilitarian agency for the solution of undetermined points in biology, the Aquarium may, in some measure, help in arriving at a solution of such problems as how to secure the proper development of and render available those almost innumerable germs of food supply that are produced by sea fishes in general. The Turbot, for instance, produces about fourteen millions of eggs annually, of which not one perhaps in ten thousand reaches maturity, nor one in a million finds its way to our tables. Our knowledge of the laws governing the movements—the appearance and disappearance in certain localities—of the Herring and other fishes, their spawning and time of development, is still obscure; and if we had light thrown upon this subject thousands of tons of valuable food would be available for us. These enquiries cannot be considered visionary, nor the results obtained from them unprofitable, when it is remembered that within the last few years of judicious legislation, the result of accurate knowledge obtained by these researches has so developed the Salmon fishery that, in place of this fish being only obtainable by the few and wealthy, it is now every season so cheap and abundant as to be found on the table of the artisan."

The idea of the Birmingham Aquarium was ultimately revived in a definite form by the late Mr. Arthur Ryland, (to whom the origination of the Midland Institute was also due,) and he succeeded in enlisting the support and co-operation of a number of influential gentlemen to a proposal, which led to the formation last year of a Limited Company for the construction of the Birmingham Aquarium. It was felt that an Aquarium alone could not be made to succeed financially, and it would require to be combined with some other attraction, such as first-class music, and must consequently involve the erection of a large building in some central situation. The great difficulty experienced was the obtaining a suitable site in a sufficiently central situation; but this has been now overcome in a highly satisfactory manner, by obtaining the site of the old Hen and Chickens Hotel, in New Street, (classic ground of the old coaching days,) which is a remarkably favourable situation for ready access of the public, in the principal thoroughfare of the town, and in close proximity to the two railway stations. The hotel will be converted into a first-class restaurant, the largest in the town, and in the rear will be built the Aquarium, with a spacious and convenient Concert Room above it, affording facilities for concerts that have been long felt to be much needed in the town.

The Aquarium will consist of a large, handsome Hall, upwards of 100 feet in length, with a series of tanks extending along each side, and forming the sides of the Hall, and amounting in total extent to about as much as those of the Crystal Palace Aquarium. There will also be an extensive series of table tanks; and in the rear a large and commodious space for the food and store tanks, the machinery, and the general working purposes of the Aquarium. The public approach will be from the present portico in New Street, through a large Entrance Hall, from which a handsome flight of steps will lead down to the Aquarium, which will be constructed of red terra-cotta, with the ceiling supported by arches resting on ornamental pillars. The large Assembly Room, on a level with the New Street entrance and over the Aquarium, will be 165 feet long, and will consist of three divisions—the first portion being appropriated to the table tanks, the central transept for a similar purpose, and at the end will be the large Concert or Lecture Room, surrounded by galleries, and capable of holding 1,000 persons. The block of the present building facing New Street will be retained, and converted into a large Restaurant on the first floor, 70 feet long; and the kitchens will be at the top of the building, according to the most approved modern arrangement. Large shops and sets of retiring rooms will be arranged on each side of the New Street entrance; and means of exit in the rear into Worcester Street will be provided for the Aquarium and Concert Room. Mr. J. A. Chatwin, F.R.I.B.A., is the Architect, and the writer is the Engineer. The company have got possession of the site, and the building will be commenced at once.

THE REV. ANDREW BLOXAM: A MEMOIR.

BY THE REV. M. J. BERKELEY, M.A., F.L.S., ETC.

There is, perhaps, no country in which so much good work in Natural Science is done in a quiet and unpretending way as in our own. Many persons, scattered up and down the country, are making valuable observations, which are recorded by themselves or others, from time to time, without taking any prominent position in the scientific world. Such was the subject of the present notice, who, whether from modesty or the cares of tuition, did not take a place as a leading Naturalist, though he might well have done so from the good work he performed, and the numerous reports on various matters which he furnished to journals of more or less importance, though he has not left any great volume behind him to bear witness to his talents.

The Rev. Andrew Bloxam, late Incumbent of Twycross, Leicestershire, and, at the time of his death, on February 2nd, 1878, Rector of Great Harborough, was the fourth son of the Rev. Richard Rouse Bloxam, D.D., one of the Masters of Rugby. He was born at Rugby, on the 22nd of September, 1801, and was consequently in his 77th year at the time of his death. He entered at Rugby School in the year 1809, leaving for Worcester College, Oxford, in 1820, of which he ultimately became a Fellow. His father had a great taste for archæology, inherited from his relative Mr. Rowland Rouse, of Market Harborough, a taste which descended to his son Matthew Holbeche, the excellent author of "The Principles of Gothic Ecclesiastical Architecture," and other valuable antiquarian works. The author of this notice recollects, when a schoolboy, procuring for the father a drawing of the curious monument to the Loringe family in Oundle Church. Mr. Bloxam's mother was sister of the celebrated artist Sir Thomas Lawrence, and Mr. Purton, of Alcester, the author of "The Midland Flora," his uncle by marriage, so that there was talent and taste on all sides, and it would have been strange if, with these advantages, he had not inherited some good qualities. There were, moreover, circumstances which were highly in his favour. It has been the practice to ignore all the good that was done at Rugby before the time of Dr. Arnold, but with great injustice. Dr. Wooll, though not a profound scholar, had great taste for literature, and encouraged it wherever he saw an opportunity of doing so. There was a small but well-selected library, which was much used by the upper boys. But this was not all. There were lectures on natural philosophy, which were extremely popular, and some of the boys were trying their hands at making air-pumps and electrical machines; there was also a course of comparative anatomy, which was extremely good, illustrated with well prepared specimens, and to these more than one were indebted for their first comprehensive views of physiology. The vicinity of the Lias pits at Newbold, and the diluvial gravel at Lawford, gave great opportunities for collecting fossils, some of which, after sixty years, the writer has now before him, and amongst the numerous collectors the subject of this memoir was not the least active. The specimens which he accumulated were utilised by Dr. Buckland, the late Dean of Westminster, in his "Reliquiæ Diluvianæ," and were ultimately presented to the Ashmolean Museum at Oxford.

In the autumn of 1824, having been offered the situation of Naturalist in the Blonde Frigate, (of which his eldest brother was Chaplain,) commanded by Captain Lord Byron, which was dispatched by Government to the Sandwich Islands to convey there the bodies of the King and Queen who had died in this country, he at once accepted it. During the voyage, which lasted eighteen months, he had the opportunity of visiting several places both on the eastern and western coasts of South America, and also numerous islands in the great Pacific Ocean, from which he brought home a large collection of objects of Natural History, amongst which were several, at that period, new to science, which, on his return in the year 1826, were deposited in the British Museum. He took Holy Orders a few months after his return, and for many years was located in a part of Leicestershire extremely favourable for natural research, where he had the pleasure of association with a very young but intelligent Botanist, now the honoured Professor Churchill Babington, who bade fair to be a shining light in the botanical world, but whose studies have since been diverted to classical and archæological literature, in which he has taken a very prominent position.

Mr. Bloxam's researches were not confined to any one department of Botany or Natural History. His communications on Conchology, Ornithology, Phænogamic and Cryptogamic plants, to leading periodicals were numerous; but, with the exception of his "Fasciculi of British Brambles," which have been appreciated highly by those who regard the greater part as mere forms of one, or perhaps, two species, as well as by those Botanists who look upon every form as distinct, his most useful work was amongst the Fungi, in which his neighbourhood was peculiarly rich. Many of the most interesting species have been recorded in the notices of British Fungi by Messrs. Berkeley and Broome in the "Annals of Natural History," and a very curious genus has been dedicated to him by the same authors. In conjunction with Mr. Churchill Babington he was enabled to furnish a very copious list of the Phænogamous plants growing in Charnwood Forest and its precincts to Mr. T. R. Potter for his history of that district, and in conjunction with his friend, the Rev. W. H. Coleman, he contributed an admirable list to "Potter's History of Leicestershire," which unfortunately has not been published. These were much appreciated by Mr. Watson in his researches on the distribution of Phænogams in the British Isles. His communications were not, however, confined to Phænogams, and we have now before us a plate containing illustrations of two most interesting Agarics, *Agaricus Babingtonii* and *Agaricus Bloxami*, of which the latter is one of our most elegant species. It should not be passed by without notice, that in the appendix to the account of the Voyage of H.M.S. Blonde to the Sandwich Islands, published by Mr. Murray, Mr. Bloxam's notes on the Natural History of these islands will be read with much interest.

Though a very constant correspondence took place between the writer of this notice and Mr. Bloxam for some years, there were but two opportunities of personal communication: one in the Herbarium at Kew, and the other at Rugby, on the occasion of the consecration of the new Chapel, after he had left Twycross for Great Harborough. There were, however, many opportunities of having tidings of him, which were all of the most favourable character, showing how he was appreciated not only for his various talents and acquisition of valuable information which always made him a welcome guest, but for that kind and amiable disposition which at Rugby made him a favourite of all who were thrown into communication with him. There is a chalk drawing of him by his uncle, Sir Thomas Lawrence, which was taken in 1824, previous to his starting for the Sandwich Islands. A daguerreotype likeness was engraved for the contemplated History of Leicestershire, which was, however, never published. There is also a water-colour drawing by the late eminent painter, Turner, in the National Gallery, representing the group of the six brothers attending the funeral of their uncle, Sir T. Lawrence.

Mr. Bloxam married Ann, daughter of the Rev. John Roby, of Congerstone, in the county of Leicester, (a descendant of Nehemiah Grew, who in 1671 dedicated the first book of his "Anatomy of Plants" to the celebrated John Wilkins, Bishop of Chester,) and by her had a numerous family.

PROFESSOR EDWARD FORBES AND HIS COUNTRY.

BY ROBERT GARNER, F.L.S.

[*Continued from page 70.*]

The Maritime Flora is more ample in species than the Lowland or Upland, probably as rich as that of any portion of the British Isles of the same size. There are about 100 species of flowering shore-plants around our Islands, and more than sixty of these are found around the Isle of Man; for instance, on the southern cliffs, about Peel Castle,* on the sands to the north of Ramsey,† and at Maughold,‡ remarkable also for its rock scenery, and for its antiquities. There is a deficiency, however, of some southern and south-eastern maritime species, as might be expected from climatal considerations, without reference to any geographical changes. But, confining ourselves to the inland, it will appear, upon the whole, that the Isle of Man, like other small isolated tracts of country, is rather limited in the number of its plants, and Forbes was led to philosophise on this point. There appears to be reason to suppose that the island was not isolated from Ireland till (geologically speaking) modern times, and he thought that this agreed with the extension to Man of certain (so-called) Lusitanian species, which he names, *Pinguicula lusitanica*, *Scirpus Savii*, &c.; and also that the absence of certain southern species, if it is not from climatal inadequacy, may likewise be set down to an analogous cause, the separation of the outer islands, whilst England still made part of the Continent, thus allowing such plants to extend themselves in it, but not further. As regards truly mountainous—or what is tantamount—northern species, the above absence or paucity holds good, but from another cause. In the main islands some of these have been supposed to have survived glacial times by their fixity on the summits of high mountains, elevation being tantamount to latitude and lower temperature. Perhaps the Manx hills were never very high, but, it may be, half submerged, and receiving their deposits of clays and drifts, whilst those of Scotland and Wales were the seats of glaciers.

With this floral deficiency it is rather interesting to observe how many plants, which are not truly indigenous, have escaped from ancient homesteads and gardens, and have become quite at home, as well as luxuriant; showing that islands and isolated places often grow in great perfection plants which are not native, when once introduced. Horticulturists are aware of this proclivity of the island. Such interlopers are the following:—*Spiræa salicifolia*, *Senecio saracenicus*, *Inula Helenium*, *Gnaphalium margaritaceum*, *Pyrethrum Balsamita*, *Balsamita vulgaris*,§ *Lavatera maritima*, *Antirrhinum Orontium*, *Reseda fruticulosa*, *Saponaria officinalis*, *Myrrhis odorata*, *Petroselinum sativum*, *Vinca major*, and, perhaps, other plants of a similar origin. The Irish arbutus, hydrangea, fuchsia, myrtle, ilex, euonymus, jasmine, escalonia, Buddleia, and tree-veronicas are very luxuriant in the open air. The cowslip appears to be absent,

* *Spergula maritima*, *Cerastium tetrandrum*, *Chenopodium murale*, *Arenaria marina*, *Hyoscyamus niger*. At the Stack of Scarlet, *Samolus Valerandi*, and *Œnanthe crocata*.

† *Salsola Kali*, *Ruscus aculeatus*, *Cakile maritima*, *Crambe maritima* *Glaux maritima*, *Convolvulus Soldanella*, and *Tamarix*.

‡ *Crithmum maritimum*, *Scilla verna*, *Silene maritima*, *Allium vineale*, and *Asplenium marinum*. After a storm, enormous fronds of *Laminaria bulbosa* *L. saccharina*, and *A. esculenta* are cast on the shore; these deep-water Fuci are most productive of iodine, which, however, can only be here manufactured to pay when the drug is high in price.

§ Costmary, or Ale-cost, smelling strongly of spearmint, but bitter. It was formerly used in brewing, and was introduced from Italy more than three centuries ago. It grows about old cottage enclosures, and the Manx call it sweet-leaf. Unless seen in flower it somewhat resembles *Pyrethrum Balsamita*, called camphor-plant, which is quite naturalised.

and Forbes adds the dead-nettle, the avens, the toad-flax, the cross-leaved bedstraw, and a few other plants; but, considering the small extent of the ground, this is not remarkable. One of the bedstraws *(Galium verum)* is so profuse that the air in July is filled with its perfume.* To the relations of the Manx Flora and Fauna we shall again advert hereafter. There is, perhaps, greater affinity of the Flora to that of the nearest Scotch or English lands than to that of North Wales; thus, one of the few sub-alpine plants assigned to the island, *Saxifraga aizoides*, is rather an English than a Welsh plant.

Contrary to what we have observed as regards the island flora generally, few spots are more productive in marine productions of the animal kingdom, and the Manx mollusca were especially studied by Forbes, and that as found at different depths, or in what he termed bathymetrical zones—littoral, laminarian, coralline, infra-medial, and abyssic. The last he had little opportunity of examining, and erroneously concluded that life soon ceased in it. Forbes considered that the Irish Sea is a kind of neutral ground, zoologically speaking, and his own island is somewhat curiously situated in the centre of it; but there are fewer of his Lusitanian species of mollusca than of plants, many Atlantic or western species, and a few of a south-British character; the generality may be said to be rather Celtic especially than European, with a small per-centage of boreal species. Forbes also paid great attention to the animals themselves in contradistinction to their shells, and in his later works to their geological distribution. In 1838 he published his "Malacologia Monensis," and in 1853 the "British Mollusca," in conjunction with Mr. Hanley. In the Malacologia he teaches that "a species is defined, unalterable, original, approaching but never uniting. Varieties are forms depending on local or accidental causes, diverging from the normal type, but often, and with facility, returning to it." Would he have spoken so decidedly in these days?

In Douglas market may often be seen at least a score of different kinds of fish, so bountiful are our seas to the island, set as it were in their centre. Forbes dredged off Ballaugh, where, however, at the present time, there are fewer facilities for doing so than at Ramsey. The Ballaugh scallop-bed is about four miles out, in twenty or thirty fathoms, and with deeper water on each side; similar reefs occur off Maughold Head and Laxey, and these may be easily dredged by the aid of the Ramsey boatmen. The bottom off Douglas is different, being coralline, with beds of Pectunculi. Port Erin is a good locality for the Naturalist, the fishing lines and lobster pots bringing up many interesting specimens.

Of land and fresh-water shells, *Helix aspersa* abounds in the island, *H. lapidicida* seems scarce. *Limax gagates* was found near Peel by Forbes, but he did not detect the minute Achatina. Many of the larger Limnæi, as well as Anodon, Paludina, and Cyclostoma are absent, as they are mostly from Ireland and the North of Britain, but rather at home in the south, seeming as if they had invaded England

* Forbes perceived the specific value of the variations in British Polygalæ, and the very different forms which Euphrasia takes in some situations.

before it had ceased to be continental, but after Ireland and the Isle of Man had become separated from it. *Unio Roissyi* Forbes found in the river at Kirk Braddon, and we there picked up some fragments of the valves.

The young Naturalist records finding the bone (so called) of the cuttle-fish on the Manx coast, but the animal is in reality somewhat a southern species; we got a large mass of the ova of another cephalopod *(Ommastrephes todarus)* off the Calf, resembling in everything but size those of Sepiola. To the naked-gilled molluscs which he records in the Malacologia must be added the beautiful *Dendronotus arborescens* from near the same place, and the fine *Doris tuberculata* or *Argo* found on Conaster and elsewhere, as in a cavern at the foot of Peel Castle rock; also *Eolis viridis* and *Aplysia* at Douglas. Of the shelled gasteropods we got *Capulus Hungaricus*, *Emarginula fissura*,* and *Fissurella Græca* from the Ramsey scallop-bed, as Forbes had already done; *Trochus Montagui* and *tumidus*, Douglas; *Acmæa testudinalis*, Ramsey; *A. virginea*, much more common than the last on scallop shells; *Trophon clathratus;* lastly, *Chiton Asellus* and *cancellatus*, F. and H., must be added to the list.† Of the common limpets, under the name of flitters, the poorer Manx make their soup.

As regards bivalve molluscs we might expect to meet with Brachiopoda in the deeper water around the island, and our friend found a single specimen of Crania at Ballaugh. Ramsey is rich in bivalves. I found a specimen of *Isocardium cor* there, many years back, with the valves still united by the ligament; also *Pecten tigrinus*, living, in the scallop-bed; *Tellina incarnata*, Douglas; *Venus verrucosa*, fine living species of this southern species, both at Douglas and Ramsey; *Tapes aurea* and *decussata*; *Solecurtus candidus; Psammobia Tellinella*, Douglas, by the dredge; these, with the exception of the last species, are not in Malacologia Monensis. We append in a note a list of other species, all of which we have found, but which are generally in that work,‡ also of Crustacea, mostly brought up by the dredge or in the lobster pots.§

We dredged *Comatula rosacea* off Douglas, but get it much finer between Port Erin and the Calf, from the source already alluded to.

* My specimens appear to be *E. Mülleri*.

† Also fine specimens of *Trochus Magus* and *zizyphinus*, with a white variety of the latter found on Conaster Rock, *Bullæa aperta*, *Natica Alderi*.

‡ Bivalve Mollusca—*Lima fragilis*, Ramsey scallop-bed; *Cardium Norvegicum; Lucina flexuosa*, *L. borealis; Lucinopsis undata*, Ramsey; *Cyprina Islandica*, sometimes with a large growth of serpulæ attached, Ramsey; *Mactra stultorum*, Ramsey, *M. elliptica*, Douglas, *M. truncata* and *subtruncata; Astarte Danmoniensis; Artemis exoleta*, Ballaugh, *A. lincta; Venus ovata*, *V. casina*, *V. fasciata*, Ramsey, *V. gallina; Psammobia Ferroensis*, Ramsey by the dredge, *P. vespertina* less plentiful than the last. Add also *Tellina crassa* et aliæ, *Donax anatina (minor, nitida)*, *Nucula margaritacea* and *tenuis*, *Pectunculus Glucimeris*. *Solen marginatus*. *Syndosmya intermedia* et aliæ, *Anomia striata* found on the inner surface of Pectens, very delicate, the lower or perforated valve convex, though often scarcely present.

§ Crustacea—*Stenorhynchus Phalangium*, Bell, Port Erin; *Inachus Dorsettensis* ibid, *I. Dorynchus*, ibid; *Pisa Gibbsii; Eurynome aspera*, Douglas; *Pilumnus hirtellus*, Port Erin; *Portunus corrugatus*, ibid; *Ebalia Pennantii*. Ramsey scallop-bank; *Porcellana longicornis*, ibid; *Galathea squamifera*, Douglas bay, under stones, *G. strigosa*, much larger than the last, Port Erin. *Astacus Norvegicus* is seen in quantities in Douglas market.

Asterias glacialis, from the same place, was a splendid object when just taken up from the sea, of which Forbes's figure in the British Star Fishes (1841) gives but a poor idea ; it reminds one rather of the frame work of a crown, with the jewels all gone. *Luidia fragilissima*, (lingthorn,) *Goniaster Templetoni*, and *Asterina gibbosa*. Off Ramsey occurred *Ophiura granulata* and *albida*, besides *O. rosula*, *bellis*, *brachiata*, and *neglecta*, recorded by the Professor, as were *Uraster hispida*, *Solaster endeca*, and the beautiful Palmipes, long since taken by us, but in a different locality, namely, the Diamond Fishing-ground, in the British Channel, possibly named from the occurrence of the animal, which is so called by the Sussex fishermen.

The Isle of Man appears, then, upon the whole, to have more affinity to Ireland than to its other surroundings. It has no mole, toad, or snake, as is the case with the latter country, and both had the great elk, which was occasionally engulfed in their deep curraghs. The frog was a new importation in both countries in Camden's time, though it is now common. There are newts in the island, the crested and smooth, and as many lizards, *Lacerta agilis* and *Zootoca vivipara*, Bell. The hedgehog was originally introduced, but is now common. The pole-cat is absent, but the stoat is common, the only species of the Mustelidæ, as it is in Ireland. The water-rat is found, the squirrel is absent. The tailless cat is, probably, aboriginal, both here and in Cornwall. Many of the Manx fowls are destitute of tail feathers. There may be some physical reasons for these peculiarities, but what they are must be left for others to explain. The habits and language of the natives are also allied to those of the Irish, with, no doubt, a trace of the Scandinavian.

One bird derives its specific name from Mona, the Manx shearwater, but it no longer frequents its ancient resort, the Calf. That peculiarly British bird, the grouse, has become extinct. The magpie is recorded to have been brought to the island by man ; and Camden says there are no woodpeckers, jays, or mawps (?). The mischievous Irish or grey crow, and the red crow or chough, are more common in some parts than the black crow. The raven and peregrine falcon are not absent from the highest rocks. There are, also, the long-eared owl, the heron, and a host of interesting sea-birds.

FRESHWATER LIFE.—2. ROTIFERA.

BY EDWIN SMITH, ESQ., M.A.

In pursuing our studies of the minute forms of Freshwater Life, we cannot fail to encounter a number of creatures much smaller than the Entomostraca before described, yet quite distinguishable with the aid of a simple lens, sailing through the water with an easy, swinging motion ; or grazing, like small cattle, among the threads of algæ ; or moored by the tail to some green spray, while a curious ciliated head is stretched forth in the act of feeding. The cilia will be seen to move in such rapid and well-timed succession as to look like revolving wheels; and so perfect is the optical illusion that you feel how appropriately these creatures have been named "Wheel-bearers," or Rotifera.

Their exact place in the animal series has not yet been finally determined. Provisionally they may be referred, as an order, to the somewhat miscellaneous class *Scolecida*, in the sub-kingdom *Annuloida*. On the whole, they appear to have strong affinities to the worm-like animals of the class just mentioned, as well as certain points of resemblance to the lower crustaceans, and to the larval forms of Echinodermata.

The Rotifera attain a maximum size of about 1-36th of an inch. Some are as small as 1-400th of an inch, or smaller. They are of a higher type of organization than the Infusoria, with which they were formerly grouped, since they have an obscure segmentation of the body, a completely separate alimentary canal, and a water-vascular system; and they never multiply by budding or self-division. They have a right and left, a dorsal and ventral, and a head and tail aspect; the end answering to the head moving habitually forwards, with the back upwards. Some are fixed by a foot-stalk to water-plants during the whole or the greater portion of their existence; but the majority are free-swimming. The former use the ciliated wreath to urge food to their mouth; the latter use it as a locomotive organ when in motion, and a feeding organ when at rest. Few things are more strikingly beautiful than this ciliated wreath in full activity. At intervals it is drawn in and tucked out of sight, so as completely to alter the look of the animal. But after a time it issues forth again, expands, and resumes its work. The food, received by a distinct mouth, is caught by a sort of champing gizzard, which has been likened to a pair of toothed hammers and a double anvil, and is there crushed small before admission to the stomach. In this receptacle, which is of variable size, the food is digested. The refuse of digestion then passes along an intestine; and finally, in most kinds, though not in all, is got rid of by a distinct orifice, connected with a cloaca, into which the ovary and a contractile vesicle also open. There is no heart; but a water-vascular system is present, consisting of two convoluted tubes, one on each side, furnished at intervals with short pipes lined with cilia, which lead into the general cavity of the body. The lower ends of these tubes open into the aforesaid contractile vesicle; and thus, the pulsations of the vesicle and the vibrations of the cilia keeping up a current, the fluids of the body are refreshed by being brought into communication with the outer water.

Of the nervous system, the following are the main features:—Near the back of the neck there is found a ganglionic mass, on which are mostly seated one or more eye-spots, generally of a bright crimson colour. Projecting from about the same place may often be seen a little telescopic feeler, armed at the tip with minute bristles; or the bristles may be sessile in a small hollow. Muscles pass lengthwise from end to end of the body, and ring-wise at intervals round it, by which the external shape can be more or less altered, enabling some species to crawl about like a leech. Other muscles assist the movements of the ciliated wreath, as well as those of the tail-foot. Under careful illumination I have occasionally observed muscular striæ.

The body-cavity, with its various internal organs, is protected by an integument of greater or less firmness, shaped like a shield, a boat, a spindle, a vase, and so forth. In those cases where the integument is hardest, it may be termed the *lorica*, corresponding to the carapace of Entomostraca, and having a similar chitinous composition. Its surface is bare of cilia, but it is not unfrequently armed with lateral or terminal spines. The only approach to an articulate appendage possessed by Rotifera is that which I have called the tail-foot. It is not a prolongation of the back, and is, therefore, not a true tail. Coming off from the under surface of the body, below the anal orifice, it may be regarded as a kind of foot. It is capable of being shortened, either on the telescopic principle, or, when soft, by contracting in wrinkles. The basal portion varies considerably in length, being reduced sometimes to a mere stump. At its narrower end are often inserted, movably, one, two, or three styles, or dagger-like bristles, which may be very long. When these are two in number, they strongly remind us of a pair of scissors; when they are three, the middle one is small. With this organ the Rotifera steer themselves in the act of swimming, or hold on to some support while groping about for food, or even, in a few instances, take veritable leaps.

With regard to reproduction, the same phenomena of parthenogenesis have been observed, which we noticed when describing the Entomostraca. The young are born from two very distinct kinds of eggs; the summer eggs, which are generally, if not always, virgin produce; and the winter eggs, which have been duly fecundated. The latter are preserved against the cold by a peculiar shell, till spring returns to hatch them. While the females multiply in enormous numbers, the males are very rarely met with. The latter, moreover, are, as a rule, so unlike the former in appearance, that it is difficult to recognise them as belonging to the same species. It is a curious fact, that in all males the alimentary canal is either absent or rudimentary. They are, consequently, short-lived.

Before briefly considering particular examples of Rotifera, I will here give my authorities for the preceding anatomical sketch, while naming a few works to which the student can refer for a fuller account of the subject. He will find that the ablest observers are by no means unanimous on many important points in the anatomy and life-history of these somewhat puzzling animals.

Works of reference :—Pritchard's "Infusoria;" Rolleston's "Forms of Animal Life;" Huxley's "Anatomy of the Invertebrated Animals;" Gosse's "Papers in the Philosophical Transactions."

[TO BE CONTINUED.]

PARASITES OF MAN.*

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

[*Continued from page 59.*]

In continuing this record it is, perhaps, as well that I should remind the members of the Section that the Cestodes differ essentially from the Trematodes in that the so-called species are multiple in character. What is spoken of as a tapeworm is not *one* creature, but in reality a multitude of organisms, or zooids, arranged in single file. The head itself is merely the topmost zooid, modified in shape, and armed with sucking disks, so as to form a means of anchorage for the whole colony. This cephalic holdfast, as it might be called, is in some sense the counterpart of what we see not only in the fixed polypes, but also in the free compound medusæ. In carrying out the analogy it must not be forgotten that the solid hydrorhiza of an ordinary Sertularian polype was once a free swimming ciliated larva, whilst the inflated end of the cœnosarc forming the float of Physalus had a similar origin. In all these cases the metamorphosis of a larva, either directly or indirectly, secures the formation of an organ of anchorage or support involving the welfare of the entire chain or colony of zooids. It is sufficient to insist upon the strict analogy of these phenomena without suggesting questions of homology. An ordinary human tapeworm (such, for example, as that derived from eating measled beef) consists of about twelve hundred zooids, or proglottides. Each proglottis is bisexual, and, when mature, is capable of holding, according to Leuckart, about 35,000 eggs. The entire colony of twelve hundred zooids is renewed every three months, and thus it follows that the amount of egg-dispersion annually resulting from a single beef-tapeworm cannot be less than twelve millions. In all probability this calculation is very much below the mark, seeing that the 35,000 impregnated germs capable of existing in the fully mature proglottis, at a given period, do not by any means serve to fix the limit of the possibilities of egg-formation within the proglottis. Of course, as compared with the quantity of germs distributed, the number that survive and come to perfection, as Tæniæ, must be infinitesimally small.

CESTODA.

13.—*Tænia mediocanellata*, Küchenmeister.

Synonymy.—*T. saginata*, Goeze; *T. dentata*, Nicolai; *T. inermis*, Moquin-Tandon; *Tæniorhynchus*, Weinland.

Larva.—A simple Scolex, known as the beef measle, (*Cysticercus bovis*, Cobbold.)

Intermediate Host.—The Ox, (*Bos taurus*,) and all its varieties. The cattle of the Punjab are largely infested. As many as 300 Cysticerci have been counted by Dr. Joseph Fleming in a pound of flesh taken from the psoas muscles.

* Read before the Microscopical Section of the Birmingham Natural History and Microscopical Society, March 19th, 1878. Mr. Hughes, on Dr. Cobbold's behalf, exhibited the following specimens:—The beef-tapeworm, (*Tænia mediocanellata*,) and its measle, (*Cysticercus bovis*,) the pork-tapeworm, (*T. solium*,) and its measle (*Cyst. cellulosæ*.) from the human brain; the slender tapeworm, (*T. tenella*,) the ridged tapeworm. (*T. lophosoma*,) the dwarf tapeworm from Egypt, (*T. nana*,) and the elliptic tapeworm, (*T. elliptica*.)

Remarks.—This cestode, often called the beef tapeworm, is much more prevalent than the pork tapeworm. Taking all classes of infested persons together it probably occurs in about ninety per cent. Of the cases of tapeworm coming under my own observation not less than ninety-six per cent. have been of this species.

Experiments on Animals.—The larvæ have been reared in cattle by Leuckart, Mosler, Cobbold and Simonds, Probstmayer, Zurn, St. Cyr, Perroncito, and M.M. Masse and Pourquier. The measles are usually found in the voluntary muscles in the beast and in the connective tissues. I have, however, twice found them in the liver and once in the lungs.

Experiments on Man.—Dr. Oliver reared the adult tapeworm in a Mahommedan Syce and in a Hindoo boy. Professor Perroncito recently persuaded Dr. Ragni, Mr. Gemelli, and others of his pupils to swallow beef-measles which had been subjected to varying degrees of temperature (45°—47° C.) One of the students thus reared a mature Tænia within himself in fifty-four days.

Literature.—Standard works; especially that of Leuckart. See also Cobbold; Tapeworms, (3rd edit.,) 1874. Perroncito; Experamenti, &c., Lo Studente Vet., (Parma, 1876, p. 146,) and various papers in The Veterinarian, (July and December, 1877.) Masse et Pouquier in Montpellier Med. Journal Mensuel de Médicine, 1876. See also Heller, (quoted below.)

14.—*Tænia solium*, Linnæus.

Syn.—*T. cucurbitina*, Pallas; *T. humana armata*, Brera; *T. lata*, Pruner; *T. vulgaris*, Werner.

Larva.—Simple scolex; familiarly known as the pork-measle, (*Cysticercus cellulosæ* of authors.)

Int. Host.—The Hog, (*Sus scrofa*,) both in the wild and domesticated state. As this measle also develops within the human body, man may himself become an intermediate bearer, and, by an act of cannibalism on the part of another man, prove a source of tapeworm-infection.

Remarks.—This cestode, though usually regarded as the common tapeworm, is comparatively rare in England. It is chiefly found amongst the poor, who are large consumers of pork which is often imperfectly cooked. In Iceland the pork tapeworm is rather more common than the beef tapeworm.

Experiments.—Pork-measles have been reared in the pig by Van Beneden, Haubner, Küchenmeister, Leuckart, Gerlach, and others. Küchenmeister likewise reared both mature and immature Tæniæ of this species in condemned criminals. Under Leuckart's auspices, several young persons voluntarily allowed themselves to become infested by swallowing fresh and living pork-measles.

Lit.—The works of Leuckart and Küchenmeister; and also, more particularly, Heller's Darmschmarotzer, in Von Ziemssen's Handbuch, (Bd. VII., s. 601,) and in the Anglo-American Edit. Davaine, Les Cestoïdes, in Dictionnaire Encyclop. des Sciences Med. (New Edit.)

15.—*Tænia tenella*, Cobbold.

Syn.—None; but Pruner gave the title (*T. tenella*) to a worm, which was probably *T. solium*.

Larva.—At present unknown, but conjectured to be the mutton-measle, (*Cysticercus ovis*, Cobbold.)

Int. Host.—Probably the Sheep, (*Ovis aries*,) which is occasionally infested by armed Cysticerci.

Remarks.—On five separate occasions I have observed measles in joints of mutton brought to my own table. I have also several times encountered a very slender tapeworm in man, which is not improbably the adult representative of this Cysticercus. Examples of the mutton-measle have also been seen by Prof. Heisch, Dr. Kirk, and Dr. Maddox.

Experiments.—The only breeding experiment performed by me with this slender tapeworm was on a lamb (1872). The result was negative.

Lit.—Cobbold; Tapeworms (3rd Edit.); and in Supp. to Entozoa, 1869 (p. 27). Maddox, On an Entozoon, with ova, found encysted in the muscles of a sheep; Nature, May 15th, 1873; Month. Micr. Journ., June, 1873; Lond. Med. Record, Aug. 6th, 1873.

16.—*Tænia lophosoma*, Cobbold.

Syn.—None. A malformed tapeworm, (Heller.)

Larva.—Unknown.

Remarks.—This a good species, notwithstanding the criticism that has been bestowed upon my determinations. It is quite distinct from Küchenmeister's variety from the Cape of Good Hope. The reproductive papillæ are placed all on one side of the strobile throughout.

Lit.—Cobbold; Tapeworms. Davaine Les Cestoïdes, (l.c. p. 573.;) Heller, (l.c. s. 594.)

17.—*Tænia nana*, Siebold.

Syn.—*T. ægyptiaca*, Bilharz; *Diplacanthus*, Weinland.

Larva.—Unknown.

Int. Host.—Probably an insect, (Leuckart.)

Remarks.—This little tapeworm has only once been found. It was discovered by Bilharz in an Egyptian boy in very large numbers. The finest examples did not quite reach an inch in length.

18.—*Tænia madagascariensis*, Davaine.

Syn.—None.

Larva.—Unknown.

Remarks.—Discovered by Dr. Grenet (at Mayotte, Comores) to have passed from two young children. The reproductive pores are uniserially disposed, as in *T. lophosoma*.

Lit.—Davaine; Art. Les Cestoïdes (l.c. p. 577 et seq.)

19.—*Tænia elliptica*, Batsch.

Syn.—*T. canina*, Pallas; *T. cateniformis*, Rudolphi; *T. cucumerina*, Bloch; *Dipylidium*, Leuckart.

Larva.—A louse measle, (Cysticercus *Tæniæ ellipticæ*.)

Int. Host.—The lice of the dog and cat, (*Trichodectes latus* and *Trich. subrostratus.*)

Remarks.—Most helminthologists believe that this cestode is identical with the cucumerine tapeworm of the dog. At best it is a mere variety.

Lit.—Melnikow; in Archiv fur Naturgeschichte, 1869; and in Recueil de Méd. Vet., 1871.

20.—*Tænia flavopuncta*, Weinland.

Syn.—*T. flavomaculata*, Molin; *Hymenolepis*, Weinland.

Larva.—Unknown.

Remarks.—This is a small worm which has only been once seen. It was obtained by Dr. Palmer, in America, from an infant. As in *T. lophosoma* and *T. madagascariensis*, the reproductive papillæ are uniserially arranged.

Lit.—Weinland; Tapeworms of Man, 1858, and in his Beschreibung zweier neuer Tænioiden aus dem Menschen, 1861.

[TO BE CONTINUED.]

ENTOMOLOGICAL BOOKS FOR BEGINNERS.

BY W. G. BLATCH.

Amongst the great number of popular books on Entomology very few are of real service to the student of that interesting science, and it too often happens that beginners expend a considerable amount of money uselessly and involve themselves in almost hopeless confusion, for want of a little friendly counsel to aid them in making, at the outset, a selection of the most suitable books. A few suggestions on this subject may therefore be not unacceptable to at least the younger Entomological readers of the "MIDLAND NATURALIST." As, however, it will be impossible to give in this number a list of all the best books on insects, I will limit this notice to two works on general Entomology, and to a few of such as illustrate some of the more prominent "Orders."

Undoubtedly there is no better book on general Entomology than "Westwood's Introduction to the Modern Classification of Insects," 2 Vols., 1839. It is, however, hard to obtain, (being out of print,) and commands a high price, (£3 10s. is now charged for a fair copy,) but the book is necessary to all who desire not to be Entomologists in name only.

Not improbably the opportunity, and perhaps the money, to purchase "Westwood" may not be at once available. It will therefore be necessary to recommend some sort of a substitute. Here is one ready to hand—cheap, but good; easy to understand, but thoroughly trustworthy, and withal containing excellent coloured figures of insects of all "Orders,"—"Staveley's British Insects," Lovell Reeve, price 10s. 6d.

Then as to special books, beginning with the Coleoptera, the works of Mr. H. E. Cox and Mr. E. C. Rye are the only two that need be mentioned. "Cox's Handbook of the Coleoptera or Beetles of Great Britain and Ireland," (1874,) 2 vols., 17s. 6d., is indispensable. It is far from perfect, but is a great improvement upon previous guides to the study of British beetles. The book is published by Mr. E. W. Janson, (himself a most accomplished Coleopterist,) at 28, Museum Street, London.

"Rye's British Beetles" may be used advantageously as a sort of stepping-stone to "Cox." In a familiar, yet scientific style, the author opens up a veritable royal road to Beetle-knowledge. He has, in fact, succeeded in making his book both charming and useful. In addition to the chapters treating on the several families and genera of Beetles, it contains a glossary of technical terms, a systematic catalogue of British Coleoptera, and a number of nicely coloured plates. It is published by Lovell Reeve, price 10s. 6d.

A copy of Dr. Sharpe's "Catalogue of British Coleoptera," (published by Mr. E. W. Janson,) price 1s., should also be obtained.

The Lepidopterist has a far better choice of books than the Coleopterist, there being a large number of excellent "Manuals" and "Histories" of British Butterflies and Moths in the market. I consider, however, that there is not a more accurate and useful work, in this branch of Entomology, than "Newman's Natural History of British Butterflies and Moths." The life-history of each species is described with careful minuteness, and every insect named is represented by an exquisitely drawn portrait. With the help of the description and figure there given, it is perfectly easy for the veriest tyro to recognise any particular butterfly or moth in his collection. The "Butterflies" and "Moths" are published separately, but can also be had bound together in one volume. The publisher is T. P. Newman, 32, Botolph Lane, Eastcheap, E.C., and the price is about 21s. for the two volumes.

I will conclude the present notes by recommending (in reply to a request that has been addressed to me) "a cheap, easy, reliable book on 'Bees.'" There exist several very valuable works on this subject, some of which may be specially referred to at a future time; but I do not know of one which answers the above description more fully than "Shuckard's British Bees," (Lovell Reeve, price 10s. 6d.) It is a small volume, but contains a large amount of trustworthy information about this most interesting section of the order Hymenoptera. A number of woodcuts of dissections, and sixteen beautifully-coloured steel plates, (containing about 100 figures,) greatly enhance the value of the book.

POND LIFE.

With my friend S. S. R., I have again visited the "Productive Pond," (ante p. 76,) and two others, in one of which my friend had some time back found *Melicerta tyro*, the new species found by Dr. Hudson at Sutton Coldfield. At first we thought we had found a specimen, but it proved to be *Floscularia campanulata*, with a large cluster of eggs at the bottom of the case surrounding its foot. I am sorry to report that *Conochilus volvox* is becoming scarce. There are, however, other rotifers in great abundance. I found the following this day, (March 16th,) besides other forms of animal and vegetable life too numerous to mention:—*Chætonotus larus*, *Conochilus volvox*, *Cephalosiphon limnias*, *Melicerta ringens*, *Floscularia campanulata*, *Notommata aurita*, *Synchæta pectinata*, *Polyarthra platyptera*, *Rattulus lunaris*. *Mastigocerca rattus*, *Euchlanis dilatata*, *Salpina mucronata*, *Metopidia acuminata*, *Rotifer vulgaris*, and two other species which I could not identify. One of the ponds we found literally full of *Volvox globator*. Recently I spent a day at Sutton Park, and found *Limnias ceratophylli* in extraordinary abundance, and a few specimens of *Stephanoceros Eichhornii* and *Melicerta ringens*. In another locality I found a great abundance of *Anuræa acuminata*, a sprinkling of *Pterodina patina*, and some few specimens of *Anuræa foliacea* and *Dinocharis pocillum*.—On the 21st February I found here, for the first time this season, the fine Polyzoan *Fredericella sultana*. This is, I think, very early for its appearance in a natural habitat. In a zoophyte trough I have now some fine young *Plumatella repens* just commencing life, and protruding their lophophores whilst still enclosed between the valve-like plates of the statoblasts, from which they have grown. They are objects of great beauty and, being very transparent, their anatomy is plainly visible under the microscope.—Thos. Bolton, Hyde House, Stourbridge.

RAINFALL AT WOLVERHAMPTON.

The average Rainfall at Wolverhampton for the last nineteen years is 28·034 inches per annum, the maximum occurring in 1872 which was a very exceptional year showing a total of 45·47 inches; the maximum quantity falling in the month of July, and amounting to 5·93 inches, and the minimum in March when 1·85 inches only fell. On three occasions in this year there were extraordinary falls in short periods, namely, on the 24th of June 1¼in. fell in forty minutes, equal to 150 tons per acre, and on the 6th and 7th July 3-10ths of an inch, and ⅝in. respectively fell in fifteen minutes. Leaving this very exceptional year out of the question, the average Rainfall for the last eighteen years would be 27·065 inches. In the year 1875 there were very heavy falls, making a total of 38·13 inches for the whole year. Of this 8·12 inches fell in July, and 12·41 inches in the months of September and October. The following table shows the total quantity of Rain falling in each separate month of the year; also, the average for each month for the last nineteen years:—

Year.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sep.	Oct.	Nov.	Dec.	Totals.
1859..............	·95	1·26	1·63	2·05	·88	2·91	3·56	3·48	2·36	3·01	2·66	1·87	26·62
1860..............	2·60	·58	1·92	·95	3·06	4·71	1·60	5·94	2·05	1·67	1·86	3·55	30·49
1861..............	·98	2·07	3·37	·87	·87	4·04	4·44	1·08	2·40	1·51	1·87	1·28	24·68
1862..............	1·93	·49	3·84	2·48	3·79	1·55	1·78	1·94	3·54	2·15	1·00	1·72	25·71
1863..............	1·99	·81	·85	1·01	·88	4·78	1·19	2·66	3·25	3·22	2·44	1·05	23·58
1864..............	1·17	2·01	2·47	1·29	2·34	2·50	·71	·94	1·71	2·24	2·61	2·61	22·60
1865..............	1·76	1·25	1·14	·66	3·15	1·56	1·62	3·98	·11	3·61	2·91	·97	22·14
1866..............	1·84	1·87	1·82	·72	1·79	3·28	1·74	3·95	5·58	2·48	2·13	1·76	28·86
1867..............	3·39	1·69	2·80	2·11	1·58	1·45	3·71	2·13	2·70	3·31	1·09	1·97	27·98
1868..............	1·91	2·28	1·85	1·94	1·85	·30	·89	4·55	2·07	2·01	1·46	5·46	26·07
1869..............	2·45	1·62	1·88	1·54	5·11	1·18	·43	1·37	6·22	1·53	1·80	3·65	28·7[illegible]
1870..............	2·07	1·97	1·86	1·02	1·02	·79	1·39	2·21	·58	4·17	1·92	2·35	21·35
1871..............	1·67	1·63	·76	2·72	1·85	3·80	3·88	1·01	5·96	2·65	·66	1·63	28·22
1872..............	4·50	2·70	1·85	3·54	2·27	5·76	5·93	4·09	2·10	5·61	3·68	3·49	45·47
1873..............	2·59	·95	2·57	·85	2·62	3·19	3·06	2·46	2·11	2·32	2·04	·54	25·27
1874..............	2·36	2·75	·80	1·44	1·98	·51	2·06	3·34	3·02	1·92	3·48	2·89	26·55
1875..............	2·76	1·21	·78	·77	1·57	3·43	8·12	2·30	6·21	6·20	3·31	1·47	38·13
1876..............	1·62	2·57	2·23	3·27	·66	3·17	2·15	1·50	4·02	1·55	3·55	4·12	30·41
1877..............	3·60	2·25	2·08	1·95	2·82	1·86	4·07	4·32	1·99	1·72	1·91	1·72	29·79
Totals	42·14	31·46	35·97	31·18	39·59	50·69	51·78	53·20	57·93	52·88	41·73	44·10	532·65
Average per month for nineteen years.....	2·22	1·65	1·89	1·64	2·08	2·66	2·72	2·80	3·05	2·78	2·19	2·32	28·034

GEO. J. C. BROOM, A.I.C.E.

METEOROLOGY OF THE MIDLANDS.

THE WEATHER OF FEBRUARY, 1878.

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

February, 1878, was, without doubt, an unusually fine, mild, and dry month. The general uniformity of the weather over the Midlands has also been remarkable. Thus, nearly every observer notes with pleasure the fine weather on the 17th, which produced the maximum temperature at almost every station, the extreme being 62° at Burley-on-the-Hill, and 61° at Cheltenham. Similarly the greatest cold was experienced everywhere on the 1st, 7th, and 8th, being a continuation of the cold period which marked the end of January. The minimum thermometer fell to 19° at Stoney Middleton on the 6th, 7th, and 8th, and to 19·5° at Coston on the 8th. Rainfall was about two-thirds of the average for February, and at most stations the maximum fall occurred on the 12th, which was a changeable and stormy day. Greatest fall was 2·70in. at Alstonfield, with ·69in. on the 12th.

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.	1·81	·56	12	9	56.0	28	22 0	1
Cheltenham	R. Tyrer, Esq.	1·56	·44	12	12	61·0	27	21·8	1
SHROPSHIRE.									
Haughton Hall, Shifnal	Rev. J. Brooke	1·23	·37	12	12	55·0	17	24·0	1 & 8
Whitchurch	A. B. George, Esq.	1·44	·38	12	12	60 0	7	27·0	8
Woolstaston	Rev. E. D. Carr	1·54	·37	12	14	56·5	17	26·0	1
Leaton Vicarage, Shrewsbury	Rev. E. V. Pigott	1·01	·24	28	15	58 7	17	21·6	1
More Rectory, Bishop's Castle	Rev. A. S. Male	1·48	·40	12	14	56·0	17	21·0	1
Larden Hall, Much Wenlock	Miss F. R. Boughton	1·63	·44	12					
Bishop's Castle	E. Griffiths, Esq.	1·30	·34	12	13	60·0	17	23·0	1
Cardington	Rev. Wm. Elliot	1·38	·34	28	12				
Adderley Rectory	Rev. A. Corbet	1·44	·43	12	14				
Stokesay	Rev. J. D. La Touche	1·26	·38	12	12				
HEREFORDSHIRE.									
Whitfield	W. Wheatley, Esq.	1·91	·64	12	13				
Stoke Bliss	Rev. G. E. Alexander	1·52	·44	12	13	57·0	17	29·0	7
WORCESTERSHIRE.									
Orleton, Tenbury	T. H. Davis, Esq	1·53	·46	12	14	61·7	17	22·3	1
Blockley	R. B. Belcher, Esq.	1·97	·44	12	12				
West Malvern	A. H. Hartland, Esq.	1·93	·40	12 & 28	12	57·5	17	29·0	6
Pedmore	E. B. Marten, Esq.	1·48	·51	12	14	58·0	17	26·0	7
Stourbridge	Mr. J. Jeffries	1·29	·40	12	13	56·0	17 21 28	24·0	7
St. John's, Worcester	G. B. Wetherall, Esq.	1·54	·25	27	12	56·0	17	24·0	8
STAFFORDSHIRE.									
Thorganby Villa, Wolverhmtn	G. J. C. Broom, Esq.	0·97	·35	13	14				
Barlaston	W. Scott, Esq.	1·48	·26	28	12	56·8	17	23·2	7
Amblecote	Mr. J. Robins	1·18	·42	12	14	61·0	17	27·0	1 & 8
Dudley	Mr. J. Fisher	1·02	·33	12	10	58·0	17	28·0	1 & 8
Sedgley	Mr. C. Beale	1·04	·33	12	15	54·0	17	29·0	1 & 8
Kinver	Mr. T. Bolton	1·17	·35	12	16	57·0	17 19 21	21·0	8
Walsall	Mr. W. E. Best	1·07	·32	12	14	54·0	17	33·0	8 & 18
Grammar School, Burton	C. U. Tripp, Esq.	1·14	·36	12	14	55·0	28	23·0	1
Patshull Gardens	T. W. Dell, Esq.	0·78	·29	13	6	57·0	22	21 0	1
Weston-under-Lyziard R'tory	Hon. and Rev. J. Bridgeman	1·27	·34	12	12	57·0	17	22·0	1
Wrottesley	E. Simpson, Esq.	1·05	·25	12	12	52·7	28	24·0	1
Tamworth	W. Arnold, Esq.	0·92	·28	12	12				
Alstonfield Vicarage	Rev. W. H. Purchas	2·70	·69	11	11	55·5	17 & 18		
Tean Vicarage, near Cheadle	Rev. G. T. Ryves	1·81				57·5	17	24·0	1
The Heath House, Cheadle	J. C. Philips, Esq.	1·81	·43	12	12	58·0	17	27·0	1 & 9
WARWICKSHIRE.									
Coundon, Coventry	Lieut.-Col. R. Caldicott	1·74	·64	12	12	55·0	18	26·0	8
Coventry	J. Gulson, Esq.	1·57	·53	12	13	60·0	18	22 0	8
Bickenhill Vicarage	W. R. Capel, Esq.	1·18	·45	12	11	54·5	17	26·0	1
St. Mary's College, Oscott	Rev. S. J. Whitty	1·08	·37	12	11	60·1	17	26·5	1
Henley-in-Arden	T. H. G. Newton, Esq.	1·55	·51	13	12	60·0	17	21·0	8
Rugby School	Rev. T. N. Hutchinson	1·43	·31	27	12	58·4	17	25·0	8
DERBYSHIRE.									
Buxton	E. J. Sykes, Esq.	2·50	·53	28	15	55·0	17	23·6	9
Brampton S. Thomas	Rev. J. M. Mello	0·86	·42	12	9	54·0	28	22·0	9
Stoney Middleton	Rev. U. Smith	1·11	·27	28	11	58·0	16	19·0	6 7 & 8
Fernslope, Belper	J. G. Jackson, Esq.	1·97	·65	12	12	56·0	18	26·0	1
Matlock Bath	R. Chadwick, Esq., jun.	2·19	·50	12	14	54·0	17	22·0	1
Linacre Reservoir, Ches'field	C. E. Jones, Esq.	1·29	·45	12	11				
Willesly Gardens, Cromford	J. Tissington, Esq.	2·19	·63	14	9				
Stuffynwood Hall	R. Rolfe, Esq.	1·24	·43	12	8	53·0	17 & 21	27·0	6 & 8
Trent College	Rev. J. F. Fenn	1·36	·23	12	10	60 0	17	28·0	6 & 7
NOTTINGHAMSHIRE.									
Hodsock Priory, Worksop	H. Mellish, Esq.	1·01	·33	14	9	59·2	17	24·7	1
Grove House, Mansfield	W. Tyrer, Esq.	1·35	·45	12	11	58·6	17	24·6	1
LEICESTERSHIRE.									
Ashby Magna	Rev. E. Willes	1·51	·41	12	12	57·0	16	23·0	1
Market Harborough	S. W. Cox, Esq.	1·60	·34	12	11	56·0	17	28·0	7
Kibworth	T. Macaulay, Esq.	1·47	·42	13	14				
Foxton Locks	Union Canal Company	1·18	·33	13	8				
Town Museum, Leicester	W. J. Harrison, Esq.	1·24	·34	12	13	59·2	17	25·5	1
Belmont Villas, Leicester	H. Billson, Esq.	1·32	·41	12	13	59·0	17	25·8	1
Syston	J. Hames, jun., Esq.	1·10	·28	14	15	57 0	18	24·0	1
Waltham-le-Wold	E. Ball, Esq.	1·51	·37	25	11	56·0	17	26·0	1
Little Dalby Hall	G. Jones, Esq.	1·40	·43	12	11	57·0	17	24·0	1 & 9
Coston Rectory, Melton	Rev. A. M. Rendell	1·75	·39	25	14	59·5	26	19·5	8
Belvoir Castle	W. Ingram, Esq.	1·10	·30	13	13	59·0	18	23·0	1
NORTHAMPTONSHIRE.									
Towcester Brewery	J. Webb, Esq.	1·46	·37	13	7				
Castle Ashby	R. G. Scriven, Esq.	1·57	·41	13	10				
Sedgebrooke	C. A. Markham, Esq.	1·59	·51	27	16	59·0	18	25·0	1
Kettering	J. Wallis, Esq.	1·73	·48	27	12	58·0	18 & 19	27·0	1
Althorp	W. F. Jakeman, Esq.	1·58	·45	27	12	56·0	17	23·0	8
Northampton	H. Terry, Esq.	1·58	·47	13	11	57·0	17	28·0	6 7 & 8
RUTLANDSHIRE.									
Burley-on-the-Hill	W. Temple, Esq.	1·31	·46	15	11	62·0	18	25·0	7
Tickencote	W. Hayes, Esq.	1·45	·28	12	11				
OXFORDSHIRE.									
Radcliffe Observatory	Mr. J. Lucas	1·35	·44	13	14	57·9	17	25·1	7
CUMBERLAND.									
Spital Cemetery, Carlisle	T. Bell, Esq.	1·79	·42	28	13	60·3	17	26·3	11
ISLE OF WIGHT.									
Ventnor Hospital	Hartley Sagar, Esq.	2·15	·60	13	15	58·8	17	30·5	8
CORNWALL.									
Altarnun Vicarage	Rev. G. Tripp	3·52	1·10	28	9	57·0	18	22·0	1

REMARKS ON THE WEATHER OF FEBRUARY.

Cheltenham.—The month opened with frost and dull, foggy weather, changing to genial weather on the 16th. This continued till the 24th, when dull days with wind and rain concluded the month. The 17th, 19th, and 21st were especially lovely days. Mean barometer (corrected) 30·264in. Mean temperature 42·2°. Whitchurch. A mild and open month. Temperature above the average. Woolstaston.—Mean temperature of month 41°. Mean daily average 11·2°. Leaton Vicarage.—An excessively mild month. Light westerly winds prevailed. Fog on 2nd and 10th to 14th, with east wind. Hoar frost on the 1st and 19th. Primroses in flower in numbers, and vegetation generally very forward. Bishop's Castle, (More Rectory.)—Snow on the 12th. Missel thrush, song thrush, chaffinch, and blackbird were all singing throughout the month, the last-named much earlier than usual at this place. The month began with a sharp frost and bright, cloudless days, but was afterwards throughout singularly mild and fine. The absence of tempests and high winds was remarkable for February. Bishop's Castle, (E. Griffiths, Esq.)—Rainfall again not more than half the average. Warm month, and vegetation very forward. The 12th was a very changeable day. St. John's, Worcester.—Barometer uniformly high. Average noonday temp. 2° below February, 1877. Rainfall a little less, but on exactly same number of days, with polar and equatorial currents in both months. This year greatest cold on 1st, last year on the 28th. Fruit trees in bloom—Pear, (Marie Louise and Bishop's Thumb,) damson, apricot, and gooseberry. Barlaston.—Rainfall ·89in. below average of last thirteen years. Mean temp. slightly above average. Light winds from all points, but chiefly S.E., S.W., and N.W. Barometer very high. Burton-upon-Trent.—Skating on shallow water on 1st. Picked woodbine in full leaf on 2nd, currant and gooseberry on 23rd, and rhubarb on 25th. Bees and wasps out on 17th. Lunar halo at 6 p.m. on 12th, accompanied by easterly gale with rain and snow at 9 p.m. Weston-under-Lyziard.—Snow and rain on the 12th. Wrottesley.—Snow and sleet on 12th. Mean temp. 39·4°; last year 41·6°. Tamworth.—Hard frosts on 1st, 7th, and 8th. Bar. very high. All spring warblers singing by the 4th. Rainfall greatly below average, and land working better than it has done since 1874. Hedges budding fast. Coventry.—Ground in excellent working order for spade and plough. Thrush, missel thrush, skylark, hedge-sparrow, wren, and chaffinch have been in full song during latter part of month, but the blackbird, although very abundant, has been unusually silent. Bickenhill Vicarage.—On the whole a dry but gloomy month, with but little sunshine and no winds. The early part cold, with frosts; the latter half mild. Henley-in-Arden.—Rainfall ·39in. below average of last seven years. Rugby.—February was remarkable for (1) the number of calm days —on sixteen days the wind was from 0 to 1; (2) the high average temperature; (3) the few days of sunshine—on only six days was any considerable amount of blue sky visible. Buxton.—Early part of month foggy and cloudy. In middle of month foggy mornings succeeded by bright sunshine. Snowdrop, crocus, and polyanthus blossomed. Few damp, cold, and windy days at end. Stuffynwood Hall.—Driest month since May, 1876, and very favourable for out-door work. Snow and sleet fell from 8 p.m. on 12th till 8 a.m. on 13th. Spondon.—Temp. above average. Much cloud. Worksop.—First fortnight cold and frosty, with thick fog on night of 8th. A very little snow on night of 12th. Mansfield.—Dry month, rainfall ·75in. below average of last seven years. Fog in middle of month. Bar. high. Coston Rectory.—Fine month, with high bar. Vegetation very forward, trees and hedges breaking into bud and leaf. Rain and snow on night of 12th. The 17th a perfect spring day. Last six days dull and wet. Belvoir Castle.—Remarkably dry month. The old north-country proverb, "February fill dyke," completely falsified. Frosty nights from 6th to 13th. Vegetation active. One consequence of the mild winter is seen in the abundance of keep for stock. Turnips are in excess of the requirements of most farmers. Good hay £3 per ton. Many spring flowers have appeared with the winter aconite and snowdrop, which usually follow those harbingers of spring, violets, primroses, yellow crocus, double daisies, *Erica carnea*, *Anemone apennina*, *A. blanda*, *Myosotis dissitiflora*, *Rhododendron dauricum* amongst the number. BELMONT VILLAS.—Very mild month. Temp. below freezing point on five nights only. Mean 41·7°. S.W. winds on 22 days. CASTLE ASHBY.—Rainfall about average of last five years, (1·59in.) "February fill dyke" has a bad character, which, however, appears to be the reverse of the truth. Results of last five years at this station show it to be the driest month in the year except May, (1·51in. average.) BURLEY-ON-THE-HILL.—Snow and rain on 13th. ALTARNUN VICARAGE.—A remarkably dry month; the first ten days rather frosty. ORLETON.—First twelve days dry and cold, with severe frosts, but no snow; remainder of month warm but cloudy, little sunshine, rainfall nearly an inch below average. BRAMPTON, NEAR CHESTERFIELD.—8th, hazel catkins; 13th, snow on ground; 18th, ash leaf; 19th, lesser celandine and dog's mercury in flower; *Rosa arvensis* and sweet violet on 25th; *Rosa canina* on 28th.

Review.

Notes of Lessons on Elementary Botany. By W. BLAND, Master of the Endowed School, Driffield. (Bemrose's School Manuals.) London: Bemrose and Sons. Parts I. and II., 6d. each.

After reading the numerous text-books of Elementary Botany which the last few years have produced, and which repeat the old, old truths in a very similar and monotonous way, it is a relief to find one which strikes out a new line as this does. Were it for nothing else, it would be remarkable for the entire absence of the stock woodcuts, which have been repeated in one book after another till they have grown wearisome. Every one of the drawings, mostly by the author himself, with which this little book is adorned, is new. This point, however, concerns more the teacher than the taught; it is of greater consequence that they are exceedingly numerous, and bear the mark of having been copied direct from nature, with the exception of a few, which are all the more conspicuous amidst the general excellence. Some of them, as those illustrating the terms *monœcious* and *diœcious*, will be more instructive to young readers than a lengthy paragraph of description. A few of the illustrations are misleading, noticeably that of the cone (p. 23,) the salver-shaped corolla (p. 29,) the silique (p. 41,) and the lichen (p. 85.) That of the *Volvox* on p. 86 is strikingly inaccurate. The microscope with which Mr. Bland saw this must have resembled Sam. Weller's "patent gas microscope of *hextra* power." Imagine a distinctly oval body, adorned with eight large tubercles, each furnished with two stout cilia, whose length is equal to half the diameter of the *Volvox !*

The value of the book is marred by the inaccuracy of some of the derivations given. An *Antheridium* is so called not because it is "like a flower," but because in function it "resembles an anther," if it and similar words should not rather be considered diminutives; and an *Archegonium* is not the "chief female," but the "beginning of the female organ." We may also notice that the useful fibres of flax and hemp are derived from the inner layer of the *bark* (p. 12,) as the author himself states on p. 90; that *valvate* means not "in folds," but "arranged like folding doors, *valvæ*;" that *ovary* does not mean "like an egg," (p. 36,) but "that which contains eggs." There are some sentences which a learner would misunderstand, but which the teacher, who knows what the author intended to say, can easily correct; *e.g.* he appears to state that the stellate form of cell is produced by the mutual pressure of adjacent cells (p. 87.) These, however, are small faults, easily corrected in a new edition, and they are pointed out with that view. For the purpose for which the book was written it is well adapted—Part I. to give a class of young children their first notions of morphology and classification; Part II. containing a practical experimental introduction to vegetable anatomy and physiology for senior scholars, based upon the South Kensington course. This part, indeed, comprises much information upon the lower forms of vegetable life, which is not usually included in an elementary book, and more advanced students than those for whom it is intended may learn something from it.

W. B. Grove, B.A.

Correspondence.

The Mildness of the Winter.—I found a bed of *Petasites vulgaris* in full flower, on January 17th; and on March 15th, *Adoxa Moschatellina*, in a wood.—O. M. Feilden.

A Feathered Visitant.—I have had a very curious visitor—a black and white blackbird—in my garden at Stoke. The markings of his plumage were a good deal like those of the magpie, but with rather more white, which was very conspicuous when he was on the wing. His manners and customs, as well as his voice, were precisely like those of the ordinary blackbird, and he had a fine golden bill. He stayed with us two or three weeks, but has since disappeared. I was greatly in hopes that he would have stayed to build his nest.—John Gulson, Coventry, March 6th, 1878.

The Harebell with White Flowers.—Will any botanical readers inform me of any spots where they have seen *Campanula rotundifolia* producing white flowers freely? Is there any connection between the colour of the flower and the soil upon which the plant grows? Last year I found the white-flowered harebell growing abundantly on the mountain limestone between Hartington and Buxton, and again at Breedon Hill in Leicestershire, also on the same rock. Is the white variety constant for succeeding years, and has any one ever met with white and blue flowers on the same plant?—H.

Is the Arum an Insectivorous Plant?—During some rambles last summer I examined numerous specimens of the common plant known as "Cuckoo-pint," or "Lords and Ladies." Without exception I found within the nearly closed spathe a number of small insects, some apparently stupified, others dead, whilst chitinous fragments of others alone remained. The remarkable appearance of the plant—its spotted leaves and strangely shaped and brightly coloured spadix, are well fitted to attract the attention of insects. Hitherto their visits have been considered chiefly in connection with the fertilisation of the flower, but it is possible that other ends may also be subserved. My only aim in mentioning the matter now is to call the attention of observers to this plant during the coming summer.—H.

Geology.—A interesting deposit of shell-marl, overlaid by peat and a considerable thickness of fine clay, has been exposed in excavations near Leicester. I hope to give particulars in the "Midland Naturalist" at an early date. A minute examination of the interesting series of freshwater shells in the marl and lower part of the peat is now being made. The peat also contains numerous insect remains, whilst the marl is so full of the seeds and stem incrustations of *Chara* as to suggest the probability of its having been formed in great part by this plant.—H.

The Meaning of Knowledge.—Mr. Watson thinks I have unduly limited the meaning of this word; but I have nowhere asserted that it bore *no other* meaning than the one I assigned to it. Like a large number of English words, it has several shades of meaning, most of which are included in my definition. I wished only to point out the incorrectness of its use as a synonym of *belief*, the difference between knowledge and belief being very wide, and the common confusion between them a source of grave and constant error.—F. T. Mott.

Postal Microscopical Society.—Allow me to draw the attention of your microscopical readers to this society, established about four years ago, for the purpose of encouraging the study of such subjects as are best elucidated by the microscope, by sending boxes containing from twelve to sixteen objects that are expected to be mounted by the sender, with an explanation of each. For that purpose a small book accompanies each box in which members write their remarks, explanatory or critical, on the different slides. The present president, Mr. Tuffen West, and Messrs. Underhill, Hammond, Kyngdon, and others, frequently illustrate the objects by excellent coloured sketches; the notes and drawings are in themselves very interesting. The subscription of 2s. 6d., (exclusive of postage, &c.,) and 2s. 6d. admission fee, are the only expenses, except four slides a year from each member to help to fill up the boxes in his circuit. Mr. A. Allen, of 1, Cambridge Place, Bath, the secretary, will, I am sure, be pleased to give every information to enquirers. Cannot our Birmingham friends form a section from among so many excellent microscopists?—Thomas Partridge, M.P.M.S., Stroud.

Botanical Querry.—Will you or some of the botanical readers of our Journal oblige by informing me of what use are the "thickened hollow spots" (of Bentham) at the base of the petals of the genus Ranunculus, and whether they occur in any other genera or species?—H. F. Devis, King's Heath.

[These "hollow spots" are what are known as nectaries. Their function is that of secreting the nectar or honey, and they often serve an important purpose in the economy of flowering plants, helping to bring about cross fertilisation; thus, the nectar they secrete is much sought after by many insects, and in obtaining the honey the insect frequently gets dusted with the pollen from the ripe anthers of the flower visited. This it carries away, and in visiting another flower in search of more honey, deposits the pollen carried from flower No. 1 on the stigma of flower No. 2. In this way it unconsciously aids in bringing about the fertilisation of the ovules. These nectaries vary in form, colour, &c.; in Cruciferæ they occur as little green warts at the base of the filaments, in Umbelliferæ they form the fleshy disk at the base of the styles; sometimes they occur as spurs at the base of anthers, as in the violets; again as spurs at the base of the petals, as in many orchids and in the larkspur. They occur as pores at the base of the petals in another of our British plants, *Fritillaria Meleagris*. For full information see Balfour's "Manual" or Sach's "Text-book of Botany," under the head Nectaries.—J. E. B.]

A Microscopic Trap for a Rover.—If you would set aside a special corner for Practical Hints in Microscopic Manipulation, I, for one, should turn to it first on opening your journal. We all of us learn something in practice worth recording. Your correspondent S. S. R. has kindly sent me a rich collection, containing amongst others *Hydatina Senta*, (see Dr. C. T. Hudson's, paper 2 M. M. J. 22,) a rotifer which, if it has room for its vagaries, is the maddest of rovers, delighting chiefly in balancing itself on one toe and pirouetting as hard as it can turn in a vertical position! I first tried my usual cell, a ring of microscopic glass, the very thinnest I can get, (and answering to the number 6 on the adjustment collar of the $\frac{1}{8}$th,) with a piece of glass as thin as itself over it. This prevented the whirligig performance, but rest was out of the question, and following even Hydatina's charms under a $\frac{1}{4}$ gets monotonous when you are always *only just catching her up*. So I tried an old idea in a new form. I took a flat glass slide and dropped two Hydatinas on it, with a small drop of water about $\frac{1}{2}$in. in diameter. Upon this drop I laid some *cotton wool*, frayed out so as to be much diluted with (I suppose I ought to say diffused in) space. I then put the thin sheet of glass on that, gave the thin sheet a touch with a needle to set the capillary attraction up, and Hydatina's gambols were over. I used a $\frac{1}{8}$th to examine her easily. The wool acts as a prison to the animal, and a protection from pressure. I had restrained the little beauty as completely as a driver holds a well-broken horse. As the water evaporated a drop added at the side ran in and made all things comfortable again, and I have the two specimens still safe and back in their original bottle. I first tried a trap like this, some years ago, on an animal of extraordinary character. It was related to the *Poduras*, I believe, but I have missed fixing its name—perhaps you can help me to it. It lived in a ditch—gregarious—hopping on the water perpetually, and most difficult to catch, about 1-10th of an inch long. There was no keeping it still a minute, so I improvised, in a deepish glass ring, a forest of cotton wool for it to ramble in, and the effect was most successful—I saw the instrument which gave it its extraordinary power of jumping actually in action. It consists of an enormous stumpy muscular organ, with a round cleft end. It is concealed in, and comes at will in and out of the centre of the under side of the abdomen; it gripped a piece of the wool with the cleft end, pinching it, and then by a violent effort—the exact nature of which I was unable fully to examine—it made its leap. The relative size of the organ, as compared with the abdomen, was something enormous—my notes say as 1 to 3, and it must have been very nearly that. Now, but for my wool trap I should have been quite baffled by both animals, for the compressorium is uncertain and difficult to manage, and, when successful, too often creates unnatural attitudes. I offer these hints with some confidence to your readers, and shall be grateful in return for a few practical hints on my own weak point, which is "light."—F. A. Bedwell, Fort Hall, Bridlington Quay, Yorkshire. [We shall be much obliged to any microscopical readers who will act on Mr. Bedwell's hint and send us accounts of their methods of manipulation.—Eds. M. N.]

London Notes from an Occasional Correspondent.—Let me congratulate you on the near commencement of the Birmingham Aquarium, and express a fervent hope that the mistake too frequently made of considering the building first, and then consulting the scientific constructor, may not be fallen into, but that the Naturalist shall advise as to the Architect's plans before they are accepted. I am sorry to add that precautions are necessary to prevent the wanton or thoughtless cruelty practised towards the animals by visitors. A short time ago a gentleman was nearly knocked down by an electric eel which he seriously injured; then the largest crocodile ever brought alive to this country was killed by some one thrusting a stick into its eye, and last week seals were poisoned by fusees thrown into their pond, and one is dead. All this has happened at the Westminster Aquarium within the last three months, and it makes it heartless work when one has to contend against so many difficulties. Cook, who brought over the white whale, left on the 14th for Labrador in quest of others, and may be expected with his treasures in due time.—The Entomological exhibition was a wonderful success, as it deserved to be, since it was the largest and most complete ever held in this country. With 900 cases, repetitions were a matter of course, but there were great rarities, including an unnamed one from the Himalayas, very like *P. Paris*, but, if possible, handsomer; Lord Walsingham's exhibit was the most interesting, and I commend it for imitation to all true lovers of entomology; not only was the perfect insect there, but the caterpillar and pupæ illustrated its progress; and beautiful models of the leaves on which it fed, made of wax paper so admirably as to truly simulate nature, completed the life history, while all were prepared by his lordship himself, who has contrived to invest the caterpillars with most life-like and characteristic attitudes. These are prepared by first killing with chloroform or ether, (not in the cyanide bottle, which destroys the colour,) then making a small perforation near the anus with fine scissors, and rolling with a cedar pencil on blotting paper till the contents are extruded. A blow pipe is next inserted into the slit, and the animal then gently inflated to its natural size, when it is dried on a hot plate or in forceps over a spirit lamp, and the thing is done. It requires skill, and some early failures may be anticipated, but the art is soon acquired, and well repays the trouble. Camberwell Beauties and Purple Emperors, were common enough; and one exhibitor had nearly 7,000 Coleoptera, the work of forty years' collection, at sight of which, I, as a semi-scientific "flaneur," felt (and I hope many more like myself did too) ashamed of my lazy life. There was, too, evidence of the progressive advance of artistic taste among the people, in fifty really exquisite drawings of insects and flowers by a poor working man who had never had a lesson, and whose painting was done by candle light, after work hours. All honour to him. Your old associate, Mr. F. Enock, was there with his microscopic objects, which are obtaining a well-deserved celebrity; his latest success being entire insects mounted without compression; these seen by dark ground illumination are as beautiful as they are instructive.—Let those who keep monkeys beware of overfeeding. Generally the animals die of lung disease, and therefore fat-forming and heat-producing foods are most suitable, but corn flour and sugared milk have just killed the most intelligent Chimpanzee I ever knew, and the *post mortem*, made by Professor Seeley, showed he was loaded with fat, expecially about the heart, which failed in consequence.—W. J. S.

Gleanings.

"On the Detection of Toxic Matter connected with Typhoid and other Enteric Diseases" is the title of a paper read at a recent meeting of the Microscopical Society by Dr. Bartlett. In the course of it he gave an account of his attempts to trace to its ultimate source the cause of a recent outbreak of typhoid fever, and showed that whilst chemical analysis had failed to discover any impurity either in the water or milk, he had been able, by means of microscopical examination, to detect in the water certain bodies, presumably of a fungoid character, which were identical with those found in the bowels of persons who had succumbed to the disease.

West London Entomological Society.—On February 22nd, Mr. Silcock exhibited *A. prodromaria*, *P. pilosaria*, *N. hispidaria*, *A. æscularia*, *H. leucophearia*, and *H. progemmaria*. March 1st, Mr. H. Timms, *N. hispidaria*. March 8th, Mr. Walford, *N. hispidaria* and *H. leucophearia*; Mr. Coverdale, a very dark var. of *H. progemmaria*, the oblique lines on the fore wings being quite invisible. March 15th, Mr. Russell several dark varieties of *H. progemmaria*.

Geological Society.—At the Annual General Meeting, held on February 15th, H. C. Sorby, Esq., F.R.S., of Sheffield, was elected President; and Profs. Bonney and Judd were chosen Secretaries. The medals, &c., were awarded as follows:—Wollaston Medal, Dr. T. Wright, of Cheltenham; Wollaston Fund, Mr. W. J. Sollas; Murchison Medal, Dr. Hans Bruno Geinitz, of Dresden; Murchison Fund, Mr. Chas. Lapworth; Lyell Medal, Prof. Geo. Busk; Lyell Fund, Dr. Waagen, of Vienna.

The Radcliffe Observatory, Oxford.—The Radcliffe Observer, the Rev. Robt. Main, M.A., has just published his Meteorological Observations for 1875. There are two sets of instruments in use in the Observatory; one of the ordinary kind, from which eye-observations are taken by Mr. John Lucas, the excellent and careful assistant; and the other self-registering, by means of photography. The diurnal inequalities of the mean monthly and yearly meteorological elements have been carefully worked out by Mr. Main, as in former years. We note that Moffat's test papers are used for the detection of ozone with apparently good results. The position of some of the instruments seems open to question. Thus, the vacuum solar-radiation thermometer, with blackened bulb, is stated to be "in a niche in the front of the west wing of the Observatory, about 5ft. from the ground;" surely the radiation from the wall must affect it? Such instruments are usually placed on a post, over grass, with the bulb at a height of 4ft. Until uniformity can be obtained in the placing of all instruments, the comparison of observations taken at different places *under different conditions* must be misleading. Why should not a general conference of English Meteorologists discuss these questions, and issue rules by which all observers would, we are sure, be willing to be bound? In an appendix Mr. Main gives very valuable tables of barometric and thermometric heights for the last twenty-one years, and mean monthly rainfall for twenty-five years at Oxford. Altogether the publication is one of great accuracy and interest, and worthily sustains the high reputation of the Radcliffe Observatory.

The United States Survey.—I have just received from Professor Hayden, of Washington, a parcel of the publications of the United States Geological and Geographical Survey for 1877, comprising monographs of North American Rodentia, by Coues and Allen, (a thick 4to. volume;) Annual Report of the Survey of Colorado, (a thick royal 8vo. vol., full of maps and plates and woodcuts;) monograph of the North American Mustelidæ, by E. Coues, (with twenty plates;) Ethnography and Philology of the Hidatsa Indians, by W. Matthews; besides several thick pamphlets, published at short intervals, with outline reports of the work in progress. The immense amount of labour and expense which these five volumes represent, the great value of their contents, and the liberality with which they are presented to such institutions as are likely to appreciate them, deserve the most cordial recognition in all scientific circles throughout the world. Yet it is probable that a majority of the members of the Midland Union are scarcely aware of their existence. I will endeavour at a future time to give some further particulars of the work which is being done by Professor Hayden and his numerous colleagues, and being paid for by the American people.—F. T. Mott, Leicester.

The Hippopotamus, which has been in the Zoological Gardens, Regent's Park, London, since 1850, died on the 11th March.

The Analogies of Plant and Animal Life.—A lecture on this subject, delivered by Dr. F. Darwin, at the London Institution, appears in "Nature," of March 14th and 21st. It will repay careful perusal.

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—Microscopical General Meeting, February 19th.—Mr. G. Hookham, M.A., read a paper on "A Method of Preparing Crystals for the Microscope."—Mr. W. R. Hughes, F.L.S., read the first portion of a paper by Dr. Cobbold, F.R.S., on "The Parasites of Man." General Meeting, March 5th.—Mr. A. W. Wills read the first of a series of papers on "Freshwater Algæ."—The Adjourned Annual Meeting was held on March 12th, when the President (Mr. Edmund Tonks, B.C.L.) delivered the Annual Address, the subject of which was "Malaria."—A vote of thanks was given to Mr. Tonks for his address, on the motion of Dr. Deane, seconded by Mr. W. Southall, and supported by Dr. W. Hinds and Mr. W. Wright Wilson.—Dr. A. Milnes Marshall presented a copy of his paper on "The Development of the Cranial Nerves in the Chick."

BIRMINGHAM AND MIDLAND INSTITUTE SCIENTIFIC SOCIETY.—February 27th.—Mr. Allen Everitt read a paper on "What to See within Six Miles of Birmingham." In the course of a most entertaining and graphic address, Mr. Everitt described the various old churches, moated and timber dwellings, and ancient farm houses within a radius of six miles The lecture was illustrated by sketches made by Mr. Everitt. March 13th.—Mr. C. R. Robinson read a paper on "The Geology of Ludlow."

BURTON-UPON-TRENT NATURAL HISTORY AND ARCHÆOLOGICAL SOCIETY.—March 12th, Mr. R. Thornewill read a paper on "The History of Burton Abbey from the date of its foundation, to the end of the XII. Century."

CARADOC FIELD CLUB.—February 25th.—Annual Meeting, held at Shrewsbury—Rev. J. D. La Touche re-elected President; Rev. J. J. Lambert elected Vice-President. Places and dates of Field Meetings for the season fixed on, viz :—June 26th, Stokesay; July 24th, Abbey-cwm-hir; August 27th, Lilleshall; September 25th, Special Meeting, for Cryptogamic Botany, Downton Castle.—The President gave his address, and a telephone was exhibited and lectured on by T. P. Blunt, Esq.

CHELTENHAM NATURAL SCIENCE SOCIETY.—General Meeting, February 21st.—The President, Dr. T. Wright, F.R.S.E., F.G.S., gave his opening address. He dwelt much on the natural advantages open to the society in the locality, and the interest each searcher after knowledge would find in studying the geological, botanical, and physical features of Cheltenham and its neighbourhood. He then pointed out, and, by aid of diagrams, explained the general geological features of the hills surrounding the valley.—Mr. H. A. James then gave a full and lucid description of the telephone. An instrument had been fixed in the room, connected with a shop in the street, and much amusement was caused by the messages sent and received.

EVESHAM FIELD NATURALISTS' CLUB.—Meeting, January 30th.—Mr. J. S. Slater read one of the Manchester Series of Popular Lectures, by Wm. Pengelley, F.R.S., on "The Cave Men of Devonshire." February 27th.—Mr. T. E. Doeg delivered an address on "Our Local Molluscs," which he illustrated with some microscopic slides.—The Rev. J. Collins Odgers, B.A., read a paper on the "The Less Parasitic Plants," including fungi, mushrooms, and potato mould.

NOTTINGHAM LITERARY AND PHILOSOPHICAL SOCIETY, NATURAL SCIENCE SECTION—March 13th.—A paper was read by Mr. G. B. Rothera, on "The Physiography of the Yorkshire Coast," illustrated by maps and sections. March 20th.—Microscopical evening. The Rev. G. E. C. Casey, M.A., F.G.S., introduced the subject of "The Epidermal Appendages of Plants." March 27th.—A paper on "Rotifera," part of which appears in our current number, was read by Mr. E. Smith, M.A.

NOTTINGHAM NATURALISTS' SOCIETY.—February 20th.—A paper on "A Feather" was read by Mr. Blandy. February 28th.—The Annual Soirée was held at the Mechanics' Large Hall. There was a very large attendance. Several societies in the Union were represented. There was a good display of microscopes and other objects, including local collections of shells, rocks, birds' eggs and nests, butterflies and moths, &c. At 9.45 Mr. A. H. Simpson exhibited, by means of the oxy-hydrogen microscope, a series of photographs for the lantern. Amongst others was one of the cover of the "Midland Naturalist." Altogether it was a most successful evening. March 6th.—"Life History of a Butterfly," by Mr. C. T. Musson. March 13th.—Microscopical evening, "Insects."

RUGBY SCHOOL NATURAL HISTORY SOCIETY.—February 23rd.—The President read portions of the Meteorological Report. The rainfall of the year was 28·72in., being less than 1876 by 1·9in. Rain fell on 195 days. Papers were read as under :—By Mr. G. Jones on "The Rise, Progress, and Fall of Gothic Ecclesiastical Architecture in England;" by Mr. H. J. Else, on "Campanology;" and by Mr. Percy Smith, on "Mushrooms," in the course of which he described the various edible and poisonous kinds. Mr. Bloxam exhibited two Roman urns and bones found by Mr. E. A. Bird, at Soreham, Cambridgeshire, and described the ancient British, Roman, and Saxon modes of burial. Numerous specimens were exhibited. March 16th.—Mr. M. H. Bloxam, F.S.A., read a paper, full of interest, on "Rugby School Close." Among the exhibits at this meeting were some beautiful specimens of arborescent copper ore.

STROUD NATURAL HISTORY AND PHILOSOPHICAL SOCIETY.—March 12th.—The Rev. W. Farren White, M.A., read a most interesting and elaborate paper on "The Slave-making Ant," *(Formica sanguinea,)* illustrated by diagrams and specimens, and a living colony of the species of ants forming the subject of the paper. There was a large attendance.

TAMWORTH NATURAL HISTORY, GEOLOGICAL, AND ANTIQUARIAN SOCIETY.—February 18th.—Mr. F. A. Grayston read a paper on "The Correlation of the Leicestershire, Warwickshire, South Staffordshire, and Shropshire Coalfields." He showed that they were portions of one extensive formation, and gave it as his opinion that probably large deposits of coal and ironstone existed beneath the Permian and Triassic rocks, which, on the surface, separate the coalfields. In support of this view Mr. Grayston stated that the 7ft. coal of that district, and also the strata between that seam and the "Smithy" coal, could be identified in each of the other three coalfields, and that there were many reasons for assuming that the thick coal of South Staffordshire was represented in Leicestershire, Warwickshire, and Shropshire, by the numerous thin seams of coal found there in the upper part of the coal measure series. Several plans and diagrams in illustration of the subject were exhibited. March 4th.—Mr. R. W. Hanbury, M.P., gave a description of his ride through Asiatic Turkey to India, in the course of which much interesting information was given. Mr. Hanbury exhibited a bronze sword, found near Diarbekr, and presented to him by some monks. It is supposed to be the oldest sword in the world. An inscription, in cuneiform characters, cut deeply on the blade, has been translated thus :—"Palace of Vulnirari, King of Nations, son of Pudil, King of Assyria, son of Belnirari, King of Assyria also." Vulnirari reigned between 1390—1350 B.C., and 500 years before David and Solomon. Mr. Hanbury also exhibited several tracings of inscriptions from the walls and stones in many interesting places visited by him on his journey.

Plate I

Fig 1× 300.

Fig 2× 300.

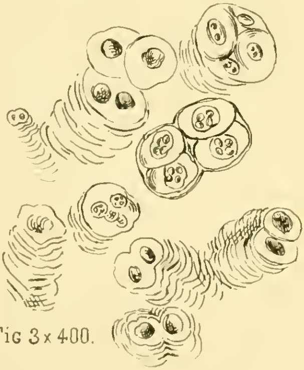


Fig 3× 400.

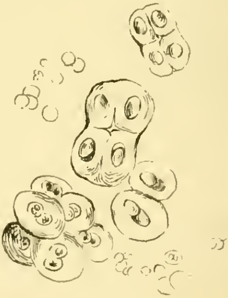


Fig 4× 400.

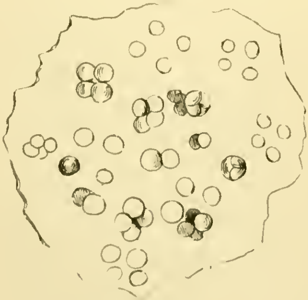


Fig 5× 200

Fig 6× 100.

A. W. WILLS del et lith.

FRESHWATER ALGÆ.*

BY A. W. WILLS, F.C.S.

The objects of the "Midland Naturalist" are, like those of the several societies in the Union which it represents, at least threefold, viz. :—1st, to record such original researches and observations as their members may be fortunate enough to make ; 2nd, to facilitate a complete record of the flora and fauna of the several districts of the Midland Counties ; and lastly, to enable lovers of Natural History to hold out a helping hand to one another by pointing out how others may pursue most profitably such branches of study as they have themselves specially affected, and by communicating to one another such hints as are derived from their individual experience, whereby success may be ensured, time saved, or gaps in special lines of investigation filled up.

The present paper falls within the scope of the last division ; it records little or nothing which is original ; its object is to invite attention to a branch of microscopical study in which there is ample scope for observation, and to point out in what fashion the examination of the great group of plants known as the Freshwater Algæ may be successfully begun and carried on.

In doing this it will be convenient to ask and briefly to answer the following questions :—What are Freshwater Algæ, and why will they repay patient investigation ? Where must they be sought ? What are the general features of their structure, modes of reproduction and morphology, and the characteristics of the principal groups into which they are divided ? How are they best collected and preserved ? And how should observations be recorded ?

1st.—Freshwater Algæ are minute plants, mostly requiring considerable magnifying power to reveal their structure, belonging to that great group of water-weeds included in the somewhat loose term of Confervoideæ or Chlorospermeæ, of which the coarser green weeds of the sea shore are the most familiar examples.

The imperfection of a classification by reference to the colour of these plants or of their spores will become evident from the outset ; it must be accepted only as a rough division by which the majority only of the genera are covered.

The freshwater species are far more delicate in texture and various in form than the marine ones, and comprise, in addition to those larger

* DESCRIPTION OF FIGURES.—PLATE I.

Fig. 1.—*Chlorococcum vulgare*, from the bark of an ash tree, showing subdivision of cells into groups of two, four, &c.

Fig. 2.—*Protococcus.*—Species allied to *P. pluvialis*, from a freshwater aquarium, showing subdivision of cells and formation of motile forms.

Fig. 3.—*Urococcus* sp? Hass., from damp wall of a greenhouse.

Fig. 4.—*Protococcus* sp?, from wet rocks at Church Stretton.

Fig. 5.—*Tetraspora lubrica*, from bogs in Sutton Park.

Fig. 6.—*Micrasterias rotata* and *Cosmarium cœlatum*, from bogs in Sutton Park, showing increase by cell-division.

filamentous kinds which everyone would recognise as first cousins of the familiar green seaweeds, an immense number of minuter forms, the relationship of which to their more robust kindred is not so evident, and at least two vast groups, totally different in external aspect, rich in the tenderest colours and most exquisite shapes.

But the whole order is especially attractive to the Botanist, not only by reason of its singular gracefulness and beauty, but because in no other can he watch so easily the mysterious fundamental processes of cell-division and of reproduction. "To penetrate everywhere to these first rudiments of structure, to follow out from them the course of the development of the tissues of all parts, and to make out the laws according to which the cell-formation progresses to produce the various arrangements on which the structure of the plant essentially depends, is one of the most difficult, but at the same time most profitable tasks."*

The facility with which these plants can be kept alive for a length of time—often long enough to enable the observer to trace in one individual its entire life-history—the translucency of their cell walls, which lays open to his observation under the microscope the active processes going on within; the many points in their morphology still awaiting solution, and the comparative ease with which they may be preserved for an indefinite period with little loss of their natural form; all these are grounds upon which they possess a high degree of interest, and challenge a more extensive study than they generally receive.

2nd.—Where are the Freshwater Algæ to be sought?

One is almost tempted, from their universal diffusion, to reply, "everywhere." It is, at any rate, safe to answer, "wherever moisture or fresh water is to be found—on the pots and walls in a greenhouse, on the shady sides of tree-trunks, on damp banks, on the moist faces of old walls, in the dripping from water-taps, in every ditch, in the hoof-holes where cattle have trodden in marshy ground, on thatched roofs, in bogs, on moist moorlands; above all, in every clear pool, lake, and mountain tarn, in cold springs and hot springs, floating on the surface of water wherever it is found, clinging as parasites to submerged roots, sticks, or larger water-plants, or entangled among bog mosses and the like."

In describing the principal families we shall revert to their habitats and give some hints as to the signs by which their presence may be recognised.

3rd.—Let us now proceed to consider briefly the principal orders into which they naturally fall, omitting, however, for convenience, that vast group of minute brittle siliceous organisms, the Diatomaceæ, whose vegetable character was so long disputed, and is not even now universally admitted, with which every Microscopist is familiar, inasmuch as their amazing variety of form and the great beauty of their sculptured markings have long caused them to stand foremost among the preparations of dealers and the objects of popular exhibition.

We begin, therefore, with the large and universally distributed division of Unicellular Algæ, which form (with the exception of the

* A. Braun. "The Phenomenon of Rejuvenescence in Nature," p. 122, (Ray Society, 1853.)

Desmidiaceæ) the least conspicuous, but by no means the least interesting member of the family, by reason of the facility which they afford for studying the phenomena of indefinite increase by cell-division.

The obscurity of the characters of these minute forms has led to a reckless multiplication of supposed genera and species; indeed there is little doubt that some of these really represent different stages in the life of the same species or even early stages in the development of higher cryptogams.

The simplest, and at the same time the most widely distributed plant in this order, probably the most universally distributed of *all* plants, is *Chlorococcum vulgare*, the humble organism to which the green colour of the bark of most trees, of old palings, gates, &c., is due. It consists of myriads of minute spherical cells, from 1-1500th to 1-2000th of an inch in diameter, [Plate I., Fig. 1,] in which the process of division of each original cell into two, four, or eight secondary ones, is admirably exhibited. This appears to be the only process by which this species is multiplied, but in that which we shall next consider we shall trace the addition of a further mode of increase which prevails, with some modifications, through many of the more highly organised families of Algæ. This plant, probably allied to the *Protococcus pluvialis* of some writers, appeared some time ago in a freshwater aquarium, and consists of innumerable spherical cells, from 1-1250th to 1-2000th of an inch in diameter, the outer coating of which takes the characteristic blue tint of cellulose when treated with iodine. The inner granular contents are sometimes bright red and at others green. Both forms exhibit the phenomenon of cell-division, giving rise sometimes to a still or motionless progeny, and at others to active zoospores, which move through the water by means of pairs of cilia, or by a single cilium. The relations of these two forms are somewhat obscure, and we have not been able altogether to reconcile our own observations with the statements to be found in books upon this subject. The red cells, at any rate, are capable of lying dormant in a dry state for long periods, the active processes of subdivision being re-established when water is added. Plate I., Fig. 2, represents some of the conditions of this plant. *Protococcus pluvialis* has been elaborately investigated by F. Cohn, whose research is translated in the Ray Society's volume for 1853.

We also give sketches of two kindred species, belonging respectively to the genus *Urococcus*, Hass., [Plate I., Fig. 3] and *Protococcus* [Plate I., Fig. 4.] From these simplest forms there is an easy transition to such genera as *Tetraspora*, in which numerous green cells are arranged in a continuous gelatinous frond, in groups which show very beautifully their repeated sub-division into two and again into four, whence the generic name. *Tetraspora lubrica* [Plate I., Fig. 5] is abundant in summer in little streamlets among boggy ground in Sutton Park,* and is at all times a

* Sutton Park is a property of some 2,500 acres, held under an ancient Charter by the Corporation of Sutton Coldfield, for the benefit of the inhabitants. It comprises woods, moor land, large sheets of water, and clear streams, and, being only seven miles from Birmingham by rail, is the "happy hunting-ground" of the Naturalists of the town and district. Many of its rarer plants and animals have gradually disappeared before the vast numbers of visitors who now frequent it, before recent "improvements," and still more before the railway works which have sorely mutilated the beauty of some of its most charming parts.

pleasing object, especially when viewed by dark back-ground illumination.

A further step towards more complex structure is traced in the nearly allied *Enteromorpha intestinalis*, which, in late summer, forms pale green *tubular* fronds, often a foot long, in similar habitats, and is found in great abundance in warm pools in the "Black Country." Like *Tetraspora*, it is a charming object, especially in a young state, and it possesses further interest, as connecting the marine and freshwater floras, being an inhabitant of salt marshes also, and leading up to several species which are exclusively marine.

To the same order as *Protococcus* belongs that most strange and beautiful of all the lower vegetable organisms, *Volvox globator*, to which the limits of this paper do not allow more than a passing reference. It must suffice to remark that the analogy between *Volvox* and *Protococcus* will be more easily realised by conceiving a number of the green cells of the latter in their motile condition thickly and symmetrically embedded in a larger glassy sphere, with the cilia only protruded.

Volvox should be examined in cells shallow enough to prevent its movement, and by transmitted light, in order to observe its structure; but its most lovely aspect is when it is viewed by powerful dark back-ground illumination in a cell sufficiently deep to allow its exquisite pale green crystal spheres, with their miniature *Volvoces* within, to maintain their swift and graceful rolling motion across the field of the microscope under low powers, when it becomes an object of matchless beauty.

It is not an abundant plant in this neighbourhood. The ruthless and wanton invasion of Sutton Park by a railway, and consequent filling-up of the well-known "Webb's Stews," have destroyed a constant habitat of this as of several other choice plants, as well as the first known locality for the beautiful Rotifer *Melicerta Tyro*, discovered there last year by Dr. Hudson.

The distribution of *Volvox* seems to be capricious, for it often appears in sufficient quantity to render the water pale green, then disappears as suddenly, and perhaps only reappears months or years afterwards.

There are, however, situations in which it appears every year, and where good specimens may be obtained by straining a few pints of the water through muslin, and so, as it were, concentrating the spheres of *Volvox*, which may then be washed off into a small bottle. If it is desired to keep this plant in cultivation, all Entomostraca must be carefully removed with the pipette, as they devour it greedily.

For details of its structure and mode of reproduction the student should refer to the researches of Busk, Cohn, and Williamson, of which a slight summary is given in the "Micrographic Dictionary."

Before passing from the Unicellular Algæ, we must glance at one other large order, which surpasses all others in variety and singularity of form, in perfection of symmetry, and in brilliance of colour—the Desmidiaceæ.

Fortunately they are widely distributed; it is rather the exception than the rule to take up a dip of water from a pool or marsh in which some of the brilliant crescents of *Closterium* or the sculptured discs of Micrasterias do not delight the eye. The most distinctive feature in their appearance is the perfect bilateral symmetry of the two halves into which each plant is generally divided.

The fronds of *Closterium* are more or less crescent-shaped, from the slightly curved form of the Tartar bow to the complete crescent form of the young moon; in *Cosmarium*, *Euastrum*, and *Micrasterias* they consist of thin discs of a more or less oval or oblong shape, deeply constricted in the middle, and with their edges cut, crenated, or sinuated into forms of exquisite beauty and endless variety; while in *Staurastrum* and *Xanthidium* they assume a triangular aspect or have their edges adorned with spines or other appendages.

A glance at the figures in Ralfs' "Desmidieæ," at Plate X. in the "Micrographic Dictionary," or better still, at a few specimens in a friend's microscope, will give the beginner a better idea of their characteristic appearance than any description, and enable him at all times to recognise them among his own gatherings.

These plants rejoice in peaty bogs, where they occur either scattered here and there among larger plants, or in thin films encrusting their submerged stems; or floating in delicate clouds in the recesses of shallow pools, where the eye only detects them when it has become accustomed to the dim light by steadily gazing into the water for some minutes.

From such positions Desmids are best removed by carefully passing a watch glass under them, and raising the contents with slow and steady motion to the surface. Many fine specimens may be obtained also by squeezing out the water from handfuls of clean Sphagnum moss into a shallow basin, allowing a few moments for the plants to settle to the bottom, and then pouring off the surplus water, and transferring the greenish residue to a tube.

Some of the best habitats in Sutton Park have been destroyed by the railway and by drainage, but some of the commoner species, as *Micrasterias denticulata*, *Penium digitus*, *Closterium acerosum*, *C. Dianæ*, &c., and the filamentous species, *Hyalotheca dissiliens*, are sometimes to be found in tolerable abundance in boggy ground by the side of the streams. One morning's search in any bog on a Welsh moorland will, however, yield more and rarer species than any amount of hunting in this district.

It is worth adding that Desmids flourish for years in cultivation in small bottles, exposed to the light of a north window, and their growth can thus be watched *de die in diem*.

The singular modification of cell-division by which they increase will be at once understood from the accompanying figures of *Micrasterias rotata* and *Cosmarium cœlatum*, sketched from specimens in the cabinet of the writer. [Plate I., Fig. 6.]

[TO BE CONTINUED.]

PARASITES OF MAN.*

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

[*Continued from page 99.*]

In addition to the eight Cestodes noticed in my previous communication, all of which belong to the genus *Tænia*, we find the human host liable to entertain several *Bothriocephali*. These are readily distinguished from ordinary tapeworms, not only by the absence of true suckers on the head, but also by the circumstance that the reproductive openings are placed on the ventral aspect of the proglottides, and in the median line. The classification of the Cestodes, as a whole, requires revision, but no zoological arrangement will stand that is not based on the examination of a large number of types. It may be that the out-of-the-way types are difficult to get at and comparatively rare; nevertheless it is just these aberrant types that are wanting to the Cestode systematist. The hard and fast line drawn between the armed tapeworms and the unarmed forms cannot be allowed to remain, since rudimentary hooklets have been found attached to the margin of the supplementary suckerlet or central disk of the beef tapeworm. Of course, as a matter of mere convenience it is very useful to separate the hooked and hookless Tæniæ, but the separation is not fitting as a primary basis of classification. In like manner the snouted or proboscis-bearing tapeworms, (*Rhynchotæniadæ*,) considered as altogether distinct from the tapeworms that do not possess any proboscis or rostellum, (*Arhynchotæniadæ*,) cannot be accepted. Of far more significance and value is the proposal that we should divide the tapeworms into two sub-orders, based on the characters of the egg-shell. This originated with Dr. Weinland of Frankfort. Thus, for the thick or hard-shelled tapeworms, he proposed the term *Scleroleptidota*, and for thin-shelled forms the term *Malacoleptidota*. The eggs of the former require the action of the gastric juice of vertebrates to dissolve their shells, whilst the eggs of the latter readily hatch within the stomach of evertebrated animals, such as mollusks and insects. Quite recently, astonishment was expressed (in the pages of a scientific journal) that herbivorous animals (rabbits and hares) should suffer from the presence of tapeworm. It was evidently unknown to the writer that the larvæ of tapeworms (Cysticerci) are found in many other kinds of food than meat. To be sure, as Melnikow's discovery of the larvæ of *Tænia cucumerina* in the louse of the dog, (*Trichodectes latus*,) amply shows, "measles" are not necessarily swallowed as part of the ultimate host's food, but may be taken into the stomach accidentally. Respecting the question (raised by the President at the last meeting of the Section) as to the temperature necessary to destroy the eggs of tapeworms, I have no special information to offer, but

* Read before the Microscopical Section of the Birmingham Natural History and Microscopical Society, 16th April, 1878. The specimens exhibited by Mr. Hughes on Dr. Cobbold's behalf were *Bothriocephalus latus* and portions of *B. cordatus*; also part of a large maternal hydatid and one daughter-vesicle, together with a microscopic slide, showing the so-called *Echinococcus* heads and hooklets.

ERRATUM IN APRIL NUMBER (p. 98, line 9).—For "muscles in the beast and in the connective tissues," read "muscles in the heart, and in the connective tissues."

it is generally understood that the ova of the *Scleroleptidota* can effectually resist the action of ice and frost. As to the limited powers of resistance to heat possessed by Cysticerci we are now well informed, but I can do little more in this place than refer to Professor Perroncito's experiments and to the enquiries of Lewis, Tommasi, Pellizzari, Giacomini, myself, and others, as set forth in a series of articles published in the *London Medical Record* for 1874. Professor Pellizzari found that measles died at a temperature of 60° centigrade, (*i.e.*, 140 Fahr.) According to Lewis, exposure of the parasites for five minutes to the same degree of heat, or even to 135° Fahr., renders the life of these parasites absolutely extinct.

CESTODA CONTINUED.

21.—*Bothriocephalus latus*, Bremser.

Synonymy.—*Tænia lata*, Luin ; *T. grisea*, Pallas ; *Dibothrium latum*, Diesing.

Intermediate Host.—The higher larvæ are supposed to reside in fishes, especially salmon and trout. According to Dr. Fock, of Utrecht, the bleak (which is much eaten by Jews in Holland, who suffer from this tapeworm) is probably the intermediate bearer.

Larva.—Scolex unknown ; Proscolex, or six-hooked embryo, furnished with long and closely-set cilia.

Remarks.—This worm is abundant in Switzerland, Russia, Sweden, and the north-east of Germany. It occasionally occurs in Ireland, but very rarely in England.

Experiments.—All attempts to rear this worm have failed, although Dr. Knoch, of St. Petersburg, supposed he had succeeded by the administration of the eggs to dogs.

Literature.—Leuckart (l. c.) ; Heller (l. c.) ; Knoch, Die Naturgeschichte des breiten Bandwurms, 1862 ; Sömmer and Landois, Beiträge zur Anat., &c., in Sieb. and Köll. Zeitschrift, 1872 ; Bötcher, in Virchow's Archiv, 1864.

22.—*Bothriocephalus cordatus*, Leuckart.

Syn.—*T. vulgaris*, Linn., Pallas.

Larva.—Unknown.

Int. Host.—Probably marine fishes.

Remarks.—This species is about a foot in length and is very abundant in the dogs of North Greenland. It occasionally infests man. The head is somewhat heart-shaped, and set on to the strobile without any neck or narrow segmentation intervening.

Lit.—Leuckart, Die mensch. Par., Bd. I., s. 438, 1863.

23.—*Bothriocephalus cristatus*, Davaine.

Syn.—None.

Larva.—Unknown.

Remarks.—This species is of moderate length, (8ft. to 10ft.,) and comparatively narrow. It is distinguished by the presence of a crest-like rostellum. It has twice been found in France. The Westminster Hospital Museum contains some tapeworms probably referable to this species.

Lit.—Davaine, "Les Cestoides," Dictionnaire Encyclopédique des Sciences Médicales, (p. 589,) 1874.

Although the last-named species closes the list of human tapeworms, properly so called, yet no record of the Cestodes of man can be considered complete without taking into account the occurrence of hydatids. These structures, often spoken of as bladderworms, form, as is now well known, the scolex condition of a minute tapeworm *(Tænia Echinococcus)* which lives in the dog. From a sanitary and professional point of view this parasite is of more importance than all the others put together, but it must be obvious that it would be out of place here to do more than glance at its strictly zoological position. Every experienced Surgeon has to deal with instances of its occurrence in important organs, and probably not less than four hundred persons perish in the United Kingdom every year from this worm. In Australia and in Iceland the echinococcus disease is excessively fatal to man. The parasite is also scarcely less frequent amongst animals, although in these bearers its presence is only rarely attended with fatal consequences. Zoologically and morphologically the common hydatid is of great interest. Whilst the sexually mature worm supplies us with a form of human tapeworm altogether unique, (both as regards its size and the small number of its proglottides,) the larva, in the character of an hydatid, presents us with a type of polycephalous bladderworm which, so far as I am aware, has no parallel. The hydatid furnishes us also with a curious illustration of the extreme possibilities of tapeworm multiplication from a single germ. Starting with the postulate that the sum total of the products of a single impregnated germ or ovum fairly represents the "individual," (zoologically, so to say,) we find that whilst, on the one hand, the egg of any ordinary tapeworm begets only one Tænia, the egg of the hydatid-tapeworm is capable of producing, under favourable circumstances, several thousand tapeworms. To appreciate this truth, it is only necessary to observe that the six-hooked embryo becomes one hydatid. This maternal bladderworm may by proliferation beget daughter and grand-daughter hydatids, all of which in their turn may give rise to the formation of echinococcus heads in their interior. Separately these so-called heads represent as many tapeworms, and collectively they amount to many thousands. Thus, when a dog or wolf swallows the polycephalous hydatid and its offspring, all the heads of the colony of larvæ or scolices will become connected into sexually mature tapeworms in the intestine of the new host. The zoological individual, therefore, will comprise not merely one tapeworm, but a multitude of tapeworms. In other words, whilst the egg of an ordinary tapeworm like *Tænia mediocanellata* supplies a single colony or strobile of 1,200 joints, (proglottides or zooids,) the egg of the little *Tænia Echinococcus* supplies several thousands of colonies or strobiles, each of which is made up of three segments, without reckoning the head. This singular mode of tapeworm multiplication is also witnessed, though in a much less degree, in certain other forms of polycephalous bladderworms.

21.—*Echinococcus hominis*, Rudolphi.

Syn.—*E. veterinorum*, Bremser, Gurlt, &c.; *E. scoliciparicns* and *E. altriciparicns*, Küchenmeister; *E. polymorphus*, Diesing; *Acephalocystis*, Laennec, John Hunter, Owen, &c.; *Polycephalus*, Goeze; *Hydatis*, Lüdersen; *Hydatigena*, Batsch; *Vesicaria*, Schrank.

Adult State.—*Tænia echinococcus*, Von Siebold.
Ultimate Host.—Dog and wolf.
Remarks.—Forms three well marked types of hydatid growth, known to pathologists as exogenous. endogenous, and multilocular varieties (*E. multilocularis*, Virchow.) The liver is the organ most frequented. Thus, in 327 cases collected by myself, 373 by Davaine, and 983 by Neisser, giving a total of 1,683 cases, the average of liver cases was very nearly 46 per cent. Hydatids probably prove fatal in 25 per cent. of all the persons attacked. In Iceland they are the cause of one-sixth of the annual mortality.
Literature.—All standard works on helminthology, especially those of Leuckart and Davaine. The best monograph is that of Dr. Albert Neisser (Die Echinococcen-Krankheit; Berlin, 1877).

[TO BE CONTINUED.]

SCIENTIFIC NAMES.—I. FORM.

BY W. B. GROVE, B.A.

At the first birth of modern science, the names which it employed were generally, though not universally, formed in accordance with the recognised rules of the classical languages, but later times, when an acquaintance with the classics is no invariable preliminary or accompaniment of scientific discovery, have given birth to a number of words, which are unclassical either in their form or their origin. This may not be a matter of much regret, since science flourishes equally well, whether its terms are of legitimate or barbarous formation, but on the other hand the attempt at accuracy in this respect can scarcely do it any injury. One might justly think it unworthy of a scientific man to descend to the level of the draper who manufactures "*pectus expandus*" braces, or the shoemaker who invents "*pannus corium*" leather. In the report of an establishment for the training of Naturalists, not long ago, it was said that those students who had previously received a classical training were always the least exact in their biological work; but it is by no means certain that this result was owing to their previous study. In fact, since accuracy is to a great extent a habit, which, like other habits, can be acquired, it would seem likely that those, who were most accurate in one study, would be so in any other in which they were equally interested.

The following remarks are meant for those who feel the want of some help and guidance in the matter of scientific nomenclature: but the subject is so extensive that only a small part of it can be touched upon here. What is to be said will be divided into two parts, the first concerning the form, the second concerning the pronunciation of scientific names. It is understood, of course, that the dictionary and lexicon can be consulted, when necessary, by the investigator; this is an essential requisite, but one in which there can be little difficulty, in these days of libraries, for any one. Most of the words, however, are not in the dictionary in their complete form, but require to be looked out piecemeal, and it is in this part of the work that help will be most needed. We must begin with a little elementary information.

In inflectional languages most of the words consist of two parts, (1) that which contains the root-idea or ideas, which is called the stem, and may itself be composed of more than one part, and (2) a termination, which has generally no meaning apart from the stem to which it is affixed. The termination may consist of one or more letters or syllables. An important rule is, that in all cases the stem of all the derivatives from any word should contain the *true* root of that word, which is sometimes not obvious. To illustrate what is meant, we will take the word *chroma*, the nominative case of a Greek word meaning "colour." The true root of this word is *chromat-*, the *t* having been dropped from the nominative case, and when the Greeks wished to form a derivative from it, they would always use the true root as a stem; so they obtained *chromat-icos*, "relating to colour," from which we get *chromatic*, and we have also *achromatism* and *chromatography*. These are correctly formed, but when Vauquelin, in 1797, discovered a new metal, the compounds of which were remarkable for their varied colours, he called it *chromium* instead of *chromatium*, as it should be. More recently the coloured envelope of the sun has been called the *chromosphere;* it ought to be *chromatosphere*, and the reader may recollect the outcry which was raised against the word on this account at its first introduction. The generic name, Stromatopora, from *stroma*, is an instance of correct formation in a similar case. In the two instances just given the misformed words are firmly established, and a change is not only improbable, but perhaps not even desirable. But this is by no means a reason for forming fresh words incorrectly, and there are cases where two modes of spelling exist, when it becomes a question which should be preferred. Thus, there is a botanical genus Portulaca; of this word Portulac- is the stem, and *-aceæ* is the termination used to denote the whole assemblage of plants of which Portulaca is the type, consequently this Natural Order should be called Portulac-aceæ. In Balfour and the London catalogue this is done, but Bentham and Babington give the title as Portulaceæ, the second *ac* having been dropped. There is another genus Dipsacus, of which Dipsac- is the stem; its Natural Order should, therefore, be Dipsac-aceæ, and it is so given by Balfour and Babington, but the other two authorities unite in writing it Dipsaceæ. I am aware that there exists a possible explanation of this anomaly, in supposing the termination in these cases to be only *-eæ*, but it ought certainly to be *-aceæ*, and the explanation will not apply to the following case. The Natural Order containing Berberis should be named Berberid-aceæ, because the stem of the former word is Berberid-, as is seen in the analogous cases of Orchidaceæ from Orchis, Iridaceæ from Iris, and many others. Here Balfour, Babington, and Bentham agree in using the true stem, but the London catalogue gives Berberaceæ. It is a case of "doctors disagreeing," but a knowledge of the principles underlying these instances will enable the student to "decide" which doctor it would be better to follow. The tendency is evidently to drop syllables which seem to be superfluous. There is a curious instance of this in a branch of science, in which brevity of nomenclature is not now studied, in the name of *formic acid*. This acid was first obtained from the red ant, *(Formica rufa,)* and should have been called *formicic acid*.

There is one rule, which seems to be well established, and deserves particular notice, as it appears to conflict with that laid down above. In such words as Distoma and Leptothrix, the last components *stoma* and *thrix* are used in the nominative case, which does not here show the true stem. The reason is that no termination has been added in these cases: when, however, that is done, the true stem ought to appear, as in Distomatidæ (erroneously written Distomidæ) and Leptotrichum. It is, indeed, impossible to insist absolutely upon obedience to these rules; euphony must be consulted, and will occasionally give the preference to the less correct form. Moreover, the ancients themselves sometimes failed to observe their own precedents. Thus from *lapis*, (stem, *lapid-*,) "a stone," they obtained *lapicida*, "a stone-cutter," after which Linnæus named *Helix lapicida;* but from those who know what it ought to be it requires an effort not to write *H. lapidicida*, as has been in fact sometimes unconsciously done.

It may be useful to give an epitome of the chief Latin terminations, with the rules concerning them, so far as they concern our purpose. The genitive case, which answers to our possessive case, and means "of (a thing,)" is given as well as the nominative, because it is often required, as will be seen further on. In Latin, nouns are divided into five classes, called declensions, but only the first three of these are important to us, words belonging to the others being very rarely met with. Those belonging to the first declension end in *-a* and *-e*, and are feminine, or in *-es*, and are masculine; those of the second in *-us* and *-er*, and are masculine, (except names of trees in *-us*, as Fagus, which are always feminine,*) or in *-um*, and are neuter. More than two-thirds of the nouns used in scientific nomenclature belong to these declensions: these are, therefore, the most important, and are also the easiest to understand.

NOUNS.

	Singular.		Plural.		Examples.
	Nom.	Gen.	Nom.	Gen.	
I.	-a, *f.*	-æ	-æ	-arum	*rosa*, a rose, *rosæ*, roses.
	-e, *f.*	-es			*crambe*, a cabbage, *crambæ*, cabbages.
	-es, *m.*	-æ			see note†
II.	-us, *m.*	-i	-i	-orum	*rubus*, a bramble, *rubi*, brambles.
	-er, *m.*	-ri	-ri	-rorum	*liber*, a book, *libri*, books.
	-um, *n.*	-i	-a	-orum	*cilium*, an eyelash, *cilia*, eyelashes.

The method of applying this and the following table is as follows: —Take away from the word the letters given in the first column; what remains is the stem, and to it must be added the respective letters given in the other columns. There is one exception; in words ending in *-er*, the *r* forms an essential part of the stem. As examples we may take *fungus*, a mushroom, *fungi*, of a mushroom, *fungi*, mushrooms, *fungorum*, of mushrooms, *fung-* being the stem; but in *liber*, a book, *libr-* is

* The chief example of a non-feminine name of a tree, (except those ending in *-um*,) is Acer, a maple, which is neuter, *e.g.*, *Acer trilobatum*. Names of large shrubs, or even of small trees, ending in *-us*, as Euonymus, are made feminine or masculine according to taste; thus we meet with both *Euonymus Europæa* and *Euonymus Europæus*.

†To this class belong the numerous generic names ending in *-ites*, as Phragmites, Ammonites, Peronosporites, &c.

the stem, as in library. The knowledge and application of these few facts alone would save many a blunder which now appears even in print. For instance, one of the commonest mistakes, so common that the Rev. M. J. Berkeley mentions it expressly in his "Outlines of British Fungology," is to say "a Fungi." By what has been said, it will be seen that Fungi is the Latin plural of Fungus; it is as correct, therefore, to say "a Fungi," as it would be to say "a Funguses." One great source of error is the fact, that the singular of the first declension and the neuter plural of the second have the same ending *-a*. But to decide to which of these a word ending in *-a* belongs, it is only necessary to consider whether it is singular or plural. This would prevent such mistakes as to use ciliæ as the plural of cilia; so with septum and septa, infusorium and infusoria, phytozoön and phytozoa. The non-existent words *infusoriæ* and *phytozoæ* may be seen in well-known chemical and botanical handbooks respectively.

Generic names are always nouns, and their gender, consequently, is invariable; specific names are mostly adjectives, and can then vary in gender, but otherwise they resemble nouns.

ADJECTIVES.

Singular.			Plural.		
m.	*f.*	*n.*	*m.*	*f.*	*n.*
-us	-a	-um	-i	-æ	-a
-er	-ra	-rum	-ri	-ræ	-ra

In the classical languages it was the rule that an adjective must agree in gender, number, and case with the noun to which it refers. Compare *Raphanus maritimus*, *Crambe maritima*, and *Alyssum maritimum*. Consequently, when a species is transferred from one genus to another of different gender, an adjectival specific name must be altered, if necessary, to correspond. Thus there is a plant called *Leontodon hirtus*. From this we see at once that Leontodon is masculine; but the plant is sometimes placed in the genus Thrincia, which is feminine; its name must then be *Thrincia hirta*. Some of the first men of science have occasionally neglected this, and produced monstrosities, by the side of which the botanist's pet name for a common roadside weed, *Dockia roadsidum*, would not appear utterly disreputable. It will be noticed that adjectives ending in *-er* generally drop the *e* in the other genders, as *Orobus niger*, *Sambucus nigra*, (because the elder is a tree,) *Solanum nigrum*; but those ending in *-fer* and *-ger*, as well as *asper* and *lacer*, retain the *e*, as *Sonchus asper*, *Chara aspera*, and *Gastridium lendigerum*. Most of the names of the large divisions of the animal and vegetable kingdoms are adjectives, agreeing with some noun understood. Thus, nearly all the names of the Natural Orders of plants are feminine plural, agreeing with *plantæ*, plants, and those of animals, (except fishes,) neuter plural, agreeing with *animalia*, animals. Examples are Cruciferæ, cross-bearing plants, and Rotifera, wheel-bearing animals. Young students almost always forget the fact that these are plural, and talk of "a Ranunculaceæ," "a Polyzoa," &c., which are as bad as "a Fungi." There is sometimes a difficulty in finding a suitable English singular for these words, but it must be done, and can be done in various ways, as a ranunculaceous plant, a crucifer, a polyzoon, a rotifer, and so on.

[TO BE CONTINUED.]

FRESHWATER LIFE.—II. ROTIFERA.

BY EDWIN SMITH, ESQ., M.A.

(Continued from page 96.)

I do not propose any elaborate description of examples, and shall merely mention, with a few notes, those which have occurred to me in the neighbourhood of Nottingham, and which are tolerably common everywhere. I have of course met with our old friends *Œcistes*, *Floscularia*, *Melicerta*, and other sedentary or case-inhabiting kinds. According to my experience, the sheath of *Œcistes* is generally of an irregular, somewhat broken form, and more or less dingy with adhering vegetable matter. Last March I found one with three eggs at the bottom of the sheath, close to the supporting stalk. *Floscularia*, with its long pedicel, might easily be taken at first sight for a large Vorticella. Round the opening at the free extremity, there are five, or occasionally six, knob-like processes, each armed with a radiating bundle of long cilia, finer than any spun glass. These long filaments, however, have no concern in producing currents towards the mouth; such currents being evidently due to vibratile cilia within the mouth or gullet itself. The species which I have most frequently met with is, *F. cornuta*, distinguished by a little horn or feeler at the back of one of the knob-like processes. The eggs cluster in a group of two or three about the pedicel; and through their thin covering may often be seen the eye-spots of the young ones. The outer sheath is perfectly transparent, and has a refractive power nearly the same as that of water. Consequently it is almost invisible, except by means of particles collecting on its delicate surface. *Melicerta* possesses a ciliated disk, arranged in wavy lobes, presenting a front aspect not unlike the stylish cap one sees in portraits of Mary Queen of Scots. Nothing can exceed the beauty of the general effect, when this graceful wreath is in full action. Still more noteworthy is the animal's building talent. Into a little pit near the head, particles of selected matter are swept from the water, and there moulded into conical pellets, which the animal then deposits in regular courses one upon another, like rounds of bricks, and so builds up its case. These cases, of a reddish brown colour, are easily detected with the naked eye, attached by one end to branches of myriophyllum, or roots of lemna. By clipping out the bits of vegetation to which the several specimens cling, four or five may be got together in the field of a two-thirds objective; and then the display, under spot-lens illumination, is simply magnificent. A zoophyte trough made specially shallow from front to back, is the most convenient for showing them. With regard to *Stephanoceros*, or the Crown-horned Rotifer, it should be noticed that the lobes of the wheel-apparatus take the extreme form of so many tentacles, fringed with whorls of moving cilia. The protecting case is highly transparent. Few specimens have rewarded my search in this neighbourhood.

We now pass from those kinds which envelope themselves in a sheath of various structure, into which they can retire at will, to the free-swimming group. The latter constitute by far the larger division of

Rotifera. Occasionally the observer is startled by seeing move across the field of his microscope a thing with long stiff outstretched tail, like a mouse; and he can hardly believe that he is looking at a creature only the 120th of an inch long. It bears the expressive name of *Monocerca rattus*, or Rat-single-tail; the tail being, as already explained, a sort of foot prolonged backwards. This species may be looked for among duckweed in the earliest days of spring, and all through the summer months. Closely allied to it, if not of the same genus, is *Mastigocerca carinata*, or Keeled-whip-tail; whose chief distinction is a dorsal expansion of the integument, like a keel. The body is about the 160th of an inch long by about the 400th of an inch broad, inclusive of the keel. It has a crimson eye-spot, and is found among confervoid plants.

I well remember the pleasurable surprise with which I saw for the first time, in the month of May, a fine example of *Notommata tigris*, so called from having its eye-spots situated on the back of the neck. It may easily be recognised by its long pair of forceps, or double setæ of the tail-foot, the longer blade being the 120th of an inch in length, nearly twice as long as the body. I noticed numerous transverse lines on the thinner half of each seta, about fourteen on the longer, and eight on the shorter of the two. These quasi-jointings evidently contributed to the flexibility of the organ. The outer cuticle of the body was soft, and allowed the most varied contortions on the part of the animal. On one occasion, in the month of June, I observed in some water taken from a small pond in our Arboretum, an egg covered all over with hairs. I watched the egg for some hours in a live-box. The enclosed animal fidgetted about in its narrow prison, and appeared to be rasping the membrane at one end of the egg. The crimson eye-spot was beautifully distinct. At last the shell was broken through, and the tiny prisoner struggled into freedom. In a few moments it unfolded its limbs from their doubled-up posture, and sailed merrily away, unmistakably a young *Scaridium longicauda*. As its name, Long-tailed-leaper, implies, the Scaridium can leap as well as swim. It leaps with the aid of its tail-foot, which attains the considerable length of the 90th of an inch, the body measuring only the 137th of an inch.

It is a good plan for the microscopist to make drawings for future reference of everything noticeable which he meets with. Referring to my notebook, I find sketches of the ventral and posterior aspect of what I take to be *Euchlanis triquetra*, although Pritchard fails to notice the lateral fissure between the upper and lower valves. The body-shield, seen from behind, looks like a three-cornered hat. It evidently consists of three valves, two dorsal rising in a ridge along the middle and divided by a deep furrow, and one ventral, separated from the foregoing at the sides. There is also a large opening behind, extending some way on the under surface, and giving liberty to the tail-foot to double up beneath the ventral valve. My first observed specimen happened to lay an egg while under examination. The egg was the 190th of an inch long, the length of the parent's body being the 80th of an inch. A near relation of Euchlanis is *Salpina*, a very common object in freshwater gatherings. The lorica is three sided, with a dorsal ridge furrowed from end to end.

The front and hinder extremities differ in different species. *S. mucronata* has a lorica furnished with four spines in front and three behind; *S. ventralis* has two in front only, and its lorica is spotted. On the back of the neck of the former will be found a feeler, armed with a bristle. The body of a full-grown Salpina is about the 100th of an inch or more long. A young one has just the reeling side-to-side motion of its parent, but has a soft lorica, which becomes hard and firm with age. Our next example is one which occurred to me in a gathering from the small Arboretum pond before mentioned. *Dinocharis pocillum* has the basal portion of its tail-foot freely jointed, the joints having spinous processes. There are also two spines near the origin of this organ, and a minute bristle marks where the fork begins. The lorica is rather loose, and stippled all over with open dots. The actions of the animal are queerly angular and vigorous. One of the most beautiful of the loricated Rotifera is *Stephanops lamellaris*, in which the body-shield undergoes a peculiar expansion on its anterior margin, so as to form a very elegant crown over the animal's head. Behind the lorica is armed with three spines, and there are three bristles at the end of the tail-foot. On each side of the head is a little horn, and the neck has a collar-like thickening. The entire length of the lorica, including spines and hood, is about the 200th of an inch. A familiar friend to the microscopist is *Squamella oblonga*. Its favourite occupation is to climb about the stems or roots of water-plants, feeding as it goes like a minute species of cattle. It has four crimson eye-spots, and a lorica armed in front with four small spines.

One of the most interesting of all the free swimming Rotifera is, undoubtedly, the little creature which has given its name to the order, and is known as *Rotifer vulgaris*. When the wheel-like apparatus is drawn in, the shape of the animal reminds one of a spindle, the forward extremity tapering, as it were, into a blunt-pointed snout. Its movements are then much like those of a leech. The body is alternately wrinkled up telescopic-fashion, and stretched out over the ground intended to be covered. The ciliary wreath is double, and serves both for swimming and feeding. On the back, near the head, is a small feeler. There are two eyes, placed much in advance of the masticatory organ, and, apparently near the tip of the snout, in the retracted state of the ciliary wreath. I was very much puzzled, some years ago, when, having caught a full-grown female specimen, I observed a young one, about half her length, freely disporting itself in the interior of its parent. Omitting the parent's tail-foot, about two-thirds of her body was occupied by the young one, with eyes, and champing gizzard all complete. Even the ciliary wreath of the latter played at intervals. And all this must have taken place in the maternal ovary, which had been stretched to accommodate the offspring for some-time before actual birth. In fact the common *Rotifer* is occasionally ovo-viviparous; that is to say, the young, though produced from eggs, may be retained within the ovary for a certain time after they are hatched.

In *Brachionus urceolaris* the lorica is closed at the sides and open at the ends like the shell of a tortoise. Into this the animal can entirely withdraw itself. It is very prolific, and sometimes increases in such numbers as to render the water turbid. The terminal forceps of the tail-foot can be drawn back into a sheath. Both the front and hinder edges of the body-shield are usually toothed. I have often seen this majestic creature, with from two to four eggs attached to the hinder part of her body, sailing about as if proud of her maternal charge. She thus tugs along a precious load of care through a large portion of her existence; while the crimson eye of the parent is prettily imitated by the tiny eye-spots of her yet unhatched offspring. My last example, *Pterodina patina*, is found lurking under the leaves of duck-weed. Its generic name refers to certain wing-like processes; its specific name aptly describes the dish-like form of the soft, flat, transparent lorica. The tail-foot comes out through an opening in the lorica near the middle of its ventral surface, giving the creature a profile somewhat like a shield with its handle. The free extremity of the tail-foot acts like a sucker, enabling its possessor to hold on to one spot, while swinging round with the rest of its body, an exercise which it seems to enjoy. Owing to the transparency of the body-shield every internal organ can be discerned with ease. The convolutions of the respiratory canals are particularly well shown. Two longitudinal muscles can also be seen, crossed by faint striæ.

In bringing my imperfect observations upon Rotifera to a close, I take the opportunity of strongly recommending to the student, as books full of interesting information and excellent figures, Slack's "Marvels of Pond Life," and Gosse's "Evenings at the Microscope."

Reviews.

British Barrows: a Record of the Examination of Sepulchral Mounds in various parts of England. By WM. GREENWELL, M.A., F.S.A. London: Macmillan and Co. Price £1 5s.

Canon Greenwell's "British Barrows" is not only the most important contribution to Archæology which 1877 produced; it is one of the most accurate and philosophic works which have yet appeared on the pre-historic branch of the science. We use the term "pre-historic" in that convenient, if rather loose sense, which applies it to the times after the Palæolithic age, and before the dawn of history. No single book has added so much to our knowledge of the Neolithic and Bronze periods. As a record of actual exploration it has few equals, as a comment on discoveries it has hardly a rival. The introduction is a compendious statement of what is known and what can be inferred respecting the unrecorded past. Many of the older books on Archæology are so obscured by fanciful or traditionary notions that the facts they contain lose much of their value. An antiquary who started on his explorations expecting to disentomb an Ophite temple, a Druidical altar, or a monument of King Arthur, unconsciously distorts his discoveries to fit in with his expectations. Other archæologists, avoiding the Scylla of fancy, have fallen into the Charybdis of bald fact. Messrs. Bateman and Carrington, for instance, aspired no higher than writing a journal of barrow-opening, and though "Ten Years' Diggings" and the "Vestiges of the Antiquities of Derbyshire" are most useful storehouses of information, it is manifest that many little matters of importance either escaped notice, or were unrecorded through their avowed disregard for any theory. Canon Greenwell's review of facts, and the deductions from them, written as it is with a knowledge of most that has been done by others, is both a key to his own work and a fairly complete epitome of the science.

The plan of the book is as follows:—First there is an "introduction" which contains the general review of fact and theory we have just referred to. Next is an account of the author's own work, the thorough examination of 234 tumuli or burial mounds. Nearly three-fourths of these (the actual number is 162) are or were in Yorkshire, the East Riding containing the great majority. The remainder belong to the counties of Cumberland, Westmoreland, Northumberland, Durham, and Gloucester. The concluding pages are occupied by Professor Rolleston's description of the skulls and his observations on them, with an appendix on the pre-historic fauna and flora.

The introduction and the appendix are not the least valuable parts of the book. We have already stated the high estimation in which the former must be held. But of course all the conclusions of the authors will not meet with general acceptance. Now and then an imperfect acquaintance with well-known facts is disclosed. "British Barrows" does not profess to be a full account of pre-historic Archæology. The complete text-book of the science has yet to be written. As an instance of oversight, one case will suffice. Every practical barrow-digger knows that the ordinary "rat" of the tumuli is the *Arvicola amphibia*, and will feel surprise that Prof. Rolleston seems to consider the fact a discovery. This little creature is so constant a member of the barrow-fauna that it has been said by one of our greatest practical archæologists to be the invariable comrade of the human tenants of the tumuli. Again, in the majority of cases, the water-rats' bones were certainly not carried into mounds by a pole-cat, as Prof. Rolleston supposes. Their calvariæ are usually intact, and there can be no doubt that the animals lived and died amidst the loose stones of the cairn. Their abundant presence is a strong testimony to the humidity of the climate in ancient times. But such a shortcoming as this is after all insignificant, and the mention of it as a fault will show how few grave errors are to be found in the book.

Turning to weightier matters we cannot altogether concur in the doubt Canon Greenwell expresses as to whether any of the round barrows are of the Neolithic period. The long barrows have been almost universally attributed to this æra, and the author's conclusion as to his own work, (including fourteen of these mounds,) and the work of others, is that these tumuli belong to a time antecedent to a knowledge of metal. The round barrows, however, he seems at the outset to class as all belonging to the Bronze period; though he afterwards qualifies this view, and, indeed, almost commits himself to the opposite opinion. There can, we think, be but little doubt that a Neolithic period existed in Britain, just

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as it certainly did in Denmark and Switzerland. And we strongly incline to Canon Greenwell's maturer conclusion that many of the ordinary bowl-shaped mounds belong to it. Apart from all other indications, the comparatively brief endurance of the Bronze age and the great number of the round barrows lead one to conclude that these tumuli could not all have been piled up in so short a time. A period estimated as lasting for only 700 years could hardly have witnessed the accumulation of nineteen out of twenty of the pre-historic cairns.

Canon Greenwell confirms the opinion that no differences of custom can be traced between the people of the Bronze age and those of the Neolithic age. His Yorkshire evidence agrees with the result of the Derbyshire explorations, viz., that there is no reason for supposing that the practice of cremation was a funeral rite distinctive of the Bronze period. Inhumation was equally in vogue. All the evidence goes to show that the general adoption in any particular district of one custom or the other was either a tribal peculiarity, or a superstitious ceremony, or (perhaps more probably) the result of circumstances. Inhumation was the rule on the Wolds, where a tree is now a rarity, and wood must have always been scarce. Cremation was generally practiced in Cleveland, where the different nature of the soil would admit of the growth of timber. It cannot be said of course that the adoption of cremation was wholly dependent on abundance of fuel, but it was probably one of the determining circumstances. Indeed, each addition to our knowledge seems to show that in very early times races and customs were mixed, and that social improvement took place amongst peacefully mingling races, rather than from conquering invaders. Not that there was peace in the land: tribe fought with tribe, and many a hill-fort now-a-days marks the scene of desperate conflicts of old. But modern research has destroyed the notion that such a momentous change as the introduction of metal was brought about by an exterminating swoop of a foreign and superior race.

Canon Greenwell makes it clearer than ever that natural conditions will account for many divergences of habit. In Derbyshire, where stone is abundant, nearly every interment is protected by a cist, a rude chamber constructed of rough stone slabs. On the Yorkshire Wolds, where such slabs must have been brought from a distance, cists are almost entirely wanting. The greater frequency of bronze in the southern counties is doubtless due to the opportunity of dealing with the Phœnician traders, though on the other hand, and curiously enough, the Wold dwellers seem to have been poorer in jet and amber decorations than many of the inland tribes.

The exact significance of depositing articles of value with the dead is not advanced towards certainty by Canon Greenwell's book. The difficulty is that the custom existed, but by no means to a sufficient extent to equip the deceased for the supposed requirements of the future life. The gift to the departed must be looked upon as symbolical, rather than as intended for actual use, and this view seems borne out by the practice of placing vessels, which doubtless contained food, with the ashes of those whose bodies had been burnt. Everything points to the observance having a superstitious origin. The traditional veneration for stone, once the material of the most highly-prized weapons, long outlasted the uses of flint and quartzite. Flint flakes are found in Roman tombs. Even in the middle ages a person outside the Christian pale was buried with pagan rites, in observing which flints and pebbles were cast into the grave. Canon Greenwell quotes the priest's speech from "Hamlet," to which Mr. Carrington called attention in "Ten Years' Diggings," where, speaking of Ophelia's burial, he refers to this remnant of pre-historic customs.

We regret that space prevents our making our readers better acquainted with this interesting book. Its style is good, its descriptions vivacious. It is with regret we leave it, hoping that our observations on it may lead to its being carefully studied. The accuracy of general results, (which are all that can be discussed within the scope of a short review,) can only be tested by examining the accounts of actual work. These, which form the bulk of Canon Greenwell's volume, will be found models of care, both in barrow opening and in note making. We may add that the book is illustrated by some capital woodcuts of the pottery and implements, &c., unearthed.

ROOKE PENNINGTON.

Adventures in the Air, being Memorable Experiences of Great Aeronauts. From the French of Wilfrid de Fonvielle. Translated and Edited by JOHN S. KELTIE, with numerous illustrations. London: Edward Stanford. Price 6s.

Mr. Keltie, a gentleman who, as many of our readers are aware, is a member of the editorial staff of *Nature*, has supplied a real want in our literature, by presenting this excellent work in an English dress. Though it does not profess to be a complete history of ballooning, but simply a collection of the more notable incidents that have marked the progress of the science and practice of aeronautics, it will be found to contain very full information on the subject. It is based on M. de Fonvielle's "Aventures Aériennes," but is not a mere translation. Some passages of interest only to French readers have been omitted and several additions made, bearing mainly on the history of ballooning in England. The volume has had the benefit of M. de Fonvielle's revision, and he has added details, embodying the most recent information. Mr. James Glaisher, F.R.S., has also assisted in the work of revision, and Mr. Coxwell has supplied some particulars to the portion of the volume in which he is referred to. For lack of space we cannot enter into details of the contents, but we can, and do, warmly recommend the book which is suited for old and young. It is perhaps specially adapted for presentation to intelligent boys. There are a number of illustrative woodcuts.

AUTOGRAPHIC PRINTING.

A method whereby drawings of objects under the microscope, of rare specimens of plants, insects, and other things, may be accurately, easily, and inexpensively multiplied has long been desired. Numerous attempts have been made to meet these requirements, but none with which I am acquainted seems to yield such satisfactory results as that lately perfected by Mr. A. Pumphrey, of Birmingham, which he calls the Autographic Printing process. This is a method, invented and patented by him, by which anything written or drawn with ink on paper can be multiplied to any extent, in absolute facsimile, and in any one colour. It differs from the Papyrograph and other devices of that kind in the fact that fine lines can be reproduced in all their perfection; another and very great advantage is that the original is in no way injured, as is the case in most other methods. A desire having been expressed by members of the Birmingham Natural History and Microscopical Society to see the process in actual work, the inventor attended at the Society's meeting, held on Tuesday, April 2nd, and gave an account of the process, and then proceeded to employ it in reproducing a number of various kinds of drawings. These sketches, prepared beforehand by members, having been given to Mr. Pumphrey, a prepared slab of slate, coated with a special preparation of gelatine, (which can be kept ready for use for an indefinite length of time,) was moistened with a solution of bichromate of potash, the drawing to be copied was placed in contact with the surface for a few seconds, and the ink on the paper, where it touched the gelatine, affected it and made it horny. Without any further operation, an ordinary inking roller was passed over the gelatine, the ink adhering to the slab only where the writing had touched. Clean paper was then laid upon it, and a little pressure produced a perfect copy. After one print was taken, the slab was moistened with clean water, and the operation repeated. With this number of the Magazine will be found a number of plates thus obtained, which reproduce the original drawings with excellent effect.*

It was at first supposed that any ink and paper would suffice, but the materials of which these are made are so various that it is advisable to use only those kinds which have been found to be most satisfactory. The chief requisite of the ink is that it should contain an excess of iron. Ink and paper of the best kind can be obtained from the patentee, Emily Street, Birmingham, and from Mr. T. Bolton, at his Microscopist's and Naturalists' Studio, 17, Ann Street, Birmingham, both of whom supply, at a small charge, a book giving full details how to obtain the best results, and a compact and handy apparatus, by means of which the printing can be done, as has been practically proved, by anyone. The price of this, with every requisite for producing prints similar to those

* We give with this number eight plates, produced by Mr. Pumphrey's Autographic process. Plate A illustrates Mr. Grove's communication, at page 52 (February) of the "Midland Naturalist," on "A Hybrid Fern." Plates B, C, D, E, and F are reproductions of some of the drawings above referred to by members of the Birmingham Natural History and Microscopical Society; Plates G and H are printed from drawings reproduced by Mr. Pumphrey at the *Soirée* of the Stroud Natural History and Philosophical Society, on the 9th of April. The process can be seen in operation at Mr. Bolton's Studio, 17, Ann Street, Birmingham.—EDS. M. N.

Plate B.

Produced by A. Pumphrey's Patent Autographic Process.

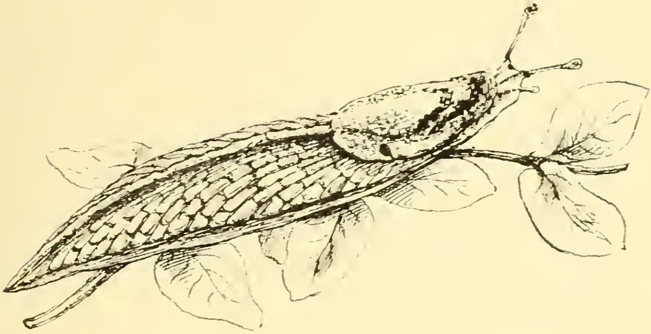


Fig 1

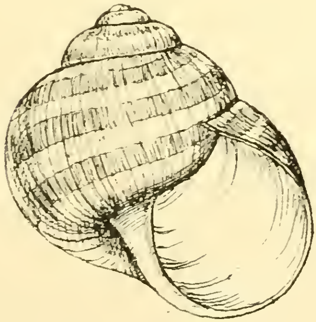


Fig 2

Fig 1 Limax carinatus

Fig 2 Helix pomatia

Plate C..

Produced by A Pumphrey's Patent Autographic Process.

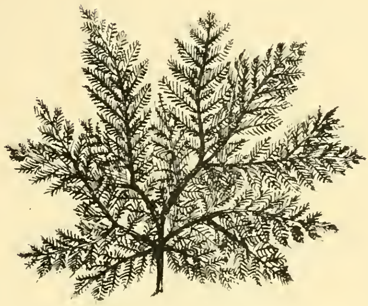


Fig 1

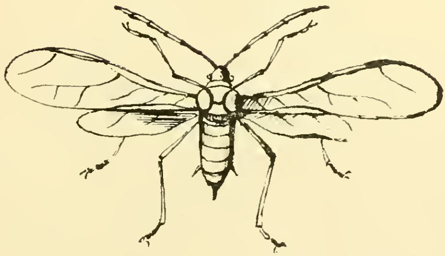


Fig 2

Fig 1. Ptilota plumosa

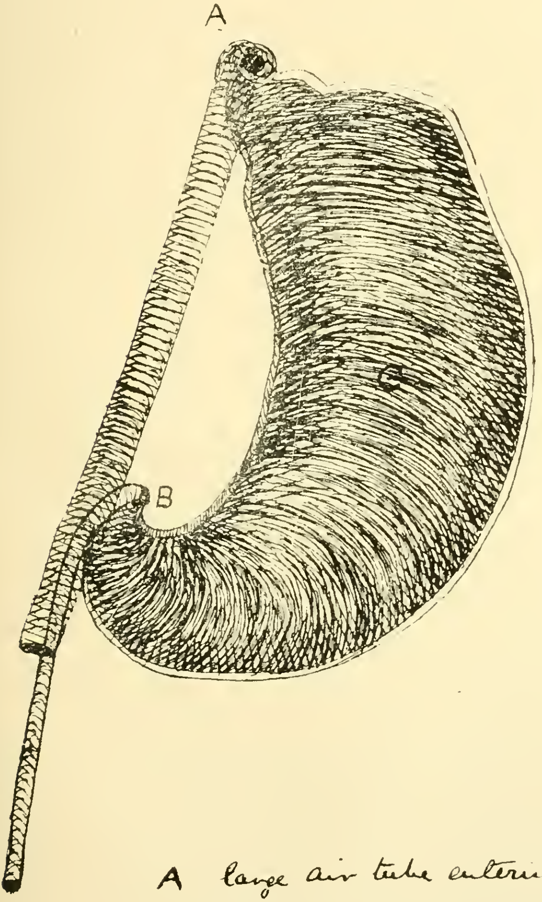
Fig 2 Aphis

Plate II.

Produced by A. Pumphrey's Patent Autographic Process.

Corethra Plumicornis Larval state.

Right Posterior Air Sa



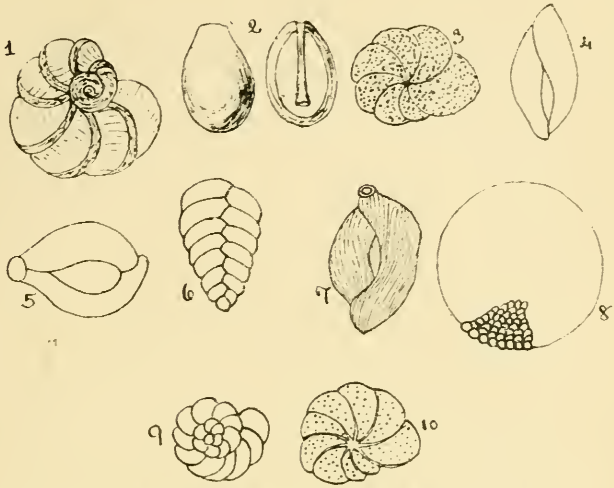
A large air tube entering air sac

B smaller air tube entering sac

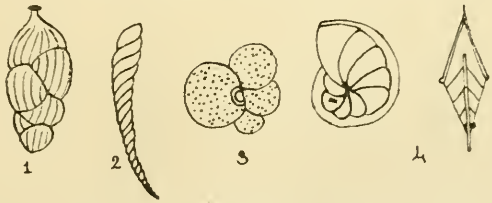
C air Sac

Plate E.

Produced by A Pumphrey's Patent Autographic Process.



All the above genera of foraminifera were found in one slide from the Mediterranean. 1 Peneroplis. 2. Entoselinia, whole and in section to show introverted tube. 3 Truncatulina 4 Polymorphina. 5 Miliolina. 6 Textularia 7. Adelosina 8 Fragment of Sorites. 9 Rotalina 10. Nonionina.

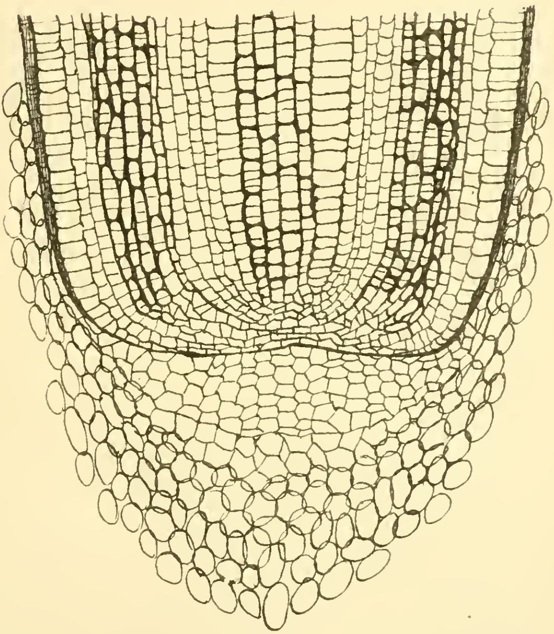


Foraminifera from the coast of Australia. 1 Uvigerina 2. Vaginulina. 3 Globigerina 4 Robulina seen sideways & edge-ways.

H.E. Forrest. Del.

Plate F.

Produced by A. Pumphrey's Patent Autographic Process.



Longitudinal section through the apex of a root of maize, (Zea mais.)

(After Sachs)

Plate G.

Produced by A. Pumphrey's Patent Autographic Process.

Produced before the Stroud Natural History Society from a sketch by a local delineator.

Plate II.

Produced by A. Pumphrey's Patent Autographic Process.

Produced before the Stroud Natural Histor

Society from a sketch by a local delineato

contained in the present number, is £3 12s., or without the rolling press, for which an ordinary copying press may be substituted, £2 2s. The gelatine plates, when used, will be exchanged for new ones by the patentee, at a very low price. Each plate will yield from 150 to 200 perfect copies, according to the style of drawing. When larger numbers are required, the best plan is to take an impression, while the plate is at its best, with transfer ink on transfer paper; if this be sent to a lithographer, more than 5,000 prints can be obtained from each of such impressions, thus multiplying, almost indefinitely, the number of exact facsimiles which can be produced. There is a great advantage in being able to transfer to stone, as any number of sketches can be combined together, or with letter-press printing. The latter is effected by taking an impression from the type with transfer ink, which can then be placed upon the stone with the drawing.

The autographic process is superior to lithography in the delicacy of its results. The only care required in making drawings for this purpose is to keep the lines as fine as possible, and to use only open shading. It is especially applicable to cases where only a limited number of copies is required, as for circulars, examination papers, music, &c., which can be printed at home, but, above all, for securing a record of any original microscopical or other observation; the drawing can be made without any elaborate preparation, and the absolute fidelity of the copies ensured.

W. B. G.

METEOROLOGY OF THE MIDLANDS.

THE WEATHER OF MARCH, 1878.

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

Want of space compels the compression of the monthly meteorological article, so that, instead of printing the *remarks* from each station in full, we must be content with a general summary. Notwithstanding this, we trust that every observer will continue to favour us with as many details as possible, especially of any remarkable occurrences, and of those facts in relation to animal and vegetable life which impart to meteorology much meaning and interest. We have quoted the references by our observers to the now famous "Eurydice squall" of the 24th of March in a special note.

March opened with charming and genial weather, "Coming in like a lamb," but it left us with a very ill grace, "Going out like a lion," thus literally reversing the old proverb. Temperature rose to 61° at Sedgley, on the 7th; and to 60° at Belvoir Castle (7th,) Worksop (1st,) and Dudley (1st.) The nights were very cold from the 22nd to the end of the month, the Cheltenham return of 12·2° (and on the grass 8·5°) on the night of the 25th, being very remarkable. Rainfall was decidedly below the average, and in most places the heavy land was so hard and dry that sowing was rendered impossible. Frequent falls of snow were experienced in the last week, those of the 27th and 28th covering the ground to a depth of 4in. or 5in. At Much Wenlock buttercups were in blossom on the 3rd, and the Wood Anemone on the 6th; Coltsfoot, Daffodil, and Palm, near Hereford, on the 7th. The Chiffchaff was heard at Kibworth on the 21st, and the small Bat seen flying near Stroud on the evening of the 3rd. The remarkable squall of the 24th is noticed separately.

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.	1·86	·75	2	9	56.0	1	22·0	26
Cheltenham	R. Tyrer, Esq.	0·90	·21	1,24,& 31	7	56·3	7	12·2	25
Stroud	S. J. Coley, Esq.	1·56	·59	1	8	58·0	1	23·0	22
SHROPSHIRE.									
Haughton Hall, Shifnal	Rev. J. Brooke	1·12	·21	28	13	56·0	1	24·0	23 & 24
Whitchurch	A. B. George, Esq.	1·48	·50	21	11	58·0	8	31·0	26
Woolstaston	Rev. E. D. Carr	1·25	·17	1	15	56·0	1 & 3	23·0	25
Leaton Vicarage, Shrewsbury	Rev. F. V. Pigott	0·94	·18	28	14	56·8	1	23·7	24
More Rectory, Bishop's Castle	Rev. A. Male	1·35	s.·26	21	17	52·0	1 2 18 19	22·0	24
Larden Hall, Much Wenlock	Miss F. R. Boughton	1·15	·25	24	13				
Bishop's Castle	E. Griffiths Esq.	1·66	·35	24	15	53·0	7	25·0	30
Cardington	Rev. Wm. Elliot	0·91	·21	24	10				
Adderley Rectory	Rev. A. Corbet	0·70	·2	11	12				
Stokesay	Rev. J. D. La Touche	0·74	·25	28	10	57·6	7	24·9	14 & 15
HEREFORDSHIRE.									
Whitfield	W. Wheatley, Esq.	1·17	·40	28	10			12·0	25
Stoke Bliss	Rev. G. E. Alexander	0·88	·39	28	8	58·0	1 & 3	26·0	24 & 31
WORCESTERSHIRE.									
Orleton, Tenbury	T. H. Davis, Esq	1·13	·38	28	14	59·0	1	25·5	23
West Malvern	A. H. Hartland, Esq.	0·54	·20	24	8	53·0	1	24·0	22 & 24
Pedmore	E. B. Mar[illegible]n, Esq.	0·95	s.·17	31	14	56·0	1 & 7	26·0	22 & 31
Stourbridge	Mr. J. Jeffries	0·86	s. 24	28	10	60·0	1	20·0	22 25 31
St. John's, Worcester	G. B. Wetherall, Esq.	0·69	·15	28	10	60·0	21	27·0	24
STAFFORDSHIRE.									
Thorganby Villa, Wolverhmtn	G. J. C. Broom, Esq.	0.90	·20	28	12				
Barlaston	W. Scott, Esq.	0·97	0·32	11	8	56·0	8	17·8	23
Amblecote	Mr. J. Robins	0.87	s.·25	28	12			21·0	13 & 14
Dudley	Mr. J. Fisher	0·76	·15	11	9	60·0	1	22·0	22
Sedgley	Mr. C. Beale	0·98	s.·61	28	11	61·0	7	27·0	22 23 24
Kinver	Mr. T. Bolton	0·[illegible]	s.·18	28	13			16·0	26(25&31
Walsall	Mr. W. E. Best	0·96	s.·26	28	12	55·0	2	27·0	22 & 29
Grammar School, Burton	C. U. Tripp, Esq.	0·88	·24	10	9	58·0	3	21·0	24 & 26
Patshull Gardens	T. W. Dell, Esq.	1·0	s.·2[illegible]	29	4	59·0	4 & 8	18·0	26
Weston-under-Lyziard R'tory	Hon. and Rev. J. Bridgeman	0·85	·18	28	15	57·0	1 & 7	19·0	23
Wrottesley	E. Simpson, Esq.	0·70	·21	28	10	56·5	2	22·9	23
Tamworth	W. Arnold, Esq.	0·99	s.·42	28	9				
Alstonfield Vicarage	Rev. W. H. Purchas	1·19	·48	1	11	53·8	4	19·3	26
Tean Vicarage, near Cheadle	Rev. G. T. Ryves	0·95	·20	1 & 21	15	56·0	1	21·0	26
The Heath House, Cheadle	J. G. Philips, Esq.	1·20			15	52·0	1, 4, & 19	22·0	26
WARWICKSHIRE.									
Coundon, Coventry	Lieut.-Col. R. Caldicott	1·10	·54	27	11	57·0	7 & 8	25·0	23
Coventry	J. Gulson, Esq.	1·10	·60	27	10			25·0	30
Bickenhill Vicarage	W. R. Capel, Esq.	1·16	·40	27	12	55·0	3	26·0	23 & 24
St. Mary's College, Oscott	Rev. S. J. Whitty	0·90	·22	27	12	56·9	3	25·0	23
Henley-in-Arden	T. H. G. Newton, Esq.	1·12	·30	28	9	57·0	1	24·0	23
Rugby School	Rev. T. N. Hutchinson	0.86	s.·25	27	11	57·4	3	24·0	23
DERBYSHIRE.									
Buxton	E. J. Sykes, Esq.	3.63	·82	1	14	57·1	24	26·0	23
Brampton S. Thomas	Rev. J. M. Mello	0·57	·20	1	7	59·0	1	24·0	26
Stoney Middleton	Rev. U. Smith	1·31	·35	1	11	55·0	1	15·0	23 25 &31
Fernslope, Belper	J. G. Jackson, Esq.	0·87	·34	1	11	57·0	1	25·0	26
Matlock Bath	R. Chadwick, Esq., jun.	1·35	·48	2	13	58·0	19	23·0	23
Linacre Reservoir, Ches'field	C. E. Jones, Esq.	0·70	·16	2	12				
Willesly Gardens, Cromford	J. Tissington, Esq.	1·31	·42	1	9				
Stuffynwood Hall	Mr. R. Rolfe	0·57	s.·15	26	12	58·0	3	22·0	31
NOTTINGHAMSHIRE.									
Hodsock Priory, Worksop	H. Mellish, Esq.	0·64	·12	9	10	60·0	1	22·7	25
Grove House, Mansfield	W. Tyrer, Esq.	0·49	·13	26	12	58·2	10	25·0	25
LEICESTERSHIRE.									
Ashby Magna	Rev. E. Willes	0·68	·16	27	12	57·0	20	25·0	25
Market Harborough	S. W. Cox, Esq.	0·55	·20	28	6	56·0	1	22·0	23 & 24
Kibworth	T. Macauley, Esq.	0·71	·18	11	11				
Foxton Locks	Union Canal Company	0·38	·13	28	7				
Town Museum, Leicester	W. J. Harrison, Esq.	0·69	s.·23	27	13	56·8	1	26·0	24
Belmont Villas, Leicester	H. Billson, Esq.	0·71	·24	27	12	57·8	1	25·0	24
Syston	J. Hames, jun., Esq.	0·76	·30	28	12	56·0	22	24·0	26
Waltham-le-Wold	E. Ball, Esq.	0·70	·13	11	10	54·0	3	23·0	25
Little Dalby Hall	G. Jones, Esq.	0·64	·10	11	10	57·0	3 18 & 21	20·0	23 & 24
Coston Rectory, Melton	Rev. A. M. Rendell	0·60	·12	11	11	56·2	1	19·9	24
Belvoir Castle	W. Ingram, Esq.	0·42	·11	1	9	60·0	7	23·0	23
NORTHAMPTONSHIRE.									
Towcester Brewery	J. Webb, Esq.	0·63	s.·14	24	11				
Castle Ashby	R. G. Scriven, Esq.	0·55	·13	31	8				
Sedgebrooke	C. A. Markham, Esq.	0·51	·12	31	11	58·0	2	26·0	31
Kettering	J. Wallis, Esq.	0·80	s.·18	24	10	59·0	2	25·0	23 24 &26
Althorp	W. F. Jakeman, Esq.	0·54	s.·15	31	8	57·0	1	20·0	31
Northampton	H. Terry, Esq.	0·63	·16	1 & 24	8	58·0	1	24·0	31
RUTLANDSHIRE.									
Burley-on-the-Hill	W. Temple, Esq.	0·58	·21	27	5	56·0	4	20·0	20
Tickencote	W. Hayes, Esq.	0·55	·17	24	10			24·0	24
OXFORDSHIRE.									
Radcliff Observatory	Mr. J. Lucas	0·78	·32	31	9	58.1	1	26·2	22
CUMBERLAND.									
Spital Cemetery, Carlisle	T. Bell, Esq.	1·21	·38	1	12	58·3	19	23·0	14
ISLE OF WIGHT.									
Ventnor Hospital	Hartley Sagar, Esq.	2·39	1·0.	28	9	61·4	2	29·6	23
CORNWALL.									
Altarnun Vicarage	Rev. G. Tripp	5·07	1 10	1	14	57·0	4	22·0	14 & 17

THE "EURYDICE" SQUALL.—Sunday, March 24th, 1878, will long be remembered as the date of the capsizing of H.M.S. Eurydice, with loss of about 300 lives, at four p.m., off Dunnose, on the east side of the Isle of Wight. The violent but brief atmospheric disturbance which was the cause of this catastrophe appears to have advanced from the N.W., and reached the north of England about ten a.m. Taking a south-easterly course, snow began to fall at Leicester about 1 45, and was followed by a strong gusty wind, but in an hour all was over. The barometer here fell but little, from 29·599 at nine a.m., to 29·494 at 12 45, and 29·477 at nine p.m. The next morning showed a marked recovery—29·731. The following interesting notes will show that the squall was of a more severe character in the West Midlands. The situation of the Eurydice—but a short distance to the S.E. of high cliffs, behind which chalk downs rise to a height of 800 or 900 feet, will sufficiently explain the way in which the squall took the vessel by surprise. The squall advancing from the N. W., the vessel was screened from it until it burst down the steep slope of the land in full fury.

The following notes on the weather of March 24th, are from observers whose names will be found in the Meteorological Returns for March, in connection with their respective stations:—BRAMPTON S. THOMAS, (Chesterfield.)—Lightning, with snow. ORLETON.—A sudden dense storm of snow, covering the ground 1½ inches deep, with a violent wind. TEAN VICARAGE, (Cheadle.)—The snow squall which swept across England from N. to S., reached Tean about noon, and cleared off about 12 45. CHELTENHAM.—A terrific snow storm, of short duration, burst over here at 2 P.M. STROUD.—Thunder and lightning, with violent wind, accompanying a snow storm. LEATON VICARAGE, (Shrewsbury.)—Violent storm at noon; darkness and heavy snow. MORE RECTORY, (Bishop's Castle.)—The snow storm or cyclone was very violent here about noon, and was followed by a display of Aurora Borealis at night. CASTLE STREET, (Bishop's Castle.)—The squall struck here with one terrific gust at 12 noon. STOKESAY.—A severe snow storm with strong N.W. wind at 12 noon; lasted about an hour. Bar. 29·531 at 12¼; Temp. 35·5. WORCESTER.—The storm burst on us very suddenly from the N.W. at 12 40. The barometer only fell two-tenths of an inch from 9 a.m., and quickly recovered. TAMWORTH.—The storm struck here about 1 p.m., and the contrast in less than two minutes from bright sunshine to a perfect hurricane of wind, dust, and snow so thick and dense that nothing could be seen twenty yards off, was most extraordinary. It was all over and bright sunshine in about ten minutes. Bar. at 9 a.m. 29·84, at 1 p.m., 29·44. STONEY MIDDLETON.—Snowstorm 12 to 12 30, then clear till 6 p.m. COSTON.—Rapid fall of Bar. Snow from 1 30 to 6 30 with squalls of wind.

Correspondence.

LEPIDOPTERA.—On April the 18th, on the banks of the Great Western Railway between Reading and Oxford I saw three specimens of *C. Edusa;* also, one of *G. Rhamni.*—E. H. MAYCOCK.

THE HAREBELL WITH WHITE FLOWERS.—In 1875 I observed a number of white harebells on a bank in the parish of Dalby, on the chalk hills or wolds in the east of Lincolnshire. If I am in the same locality this summer I will look for them, and can then answer the two last questions. —A. E. J.

Petasites vulgaris, &c.—Can any of your readers explain why *Petasites vulgaris* and other wild flowers, which blossomed during January and February, near Oswestry, Birmingham, and elsewhere, should not blossom until a month later in this neighbourhood, so much farther south.—Observer, Stroud.

Rats.—A rat being closely pursued by a cat, jumped from a garden wall into the road and saved itself by jumping between the spokes of one of the wheels of a cart that at the time was passing at a good speed. The cat being baulked for a moment till the cart passed gave the rat time to escape. This was told me by a man living near Nottingham, who saw the circumstance.—C.

Pheasant and Pike.—I heard the following anecdote told by an experienced fisherman, who pronounced it authentic. A party of gentlemen were shooting over an estate, near Nottingham, close to the River Trent. A pheasant was wounded and fell in the river. A pike, which must have been on the look out for some sort of prey, immediately struck it, its teeth becoming so entangled in the feathers that it was easily captured, with the pheasant held fast in its teeth.—C., Nottingham.

Mosses.—It may be interesting to those readers of the "Midland Naturalist" who study the mosses to know that I have recently found near Kingswood, Warwickshire, a moss new to the county, *Orthotrichum leiocarpum*, Br. and Sch. In this station it occurs on the lower part of the trunks of the Ontario poplar. In other parts of Great Britain this moss is somewhat plentiful, but in Warwickshire it is apparently very rare. I may also state that I have also found, in abundance, *Sphagnum auriculatum*, a very rare sphagnum, near Solihull; hitherto I have only seen it in Sutton Park. In this new Warwickshire station it occurs on the borders of drains in a small wood, in company with *S. contortum*.—J. E. Bagnall.

Early Swallows.—Passing over Baginton Bridge on Sunday, April 7th, I saw about half a dozen swallows flying about over the water and adjoining meadows. I watched them for a few minutes, but in the course of a short time they disappeared. I recrossed the bridge later in the day, but none were to be seen, and I have not seen one since. The swallow usually returns to us about the 20th April, sometimes one or two are seen earlier, but I never before saw so large a party at this early period. On the same day I heard the Chiffchaff and the Wryneck. The former is generally the earliest arrival of our summer birds, and is later than usual this season.—John Gulson, Coventry, 10th April, 1878.

Prunella Vulgaris, White Variety.—I do not know whether this very pretty variety of the common *Self-heal* is anywhere abundant. It is but slightly mentioned by Syme, Hooker, or Babington. In this neighbourhood it occurs in one locality only, an old pasture field on the slope of a low ridge of boulder clay. But the large creamy-white flowers, closely aggregated in short, blunt heads, and of which six or eight in a head are often open at the same time, are much more elegant and showy than the purple ones of the common form. I think it deserves to be introduced into gardens, and I mean to try what cultivation will do for it. The leaves are all narrower than those of the common form; the lower leaves oblong-lanceolate and toothed at the base, the upper ones narrow and linear, some pinnatifid with linear segments, others merely toothed, the teeth projecting at right angles from the blade. I should be glad to hear of any other localities in which the white variety occurs, and whether it corresponds with the above description.—F. T. Mott, Birstal Hill, Leicester.

Preserving Fish.—I would in answer to T.'s enquiry (page 80) as to the best methods of preserving fish refer him for full directions to Mr. Montagu Brown's useful manual entitled "Practical Taxidermy," (Bazaar Office, London.)—F.

Cocks and Chickens.—We have had two instances at Highfield House of cocks taking to chickens. In 1837 a Dorking hen died leaving some young chickens, which a Dorking cock took charge of, brooding them like a hen, and rearing the whole number. Last year, (1877,) a Duck-wing Bantam cock sat on a single egg, hatched a chicken, brooded it as a hen, and altered his voice to the peculiar tone of a hen with chickens, exhibiting as much care of the chicken as would have been the case with a hen, and attacking in a savage manner anything that came too near the little one.—E. J. Lowe.

Preservation of Fungi for the Herbarium.—In reply to C. T. M.'s request (p. 79, ante) that some of your readers would describe the best method of preserving Fungi, I would refer him to the following sources of information, in either of which he will find all he can possibly require. The authors are practical Mycologists of the highest standing, and nothing can be added to the admirable instructions they give on this subject:—"The Outlines of British Fungology," by the Rev. M. J. Berkeley, a work indispensable to the student of fungi on account of the admirable plates, contains a chapter on the subject; as does also that excellent little work, "Cooke and Berkeley's Fungi: Their Nature, Influences, and Use." Mr. Worthington G. Smith contributed several chapters to "Hardwick's Science Gossip" for 1872, which are evidently the result of his own large experience. If C. T. M. will allow me I would strongly recommend to him what I have found of great value in my own case, namely, to make careful drawings of each species he collects to accompany the dried specimen. So many of the characteristic features of the larger *Hymenomycetes* pass away in drying that it requires considerable experience to make out a species from herbarium specimens, unaided by drawings, and hence the very general adoption of the practice I recommend among Fungologists.—William Phillips, Shrewsbury.

Deformed Primroses and Double Flowers.—The banks of the roads and lanes in South Devon are in many places for long distances covered with primroses. They often vary in colour, from the ordinary yellow to pure white, both on the sunny and shaded banks. Several of the white varieties were collected last spring, and planted in a garden in good rich soil. This year they have all bloomed freely and the blossoms were of the same pure white colour. In an orchard of the same district, where there were a great number of primroses in blossom beneath the trees, the blossoms of two plants looked like double flowers and one plant had the appearance of a polyanthus with primrose blossoms. The plants were removed and planted in the garden last spring. They all present the same peculiar aspect. Some perfect flowers have appeared, and upon the same plant flowers with the calyces containing five petals, two united by the stalk of the petal, and the three others are separate, (on one stem.) The same polyanthus-looking blossoms are coming out, and on one of the plants are pure double blossoms. Red-coloured primroses are common on the banks of the Teign. It has not fallen to my lot to notice such variety in the colour of primroses, in either Breconshire, Monmouthshire, Herefordshire, or Gloucestershire; and in no instance has a double primrose or one so deformed as above described been seen by me in a wild state before, and far removed from garden grounds. It is very common to meet with double-flowered cuckoo plants in Devonshire, and double-blossomed dwarfed brambles are common, especially in the Forest of Dean, Gloucestershire.—Henry Bird, Stroud.

Is the Arum an Insectivorous Plant ?—This enquiry is made at page 106, where the fact is recorded that in numerous specimens of *Arum maculatum* examined last summer by the writer of the question small insects and chitinous fragments of others were invariably found inside the nearly closed spathes. The following observations may, perhaps, throw some light on the subject. For two years past I have grown a plant of *Arum crinitum* in my garden, and each year it has produced one of its lugubrious looking spathes. The plant grows about 18in. high. The spathe is very large, the spadix long and strange looking. The inside of the spathe and the whole of the visible part of the spadix are covered thickly with black hairs. When the infloresence is fully developed a most offensive carrion-like smell is emitted. Directly the disagreeable odour is produced blue bottle flies *(Musca vomitoria)* make their appearance and swarm on to the protruding lip of the spathe. Both years I have noticed no sign of these flies until the fetid smell of the Arum attracted them. Readers of Robert Browning's weird poem of the Pied Piper of Hamelin will remember how mysteriously the children were compelled to follow the insulted musician : the flies seem as strangely and powerfully fascinated by the Arum. They arrive in a bustle, they have evidently come purposely, they fly unerringly to the plant, they then speedily make their way to the narrow entrance to the lower part of the spathe in which the base of the spadix is chambered in almost absolute darkness. The inlet is narrow, and is well protected by the hairs before mentioned, though they seem no obstacle to the ingress of the flies. But after they are once inside there they must remain ; whether stupefied by the noxious exhalation of the plant or imprisoned by the hairs which yielded them such easy entrance I do not know. I have watched the plant for hours, but never saw a fly return from what may be deemed a condemned cell. The spathe remains open only a day or two at most, and then gradually closes and shrivels up. Each year at an interval of a week or so after the closing of the spathe I have cut open the chambered part of it, and have found it nearly full of dead and partially decomposed flies. If I am fortunate enough to have the plant in flower this summer I shall take care to observe it more closely, and will forward it to Mr. Lawson Tait for examination.—E. W. B., Moseley.

Wasted Energy.—There are many hard-working Naturalists in the Yorkshire Union, and no doubt in the Midland too, whose energies are more or less wasted. Speaking of Entomologists particularly, too many devote all their attention to one family. Thus Lepidoptera are generally the insects most systematically collected, and there are instances of all the Entomologists in a society collecting nothing else. The result is a waste of energy, as half the number would generally work a district efficiently ; whereas the larger number overdo it, and frequently exterminate the rarer insects. Where so many are engaged in the same pursuit there is sure to be rivalry as to who shall make the *largest* collection. Thus it comes to pass that a dozen or more specimens are obtained where two would serve every legitimate purpose. One male and one female with varieties are enough imagos for any scientific collection. To these should be added specimens of their various stages of metamorphosis. Larva-preserving is now so generally well understood that nearly all Lepidopterists can preserve larvæ (most kinds at all events) as well as they can set insects. These should invariably be mounted on a twig or leaf of the plant on which they ordinarily feed. The pupa and its cocoon (especially in the case of the Bombycidæ) should, where possible, always form part of the collection. But there are other fields where the energies of the Entomologist may find ample and useful employment, and where at present the workers are far too few. Take, for instance, the *Diptera* : how little is done with them, and yet how much wants doing! Their, at first sight, unattractive appearance in part, perhaps, accounts for their neglect; yet not a few of the species are extremely beautiful. The scarcity of reliable, but not too expensive, books of reference, is doubtless another reason; but this should not deter us from collecting these insects and observing their habits. When a sufficient demand exists for the books, they will probably be forthcoming from some quarter or other. The *Hemiptera*, again, is another despised group: but why? The insects are generally small, it is true, but science is not chiefly concerned about mere size, and as to colour this class includes some real beauties, I would therefore urge Entomologists to extend their operations to some of these too little known classes of insects. A little more mutual help is also much wanted among us. Thus, when a Lepidopterist is out collecting and meets with insects other than those he is specially interested in, he might often be of use to some fellow workers if he would devote a little trouble for their sake, and pick up "bugs," or bees, or other insects which he knows them to care for. In return he would invariably be helped in his pursuit. "Fellow feeling makes us wondrous kind." Speaking for myself, I shall always be glad to send *Lepidoptera* in exchange for *Diptera* or *Homoptera*, and shall only want to know concerning any specimens sent to me the locality from whence they are obtained.—S. L. Mosley, Hon. Sec., Huddersfield Naturalists' Society, Primrose Hill, Huddersfield.

A Parasitic Worm infesting the Air Sinuses of the Common Weasel.—April 13th, 1878, Mr. Montagu Browne, the Naturalist, forwarded to me, for the purpose of ascertaining the cause of death, an adult specimen of the common weasel, which had not been trapped or shot. I carefully examined all the abdominal and thoracic viscera, squeezing up their structures into thin layers for the purpose of finding any parasitic larvæ or adult worms. I searched the alimentary canal from the mouth to the anus but found no parasites. Not suspecting that the air sinuses and nostrils might contain parasites, I was stupidly content to let them pass with a cursory glance; but as I desired to observe the arrangement of the bones of the ear in this animal, I commenced to skin the head, and arriving at the point of union of the frontal bones, I observed a round hole in the median line, one-eighth inch in diameter, covered with a clear transparent membrane, which was continuous above and internally with the periosteum. I could not make out any mucous lining, though I suppose there should have been one, for the sinus communicated immediately with the left nostril. On removing this clear membrane, which looked as though it covered a hole filled with ink, I found what at first sight appeared to be small elongated clots of blood. There were no movements whatever, no apparent sign of life; however, I examined one of them, and made out that it was a worm, (a female,) full of eggs for about one half its length, and the remaining half occupied by many hundreds of minute, young, living, wriggling worms. There were in this sinus six specimens, four females, and two males. The male is considerably smaller than the female, not reaching to even half her size in the largest and best developed specimen. The female, the largest, measured one inch and a quarter long, and the thirty-second of an inch in diameter, and the smallest specimen, which contained both eggs and young alive, measured half an inch long and about four lines in greatest diameter. After being satisfied as to their character I proceeded cautiously to search the remaining sinuses, the brain and its cavities. The brain was healthy as far as the microscope could determine, but the sinuses were full of the parasite. In the sinus of the left temporal region no less than fourteen of these creatures were discovered coiled round one another and dead, twelve of them females and two males; in the air passages of the nose, amongst the expansions of the olfactory nerve, I found eight other specimens, all of which were males. I then examined the auditory canals, but no traces of the parasite were to be seen. I immediately prepared some of them as specimens for the microscope, thinking that if I could keep the young alive *in situ* until the next meeting of the Birmingham Natural History and Microscopical Society, when Mr. W. R. Hughes, F.L.S., was to present a paper on an allied subject by Dr. T. Spencer Cobbold, I might, perhaps, assist in throwing light upon a matter of considerable difficulty, one which has occupied the minds of some of the most distinguished scientific observers for years past, and which is now bearing fruit in the shape of contributions of a character so important to the medical and non-medical world, that I feel bound to express my personal obligation to Dr. Cobbold for the very complete form in which he is bringing the subject before the Society and general science-loving public. The mounted specimens were exhibited at that meeting, immediately after Dr. Cobbold's paper. The young worms were then alive, as was testified by Mr. Hughes himself and several others, having then been mounted in Canada balsam for four days, showing the extreme vitality of these young minute threads of living matter. I have written to Dr. Cobbold, and sent him specimens for examination, and until I hear from him, with his declaration as to the name of species of this round worm, I must defer my anatomical description. It may turn out to be a well-known form. If it does, no description will be necessary; but any departure from the usual form will be noted and described. The worm, and the skull showing the sinuses, may be seen at Mr. Bolton's Studio, No. 17, Ann Street, Birmingham, where I have placed them for inspection.—WRIGHT WILSON, M.R.C.S., F.L.S., &c.

Gleanings.

OUR UNION.—We have much pleasure in announcing that at the annual meeting of the Woolhope Naturalists' Field Club at Hereford, on the 23rd April, it was unanimously resolved that the Club join the Midland Union of Natural History Societies.

PRACTICAL TAXIDERMY.—Under this title a valuable book by Mr. Montagu Browne, of Birmingham, has recently been published at "The Bazaar" Office, London. In an early number we hope to review it at length.

RUBI.—In the March number of the "Journal of Botany" Professor Babington commenced a series of articles "Notes on Rubi." In the March and April numbers are criticisms on little understood forms, which will be read with interest and instruction by all students of this difficult genus.

LICHENS.—In the "Quarterly Journal of Microscopical Science" for April a valuable contribution appears, entitled "Recent Researches into the Nature of Lichens," by Sydney H. Vines, Fellow and Lecturer of Christ's College, Cambridge, in which the more recent speculations for and against the Algoid Nature of Lichens are given, and very ably criticised.

BRITISH HEPATICÆ.—Students of these interesting plants will be glad to see by an announcement on cover of present month's number, that a fasciculus of seventy-five specimens, representing sixty species, illustrative of "Carrington's British Hepaticæ," will be ready for distribution on 1st June next. Communications should be addressed to Mr. W. H. Pearson, 115, Church Street, Pendleton, Manchester.

Bland's Lessons on Elementary Botany, reviewed in our last number, has, we learn, been revised, and new editions of Parts 1 and 2 are in the press, and will be ready in a few days.

A Cat Walking Seventy Miles.—The *Sheffield Daily Telegraph* says a family recently removed from Dawley, Shropshire, to Nottingham. They took with them a cat which they had had for years. A few days after arrival at Nottingham she disappeared. The other day the cat walked into the old house at Dawley, to the great surprise of the neighbours. She was very footsore and lame, but otherwise all right. The distance travelled by the cat is over seventy miles. It is strange how the cat traversed the whole distance without being lost or worried.

Birmingham Philosophical Society.—The first part of Vol. I. of the proceedings of this Society, (Session 1876-7,) has just been issued. Its contents are as under:—"New Researches in Contractility and Elasticity," by Professor R. Norris, M.D., F.R.S.E.; "Vortex Motion," by J. Hopkinson, D. Sc., M.A.; "The Kinetic Theory of Gases," by the Rev. H. W. Watson, M.A.; "The Study of Science as an Instrument of Higher Education," by G. Hookham, M.A.; "The Place of Archæology in Science," by James Kenward, F.S.A.; and "The Evolution of the Sense of Hearing," by Lawson Tait, F.R.C.S.

The Herefordshire Pomona, about to be published by the Woolhope Naturalists' Field Club, is being got on with vigorously. The letterpress of Part I. is quite ready, and its publication will take place as soon as the coloured plates can be finished. Prepared as it is by such competent hands, the Herefordshire Pomona will no doubt be a work of considerable merit. The introductory matter of the first part consists of an elaborate treatise on "The Early History of the Apple and Pear," mythically, mythologically, and historically considered. This is followed by a sketch of "The Life of Thomas Andrew Knight and his Work in the Orchard." The common belief in the limited duration of varieties of apples is here stoutly called in question; and the results of Mr. Knight's experiments in the production of new sorts of apples and pears by hybridisation, is also fully entered into. In short, the introduction is the result of much work and much thought; and, what is of still more importance, contains matter in practical physiology that can scarcely fail to make others work and think too. Then will begin the main object of the Pomona—to give beautifully coloured plates of all the best varieties of apples and pears, &c. Communications from intending subscribers should be addressed to Mr. J. R. Symonds, Hereford.

Mr. Bolton's Microscopist's and Naturalist's Studio.—Mr. E. Ray Lankester, F.R.S., has contributed a note in the current number of the "Quarterly Journal of Microscopical Science," on the agency recently established by Mr. Bolton, at No. 17, Ann Street, Birmingham, for the supply of microscopic organisms to students and class teachers, from which we have much pleasure in copying the following extract:—"If serious students of our pond-fauna and flora will avail themselves of Mr. Bolton's services, and not only purchase from him examples of the specimens he has on hand, but will also *send to him supplies of such rarities as they may find, for the purpose of distribution among his correspondents and customers*, we shall have started among us an agency which will be of immense service not only to the individual student but also (and perhaps chiefly) to the teacher who requires to be able to obtain supplies of given microscopic organisms for his practical classes, and to feel with absolute certainty that the specimens needed will be forthcoming on the appointed day. Mr. Bolton can, at present, be depended on for certain forms; after a little time he will be able no doubt to enlarge his list."

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—March 26th, GEOLOGICAL SECTION.—Rev. H. W. Crosskey, (President of the section) delivered an address on "Some Problems in Glacial Geology." He described in detail a section near Glasgow in which the lowest bed was the typical till or boulder clay. This is succeeded by finely laminated clays, probably derived from the first during a slow sinking of the land, the continuance of which is proved by beds containing shells showing first littoral and then deep sea conditions. Afterwards a gradual rise took place, as shown by gradually altering species of shells, until in the upper portions of the section estuarine and freshwater species prevail. The climate seems to have gradually ameliorated from the time of the land ice, though with some fluctuations. The same series of changes both in level and climate are traceable in Canada and South Norway. Mr. Crosskey believes that the climatic changes were due to the alterations in the distribution of the land surface, which interfered with the ocean currents and changed their directions. The address was illustrated by a beautiful and very numerous collection of fossils from the beds described.—Mr. Slatter, of Redditch, showed calamites and *Estheria minuta* from the waterstones near Redditch. April 2nd, GENERAL MEETING.—Mr. A. Pumphrey described and exhibited his new process of autographic printing.—Mr. Wright Wilson, F.L.S., exhibited the brain of a shrew mouse, *(Lorex vulgaris.)* showing apoplectic clot on the right hemisphere.—Mr. W. G. Blatch exhibited the angle-shades moth, *(Phlogophora meticulosa,)* from Knowle. This was found in March. It is generally found in June and later.—Mr. J. E. Bagnall exhibited a confervoid alga *(Draparnaldia plumosa)* and a moss *(Orthotrichum leiocarpum,)* both from Kingswood, the latter new to Warwickshire.—Mr. T. J. Slatter exhibited a confervoid alga belonging to the genus *Tyndaridia*. April 16th, MICROSCOPICAL GENERAL MEETING.—Mr. W. R. Hughes, F.L.S., read the third paper by Dr. Spencer Cobbold, F.R.S., on "The Parasites of Man."—Mr. Wright Wilson exhibited a nematode worm, found in the air sinuses of the skull of the ordinary weasel, *(Mustela vulgaris,)* apparently allied to *Oxyuris vermicularis*, which infests the human intestine.—Mr. T. J. Slatter exhibited *Testacella haliotoides*, a slug which feeds on earth worms, also the male of *Diaptomus castor*. Mr. T. Bolton exhibited one of the microscopic fungi *Æcidium Urticæ*, the golden cluster cup on the leaf of the nettle.

BURTON-UPON-TRENT NATURAL HISTORY AND ARCHÆOLOGICAL SOCIETY.—ANNUAL MEETING, March 26th.—The following officers were elected for the year 1878-9:—The Rev. C. F. Thornewill, M.A., President; Mr. H. G. Tomlinson and Mr. J. C. Grinling, Vice-Presidents; Mr. H. Partridge, Hon. Treasurer; Mr. C. U. Tripp, M.A., and Mr. T. C. Martin, Hon. Secretaries; Committee—Messrs. R. Anty, W. Boden, H. T. Ford, J. T. Harris, A. J. Lyle, P. B. Mason, C. Perks, R. Thornewill, W. C. Owen, and C. J. Crawshaw. The following prizes were awarded to the successful junior members:—Botany: Mr. J. E. Nowers, first prize; Mr. S. R. Hallam, second prize. Geology: Mr. A. Molyneux. Freshwater Life: Not awarded.

NOTTINGHAM LITERARY AND PHILOSOPHICAL SOCIETY, NATURAL SCIENCE SECTION.—Papers read before the Section during April:—April 3rd: Microscopical evening. Mrs. Cowen read a paper on "Raphides and Plant Crystals," which will be printed in the "Midland Naturalist" for June. April 17th: Mr. J. J. Harris Teall, M.A., F.G.S., read a paper on "The influence of the Earth-movements of different Geological Periods on the Physical Structure of the British Isles.

NOTTINGHAM NATURALISTS' SOCIETY.—March 20th: A paper on "A Dead Fly" was communicated by Mr. R. A. Billiald. April 3: A lecture on "Optical Illusions," illustrated by numerous experiments, was delivered by Mr. A. H. Simpson, President of the Society.

STROUD NATURAL HISTORY AND PHILOSOPHICAL SOCIETY.—The Winter Session closed on 9th April, with a most successful conversazione. Mr. C. Playne was elected President for the ensuing year, and Mr. J. H. Taunton a Vice-President. The following re-elections were also made:—Mr.

Witchell, a Vice-President; Dr. Partridge, Secretary; Mr. Bishop, Treasurer; Mr. Smith, Librarian; and the whole of last year's committee. The Secretary read the Committee's Report, which gave a satisfactory account of useful work done by the Society, which is in a flourishing condition. The retiring President, Mr. J. E. Dorington, delivered an excellent address, in which he reviewed the proceedings transacted during his term of office. A vote of thanks was unanimously accorded to Mr. Dorington.—Dr. Bird then read a paper on "The Ancient Dwellers of the Cotswolds," an abstract of which we hope to present to our readers. The exhibition of scientific apparatus and objects, which next occupied the attention of the meeting, was varied and interesting. Mr. A. Pumphrey and Mr. T. Bolton, of Birmingham, exhibited and described the autographic printing process dealt with fully in another page. Mr. Bolton also exhibited numerous interesting specimens of freshwater life. The electric pen, the process of electro-plating, a telephone, spectroscopes, collections of entomological and geological specimens, and other matters, fully occupied the remainder of the evening.

TAMWORTH NATURAL HISTORY, GEOLOGICAL, AND ANTIQUARIAN SOCIETY.—March 25th.—A handsome and well-preserved skin of an Egyptian crocodile was presented to the society, through the secretary, by Mr. Charles Long.—Dr. Joy read a paper, entitled "The Darwinian Theory Reviewed." A warm discussion followed the reading of the paper, in which the Chairman, (Rev. Brooke Lambert,) Dr. B. W. Foster, of Birminhgam, Messrs. Chesshire, Nevill, Hamel, and others took part. April 1st.—Mr. R. B. L. Johnston gave a paper on "Sponges, Hydras, and Corals." After describing the several varieties of sponge, and the numerous members of the Hydra family, he proceeded to touch more fully on the many species of coral. He exhibited several beautiful specimens lent by members of the society.—A small skate, dried and mounted, was presented by the Rev. Brooke Lambert.—Mr. W. G. Davy exhibited a cryophorus, the water within which was by evaporation frozen in a few moments.

YORKSHIRE GEOLOGICAL AND POLYTECHNIC SOCIETY.—The first meeting of this old Society since it changed its name was held on the 13th March, at Selby. The attendance was large. The local secretary, Mr. J. T. Atkinson F.G.S., who presided, gave an interesting address, in which there were references to local history, a *resumé* of the history of the Society founded forty-one years ago, and an account of the geology of the district. Mr. Atkinson entertained the members at luncheon. Later in the day a second meeting was held, the Chairman of which was Mr. H. C. Sorby, F.R.S., President of the Geological Society. Twenty-three new members were proposed, and a resolution passed that the June meeting should be held at Scarborough, or Bridlington if suitable arrangements could be made; or failing both, at York. In addition to a paper by Mr. J. E. Clarke, B.A., B.Sc., F.G.S., on "The Triassic Gravel, Sand, and Clay Beds at Sutton Park, near Birmingham," the Chairman contributed an important one on "A New Method of Studying the Optical Character of Minerals."

WEST LONDON ENTOMOLOGICAL SOCIETY.—March 22nd.—Mr. Reed exhibited a series of *B Hirtaria*; bred. March 29th.—Mr. Walford, bred specimens of *Verbasci*. April 12th.—Mr. Maycock, *Pilosaria* and *D. Fagella*; also a series of *Leucophearia*, varying from the ordinary type to black. Mr. Coverdale, *Lithoriza* and *Parthenias*. Mr. Gates, *Multis-trigaria*. Mr. Meek, a very fine series of varieties of *L. Monacha*, some of the specimens being quite black.

EXCHANGE.

I have vols. 1 to 5 of The Geologist, (1858 to 62;) Geological Record for 1875; Smithsonian Reports; Geological Society's Journal, 1876 and 1877, &c. I want set of Geological Magazine; Science Gossip; Report Coal Commission, 1871; vols. 1 to 14 Geological Society's Journal; or will give fair cash price.—F.G.S., *Herald Office*, Birmingham.

Bird eggs, side blown, 200 species, rare duplicates. Exchange lists supplied. Wanted various varieties new to collection. All letters answered.—J. W. SISSENS, Sharrow, Sheffield.

MIDLAND UNION OF NATURAL HISTORY SOCIETIES.

FIRST ANNUAL MEETING, AT BIRMINGHAM,

ON MONDAY AND TUESDAY, MAY 27TH AND 28TH, 1878.

The arrangements for the forthcoming Meeting of the Members of the Societies in the Union are so far made that we are enabled to publish the following particulars :—

On Monday, May 27th, the Annual Meeting of the Union will be held in the Theatre of the Midland Institute, Paradise Street, Birmingham, at three o'clock precisely, under the presidency of Mr. Edmund Tonks, B.C.L., President of the Birmingham Natural History and Microscopical Society. The business of that Meeting will be to receive the Report of the Council; to decide where the Annual Meeting in 1879 shall be held ; to consider any suggestions which Members may offer; to discuss Joint Excursions during the coming year; and to transact all other necessary business.

In the evening, at half-past seven o'clock, a Conversazione will be held in the Town Hall, the arrangements for which are entrusted to a Committee, consisting of Members of the following Societies, namely :—

The Birmingham Natural History and Microscopical Society,
The Birmingham Philosophical Society,
The Birmingham and Midland Institute Scientific Society, and
The Birmingham School Natural History Society.

Every effort will be made to provide an Exhibition of objects of Scientific interest, Natural History, Archæology, and Art, worthy of the Union and the town in which its First Annual Meeting will be held. Members of Societies in the Union willing to contribute Specimens or to exhibit or lend Microscopes will oblige by at once communicating to Mr. John Morley, 24, Sherborne Road, Birmingham, Hon. Sec. to the Conversazione Sub-Committee. The charge for admission to the Conversazione (including Refreshments) will be 2s. 6d. Morning Dress.

On the following day, Tuesday, May 28th, there will be an Excursion to Dudley and the neighbourhood, under the auspices of the Dudley and Midland Geological and Scientific Society and Field Club, which it is hoped will include visits to

I.—Open Coal Work at Foxyards.
II.—Wren's Nest.
III.—The Priory Ruins and Castle, and also to the Caverns, if considered safe.
IV.—Lye Cross Pits.

All by special permission of Mr. E. Fisher Smith, on behalf of the Right Hon. the Earl of Dudley.

Arrangements will be made to meet the wishes of Visitors who may desire to inspect some of the leading Birmingham manufactories.

As the success of the Conversazione and Excursion will very much depend on ample arrangements being made for the accommodation of Visitors from a distance, and as it will be impossible to make those arrangements without knowing the number who will be present, the Secretaries of the Societies in the Union are earnestly urged to bring these particulars before their Members at the earliest possible moment, and to ascertain what number will require tickets, which should be applied for as soon as practicable, *but under no circumstances later than* TUESDAY, *the 21st day of May*. Applications for tickets must be addressed to Mr. Edw. W. Badger, *Midland Counties Herald Office*, Birmingham.

Members may secure Tickets for friends not Members of the Union.

At the earliest possible moment the detailed Programme will be issued to the Secretaries of all the Societies in the Union, for distribution among the Members. If special Railway facilities for Members and Friends coming from a distance can be secured full information will be given in the detailed Programme.

Plate II

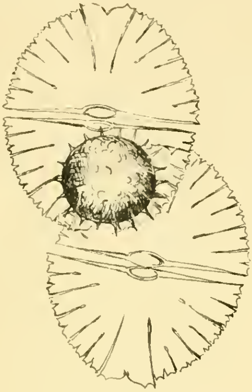


Fig 7×100.

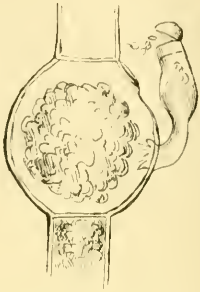


Fig 11×200.

Fig 9×120

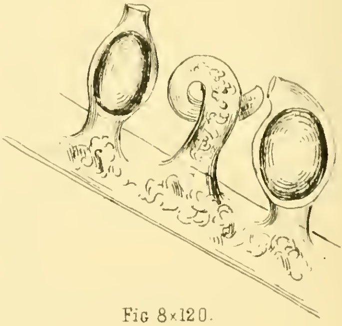


Fig 8×120.

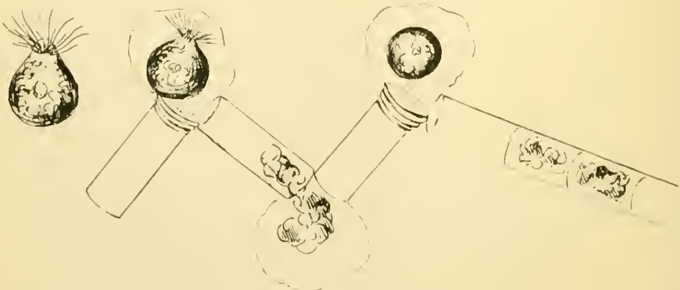


Fig 10 × 160.

A.W. WILLS, del et lith.

FRESHWATER ALGÆ.*

BY A. W. WILLS, F.C.S.

(*Continued from page 117.*)

We must now turn to the very important question of the modes of multiplication and reproduction of these singular plants.

In the simplest forms of unicellular Algæ, (*Palmellaceæ* and *Volvocineæ*,) the only mode by which most of the genera seem to be perpetuated consists of the conversion or breaking up of the contents of certain cells into small oval bodies, (zoospores,) which move freely through the water for a while by means of delicate lashes or cilia, and then, after losing these motile organs, undergo cell-division into fresh individuals, identical with the parents. [Plate I., Fig. 2.]

In *Desmidiaceæ*, to this process is superadded that of reproduction by the formation of large "resting-spores" resulting from the commingling of the contents of two separate individuals in the space between their adjacent sides. [Plate II., Fig. 7.] Such spores are capable of retaining their vitality for a long period, and then producing from their contents a fresh generation of plants of their specific kind; while, on the other hand, zoospores undoubtedly perish, unless placed in conditions favourable to their immediate germination.

In many of the higher order of Algæ (freshwater and marine) both these phenomena can be traced, and it appears probable that in all cases the development of spores alone constitutes a true sexual reproduction of the species, comparable to that which prevails among Phanerogams, whereby its indefinite perpetuation is secured; while the so-called "reproduction" by zoospores is rather to be compared to the increase of flowering plants by buds or offsets, or artificially by cuttings, a process by which, as is believed by most florists, while the multiplication of individuals is accomplished, the continuation of the species is not secured beyond certain limits.

It is probable that even in those genera in which no such sexuality or *polarisation* of cell-contents has been observed, it has yet to be discovered, much as the fine researches of Messrs. Dallinger and Drysdale "On the Life History of Monads" have proved, that after the succession of many generations of asexual individuals among the lowest Infusoria, a sexual process suddenly intervenes.

The production of spores in *Desmidiaceæ* is a most interesting phenomenon, and will be best understood by those to whom it is

* Description of Figures in Plate II.

Fig. 7.—Formation of resting-spore of *Micrasterias rotata*, from contents of two plants.
Fig. 8.—*Vaucheria ornithocephala.*
Fig. 9.—*Vaucheria racemosa*, showing "horns" and flask-shaped cells, the latter containing spores.
Fig. 10.—Formation of zoospores from contents of single cells in *Œdogonium.*
Fig. 11.—Formation of spores in *Œdogonium*, the contents of the enlarged cell being fertilised by spermatozoids developed in dwarf parasitic male, or antheridial plants.

not familiar by reference to our sketch. [Plate II., Fig. 7.]* Two individuals approach one another, and a communication being established between them through the bases of their separated halves, the cell-contents are poured out into the intervening space and there form a spore, generally spherical and at first smooth, but in the mature state often ornamented with tubercles or spines. In this condition the structure and markings of the empty cellulose cases are beautifully displayed.

What is the exact series of changes by which the original form is developed from the spore requires further investigation, in spite of Berkeley's statement that it is propagated in some species by division, exactly after the fashion of the ordinary cells, and in the third generation acquires its normal form.

Other points in the physiology of these plants also await further research, as, for instance, the nature of the curious circular hyaline spaces filled with moving granules, which are seen in the ends of the frustules of *Closterium* and *Penium;* the circulation of similar particles between the cell-walls and the endochrome; and the remarkable "swarming" of the entire cell-contents, which occurs in some genera, probably before conjugation, when every grain of endochrome seems to be rushing wildly in and out among its fellows in a sort of giddy dance.

Passing from the unicellular to the filamentous Algæ, which consist for the most part of elongated cylindrical cells placed in juxtaposition, end to end, in various arrangements, we are compelled by want of space only to glance at many large and interesting orders. Among these are the *Batrachospermeæ*, represented by the exquisitely graceful genus *Batrachospermum*, whose gelatinous tresses of tender grey or olive green whorled branchlets are not uncommon in clear streams in this district; the almost equally beautiful *Chætophoraceæ*, of which abundant examples are to be found in the deep green gelatinous masses of *Chætophora endiviæfolia* and *C. elegans*, in the tender green filaments of *Draparnaldia plumosa* waving gracefully in clear running waters, and in the singular disk-shaped fronds of *Coleochæte scutata*, found adherent to leaves of submerged aquatic plants; the *Oscillatoriaceæ*, which comprise many singular forms, inhabitants of pools, wet rocks, damp ground, &c., and well represented in our district; and finally the *Nostochaceæ*, of which the typical genus *Nostoc* contains many species, consisting of long beaded filaments, twisted like intricate coils of rope, and agglomerated into gelatinous fronds ranging in size from that of a pea to that of a walnut, most cosmopolitan in their habitats, rejoicing in situations so various as clear streams, exposed moorlands, and thatched roofs.

In what remains of this paper we purpose to refer in some detail to three of the remaining groups of Confervoid Algæ, each of which presents interesting points of structure and remarkable aspects of the phenomena of reproduction.

First among these is the large family of *Siphonaceæ*, of which the commonest examples are the various species of *Vaucheria*, some of which

* The figures given in these papers are all drawn under the microscope, from actual specimens. We do not hesitate to insert them, because those given in text books are often only diagrammatical, and convey but an imperfect idea of the actual object.

form a close felt-like coating at the bottom of almost every ditch. They consist of long, more or less branching filaments, not divided into a number of cells, but open from end to end and filled with very dark green endochrome. The cell contents are frequently poured forth from the ends of the filaments in the form of large ciliated zoospores, of which operation a good description will be found in Hassall's "Freshwater Algæ." But there is, in addition to this, a true process of sexual reproduction, as singular as it is interesting.

At various points on the filaments are formed two very distinct kinds of projections—the first consisting of one or more narrow "horns," as Unger appropriately terms them, forming short branches from the parent filament, sometimes straight and at others curiously curved; the second, in close proximity, assuming the form of one, two, or occasionally more, flask-shaped cells, open at their apex. [Plate II., Fig. 8.] In one species, *V. racemosa*, both kinds of organ are carried upon a common shaft or pedicel. [Plate II., Fig. 9.]

The contents of the flask cells gradually assume an irregular spherical shape, while those of the "horns" are converted into active *Spermatozoids*, which issue into the surrounding water, and thence swarm through the narrow neck of the flask-shaped spore-cells, and there fertilise their contents. These thereafter assume a true spherical form and a distinct cell-covering, while between them and the filaments which bear them dissepiments are formed, at which the heads finally break off, and by decay of their outer walls at length liberate the spores.

The singular plant *Hydrodictyon utriculatum*, remarkable for its growth in a network of hexagons, and for the marvellous rapidity of its increase, is referred to the same family *(Siphonaceæ.)* A good summary of its life-history is to be found in the Micrographic Dictionary, and a detailed investigation is recorded in the researches of A. Braun, (Ray Society, 1853.) Some years ago it suddenly appeared in Blackroot Pool, Sutton Park, in enormous quantity; in a few weeks it wholly disappeared, and we have never seen a trace of it since in that habitat.

The *Œdogoniaceæ* comprise two genera, *Bulbochæte* and *Œdogonium;* the former containing only one species, the elegant little *B. setigera*, a plant of great beauty by reason of the long slender bristle-shaped cells which form the ends of its lateral branches—a lovely object, especially by dark back-ground illumination.

It is said to be reproduced by zoospores, and also by a process very similar to that described above as occurring in *Vaucheria*, each resting-spore being ultimately resolved into four smaller ones, which develop into four new plants. We have not been fortunate enough to witness these phenomena, although we have frequently gathered the plant, both in our own district and elsewhere. The genus *Œdogonium* includes several common species, some characterised by a very curious annular structure at the base of many of the cylindrical cells of which the plant is made up, which becomes especially manifest when the filaments break up into separate joints for the emission of zoospores. [Plate II., Fig. 10.] We were once fortunate enough to see this curious process taking place under the microscope in a specimen which had been *just mounted*, and think that a brief description of one of the most remarkable sights we have ever been privileged to witness, taken from notes made at the moment, and illustrated by sketches made from the specimen in question, will prove more than usually interesting.

"At 12 20 this afternoon, on placing the slide under the microscope, I observed that one of the long filaments was breaking up rapidly into a zig-zag of separate joints, each of which remained attached only at a single point to its neighbour. Placing one cell in the middle of the field, I watched it closely, and observed that the somewhat oval mass of endochrome was gradually leaving the cell-case, though clinging to its base as if reluctant to leave it. At the same time there appeared a very faint transparent membrane across the mouth of the open cell, *exactly like a thin soap bubble being blown out of it.* This quickly increased in size *pari passu* with the extrusion of the endochrome. At 12 25 this had completely left the cell and formed a spherical green mass inside the "bubble," in fact an incipient zoospore. This now began to move very slightly, and at one side of it appeared faint traces of cilia waving a very little, suggestive of a piece of machinery just getting started. At 12 30 the "bubble" was much blown out, and the cilia active, the zoospore twirling round for part of a revolution and then stopping, and so on. At 12 35 the membrane was more enlarged, and only faintly discernible by very careful illumination. At 12 40 the zoospore was liberated; the ciliated end slightly protruded and transparent; its motion regular and swift. At 12 47 this motion was much diminished, the zoospore slowly creeping round with an irregular motion from left to right. At 12 50 the ciliary action had become sluggish, and the endochrome was receding from the cell-wall. The vibration of the cilia gradually diminished till 1 1, when it quite *suddenly* ceased altogether; at the same moment the whole mass of endochrome was *violently convulsed with a sort of shuddering movement*, and the transparent point was much protruded. By 1 3 the cilia had disappeared, the projection of the point was largely increased, and there is no doubt that if the germination had not been arrested by enclosure in the glass cell, the next stage would have been the formation of a distinct nucleus, and the separation through this into two cells, in fact the first process in the development of a filament like the parent one."

How enormous is the rate of increase in this plant may be inferred from the fact that in one filament in this specimen, both ends of which were broken, the number of cells still remaining was 683.

It will be seen from Plate II., Fig. 10, that each zoospore is the product of the endochrome of one cell only.

The formation of true spores in *Œdogonium* is the result of the fertilisation of the contents of certain cells by the entrance through small slits in their margins of spermatozoids; these being produced either from other cells in the ordinary filaments or otherwise in small "dwarf male plants," which appear to be developed from the zoospores above described, and of which numbers may be often seen parasitic upon the larger plants. [Plate II., Fig. 11.]

[TO BE CONTINUED.]

SCIENTIFIC NAMES.—I. FORM.

BY W. B. GROVE, B.A.

(Continued from page 124.)*

The third declension differs from the other two, and presents some difficulty. Words of this class have many terminations, but they rarely end in *-a*, *-e*, or *-er*, never in *-um*. It is chiefly those ending in *-us* that can be mistaken. The peculiarities of the third declension are that the genitive singular always ends in *-is*, and has very often one syllable more than the nominative; the plural ends in *-a* or *-es*, according as the word is, or is not, neuter. It is an invariable rule that the plural of a neuter word ends in *-a*. For most of the words of this class recourse must be had to the dictionary, but the following table of the chief forms may be useful. Notice that the true stem seldom appears in the nominative, but may be obtained from the genitive by removing the termination *-is*. Though there are rules for determining the gender, the only safe course is to refer to the dictionary. Examples of the fourth and fifth declensions are added for the sake of completeness.

NOUNS.

	Singular, Nominative.	Genitive.	Plural Nom.	Genitive.
III.	Ovis, *f.*, a sheep.	ovis.	oves.	ovium.
	Iris, *f.*, part of the eye.	iridis.	irides.	iridum.
	Naias, *f.*, a naiad.	naiadis.	naiades.	naiadum.
	Salix, *f.*, a willow.	salicis.	salices.	salicum.
	Carex, *f.*, sedge.	caricis.	carices.	caricum.
	Plantago, *f.*, plantain.	plantaginis.	plantagines.	plantaginum.
	Senecio, *m.*, groundsel.	senecionis.	seneciones.	senecionum.
	Dens, *m.*, a tooth.	dentis.	dentes.	dentium.
	Foramen, *n.*, an opening.	foraminis.	foramina.	foraminum.
	Genus, *n.*, a kind.	generis.	genera.	generum.
	Animal, *n.*, an animal.	animalis.	animalia.	animalium.
IV.	Quercus, *f.*, an oak.	quercus.	quercus.	quercuum.
V.	Species, *f.*, an appearance.	speciei.	species.	specierum.

The only important adjectives of this type end thus:—

ADJECTIVES.

Singular.			Plural.		
m.	*f.*	*n.*	*m.*	*f.*	*n.*
-is.	-is.	-e.	-es.	-es.	-ia.
-or.	-or.	-us.	-ores.	-ores.	-ora.
-ns.	-ns.	-ns.	-ntes.	-ntes.	-ntia.

Thus we have *Carduus palustris*, *Viola palustris*, but *Comarum palustre*; *Lotus major*, *Astrantia major*, but *Arctium majus*; *Ranunculus repens*, *Linaria repens*, and *Trifolium repens*; as an example of the plural we may take *Rodentia*, the rodent animals.

There are many Greek words also in use, but in many or most cases they are Latinised, and will come under the rules already given. Only two, which do not, can be mentioned here.

* ERRATUM IN MAY NUMBER (p. 124, bottom line.)—For "polyzoon," read "polyzoan," after the analogy of entomostracan, infusorian, &c.

NOUNS.

Singular Nominative.		Genitive.	Plural Nom.	Genitive.
II.	-on, *n.*	—	-a.	—
III.	-ma, *n.*	-matos.	-mata.	-maton.

Examples are found in *polyzoön*, plur. *polyzoa*, and *stoma*, plur. *stomata*, the stem of which, as is the case in all Greek nouns ending in *-ma*, is formed by adding *t* to the nominative.

Having obtained the stem of a word, of whatever declension, if we wish to form a derivative, we add to it any termination which expresses the required idea. The only point of importance occurs when this termination begins with a consonant. In this case the letter *i* is generally inserted, if the word is of Latin, and the letter *o*, if it is of Greek origin. Thus from the Latin *heder-a*, "ivy," we get *heder-aceus* and *hederi-folius*; but some botanists, wishing probably to retain the *a*, write *hederæfolius*. For this there seems to be no classical authority whatever, and it should therefore be avoided, as founded upon a mistaken idea. Other examples are *Boragin-aceæ*, from borago, *linarii-folius*, from linaria, *anagallidi-folius*, from anagallis, *formici-forme*, from formica. As before, some entomologists write *formicæ-forme*, but the very same persons spell *tipuliforme*, from tipula, without the *æ*. Similarly from the Greek we get *chloro-phyll*, *morpho-logy*, *Gastero-poda*, &c. This inserted *o* generally serves as a mark that the roots from which the word is derived are Greek; I say generally, because some words, as Fungology, are hybrids, *Fungus* being a Latin, and *logos*, a Greek word. There is one case where this *o* is inserted, which is seldom suspected. Thus *hypnoides* is compounded of *hypn-um*, a moss, and the termination *-ides*, meaning "resembling, similar to." This termination was used by the Greeks, but, since in very ancient times it began with a consonant having a sound like *f* or *v*, it required the insertion of *o* before it. Thus we should get *hypno-fides*. This consonant, (called the "lost" Digamma,) ceased to be used by the Greeks thousands of years ago, but they still retained the *o*, and we follow their example. Thus the *o* and *i* in *hypnoides* belong to distinct syllables: the importance of this will be seen when we come to pronunciation. There are many words used in scientific English of the same kind, *e.g.*, albuminoid, anthropoid, and botryoid. The same termination is sometimes used in the plural in the names of sections of the animal and vegetable kingdoms; thus Crinoidea, from *crin-on*, "a lily," is really crino-idea, and means "lily-like" animals, and Aroideæ, from *ar-um*, the cuckoo-pint, means "arum-like" plants. There is another class of words, apparently similar, but really of a different origin, those ending in *-idæ* or *-iadæ*, which must not be confounded with those just mentioned. This latter termination was used to designate the children and remoter descendants of any person; thus the Pelopidæ were the descendants or family of Pelops, and the meaning with which it is employed now is, whether purposely or not, very similar. The Equidæ, for instance, are the descendants of some common original form, which existed in geologic times, to which indeed the name Equus could not be applied, but which was the type and first foreshadowing of the group of animals to which we now restrict the name, and so far the idea suggested by these terminations is applicable to the case. It may be noticed that it is customary to use *-iadæ* for all words ending in *-ia*, as Crania, Craniadæ, and for all others to affix *-idæ* to the true stem, as Mactra, Mactridæ; Helix, Helicidæ; Bos, Bovidæ. As usual this rule is sometimes, though without reason, infringed, as in Cerithium, Cerithiadæ; Arca, Arcadæ.

Something, also, must be said about specific names, which are not adjectives. First among these are the so-called complimentary names, used in the genitive case. When the name of a modern man or woman is to be Latinised, the usual plan is to add *-us* or *-ius*, as may be most euphonious, for the one, and *-a* or *-ia* for the other, with the ordinary genitives. This, of course, does not apply to complimentary generic names, *e.g.*, Linnæa, Hookeria, which are always feminine. Thus, *Rafflesia Arnoldi* means "Arnold's Rafflesia," and commemorates not only Dr. Joseph Arnold, its discoverer, but also Sir Stamford Raffles, the Governor of Sumatra at the time of its discovery; in *Lepidium Smithii* two *i*'s are used to produce a smoother sound; *Nitophyllum Hutchinsiæ* is Miss Hutchins' Nitophyllum. These should always be spelled with a capital letter, as also should adjectives derived from proper names, but in this latter respect practice differs. Both *Silene Anglica* and *S. anglica* are found, and some have even ventured to write *hookerianus*. It may be presumed that this license, so foreign to both the English and the classical tongues, has been imported from the Continent, as it is in accordance with the usage of the French and other languages. Still another class of specific names should be written with a capital initial, those which are nouns in the nominative case, which have been for the most part originally the names of genera, as in *Potentilla Tormentilla*, *Poterium Sanguisorba*, *Hipparchia Tithonus*. The last two instances show pointedly that these, not being adjectives, do not necessarily agree in gender with the generic name. There is, finally, the class represented by *Pieris brassicæ*, which means the Pieris "of the cabbage," because the larva of that butterfly feeds upon the cabbage. These should, properly, not be spelled with a capital, (though this is sometimes done,) and are in the genitive case, either singular or plural. They are most common among the names of Lepidoptera, as *Anthocharis cardamines*, *Sphinx convolvuli*, *Thecla quercus*, but are not wanting in other places. Thus *Rosa dumetorum* means the rose "of the thickets;" *Æcidium compositarum*, the Æcidium "of the Compositæ;" and, to take an example from the "Midland Naturalist" of March, *Amphistoma hominis*, the Amphistoma "of man."

In order to find out the meaning of a scientific term, it is necessary for one not accustomed to the search to form first some idea of the kind of word he has in hand, in doing which it is hoped the previous observations will be of use. The word should then be looked out in the dictionary as a whole; if it be not found, as will very often be the case, it must next be considered what are its probable component parts. In this the inserted *i* or *o* is of great assistance, nor should the help which can be obtained from comparison with other words be neglected. Thus the common adjectival terminations, *-osus*, *-ilis*, *-inus*, *-anus*, *-arius*, *-atus*, &c., can be recognised, and their meaning arrived at by the consideration of English words of a similar ending. Moreover, if one or more syllables are found to occur in many different words, it may be presumed that they form a root; compare Cardium, Cardita, Cardiomorpha, and with the latter Callimorpha; Apteryx, Micropteryx, and Microspore; Diplacanthus, and Acanthoides. These parts should then be looked out separately; but there will often be a considerable amount of search required, and after all there will remain some, the derivation and meaning of which none but a practised investigator could discover, not to mention those which are incorrectly formed, and have in their present shape no meaning whatever. The chief difficulty lies in the Greek roots, for investigating which it is necessary to be acquainted not only with the value of the letters of the Greek alphabet, but also with the conventional changes which are made in expressing a Greek word in English letters. The chief are given below:—*κ* is generally represented by *c*, *υ* by *y*, *ου* by *u*, *ει* by *i*, *αι* by *æ*, and *οι* by *œ*. The last two are often further degraded into *e*, as the word becomes more Anglicised, *e.g.*, palæozoic, paleozoic. Here again, of late years, innovations have been made, the result partly of carelessness, partly of a desire to keep more nearly the supposed ancient pronunciation. Thus diœcious and monœcious are sometimes written dioicous and monoicous, the *οι* being represented by *oi*, instead of by *œ*; similarly the first syllable of Cainozoic is really the same as the last syllable of Eocene.

It may, perhaps, illustrate the analytic process of finding the derivation of a given word, if we show the reverse, synthetic method of forming a word to represent a given idea. Thus, suppose we wish to invent a generic name which shall mean "cleft-tooth," we find the Latin for "cleft" is *fiss-us*, for "tooth" *dens*. As the *dens* is to go last, we shall use, not the true stem *dent-*, but the nominative case; placing the two syllables together, and inserting *i*, we get Fissidens, the name of a genus of mosses which has the peristome-teeth cleft half-way down. Then comes the question, what is to be the gender of Fissidens. On this point the rule is clear and precise: it must have the same gender as the last component, *i.e.*, since *dens* is masculine, Fissidens is masculine also. If, however, any termination is added, which generally ends in *-us*, *-a*, or *-um*, it is masculine, feminine, or neuter accordingly. For instance, from the same word *dens* we get Dentaria, which is feminine.

There are too many words in scientific language which are not formed according to these principles, but still the vast majority obeys them, and it is for this reason that they concern all students of science, for upon them in great measure depends the pronunciation, as has been already pointed out in one case, and will be further illustrated in the following papers. In conclusion, it may be added that the rules have been founded in every case upon the practice of the best authorities, and, though many points have been omitted for want of space, it is believed that all the chief variations of usage have been included.

DIGGING OUT A BOULDER.

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

A few days since an eminent Geologist remarked to me—"Twenty years ago I thought I knew all about the drift; now I am doubtful if I know anything certain about it." In fact, the more those surface deposits which we assign to the glacial period are studied, the more difficult does the problem of their precise origin become. In Leicestershire we find the oldest glacial deposits to be beds of sand and gravel, which are seen at certain points to be *overlaid* by a stiff, clayey mass, full of stones of all sorts and sizes, to which the name of the "Great Chalky Boulder Clay" has been assigned, from the number of fragments of chalk which it contains. This arrangement holds good elsewhere, but both on the east coast, (Lincolnshire, &c.,) and the west coast, (Lancashire, &c.,) the sandy, gravelly deposits are *underlain* by a clayey deposit, or Lower Boulder Clay, which is absent in Leicestershire.

In the Upper Boulder Clay of this county there are many fine masses or erratic blocks, some of which are referrible to the Mountain Limestone, others to the Millstone Grit or carboniferous sandstones, still others to the Lower Oolite, but the finest masses are decidedly those from Charnwood Forest, as we might expect from its immediate proximity. Of rocks foreign to England no authenticated instance has ever occurred.

Of the Charnwood Rocks none are more readily recognisable than those of Mountsorrel, under which name I include the entire igneous mass which covers about one square mile of surface in the vicinity of the famous quarries. The stone is a hornblendic granite, finely crystallised, and of a pink or grey hue according to the tint of the felspar. Erratic masses of this rock occur at intervals along a definite line on the east side of the Soar Valley, a line which is marked by the occurrence of some very fine blocks.

Some of these boulders have attained to the dignity of a mention in the pages of the historian, and among these is the mass whose disinterment I am about to describe.

It is situated in a field 2¾ miles north-east of Leicester, and on the north side of the road from Humberstone to Thurmaston. Here it lies nearly on the top of the low ridge of Rhaetic Beds and Lower Lias, which forms the eastern boundary of the Soar Valley. The boulder clay in which it is embedded rests on the Lower Lias, the mid-glacial deposits being absent. Mountsorrel bears north-west, and is on the *west* side of the Soar Valley, which the boulder has consequently crossed. The spot where it now lies is about 260ft. above the level of the sea.

In Nichols' History of Leicestershire, (Vol. III., p. 981,) this stone is referred to by the Rev. Mr. Woodcock, who says that there is a tradition that a house, or cell, or nunnery, having some underground connection with the Abbey of St. Mary de Pratis, in full view of which it would stand, was once situated here. The block was called "Hellstone," or "Holstone," and the field "Hoston Field," a word which seems to be a corruption of "Holystone." The boulder lies fifty yards within the field, not far from a hedge. Before being uncovered its visible mass was insignificant, being lichen-covered and rising only some seven or eight inches above the grass, with an area of 2ft. by 3ft., but that it extended under the turf for some distance was evident from the dryness of the surrounding patch in winter, and the burnt appearance of the grass in summer.

Nichols also tells us that this stone "seems to confirm the generally received opinion of Naturalists concerning the growth* of these bodies; for, notwithstanding great pains have been taken by a late proprietor of the land to keep it below the surface, it defeats his efforts, and rises gradually, though not insensibly." The Holstone is nearly three miles distant from the site of "St. John's Stone," another fine mass of Mountsorrel granite, which formerly stood in a hollow in a field near Leicester Abbey. A line joining these two masses was said to point to the rising place of the sun on Midsummer-day. It would bear two or three degrees north of east.

The occupier of the field—Mr. Kirby, of Humberstone—who is a member of the Leicester Literary and Philosophical Society, kindly undertook to have the stone uncovered, and invited a party of gentlemen interested in Geological and Archæological pursuits to view its bared proportions. On arriving on the ground on the afternoon of May 2nd, I found that a trench had been dug completely round the boulder. It was now seen to be a pentagonal mass, the sides measuring 7ft., 5ft., 6ft., 4ft., and 5½ft. respectively. Its height varied from 4ft. 9in. to 3ft. 6in. Now the average specific gravity of the Mountsorrel granite is 2·659, and, consequently, each cubic foot weighs 166·19 pounds. Taking the contents of the boulder at 200 cubic feet, we find its weight to be in round numbers fifteen tons. The matrix in which it was embedded was boulder clay of the ordinary description, rather sandy in the upper part, and full of rounded quartzite and grit pebbles from three to six inches in diameter, with broken liassic fossils, also pieces of mountain limestone, millstone grit, &c. The sides of the boulder are clean and sharply defined, evidently traversed by master-joints. No striations were visible, but they may possibly exist on the under-surface. Its top is worn into rounded hummocks, just as the summits of the syenite hills of Charnwood now weather. I have, indeed, little doubt that this mass formed a part of the then summit of Mountsorrel, when a glacier advancing southwards tore it from its home, carried it over a depression in the Soar Valley of more than 100ft., and finally dropped it at a point six miles distant from its native mass.

* The apparent growth of boulders is thus referred to in the report of the British Association Boulder Committee. "It should be mentioned here that boulders gradually 'work up' to the surface. This is due, no doubt, to denudation which is taking place. In a field on Red Hill Farm, between Stafford and Stone, is one of the largest boulders of the district. This boulder was not noticed till some twenty years ago, when it was found to obstruct the plough, although still some depth underground. The obstruction became more and more serious each year until, in consequence of this impediment, the field was turned from an arable to a grazing one. At this time the boulder rises about 1ft. above the level of the field. The part exposed measures 6ft. by about 5ft., and evidently extends under the turf for a much greater distance."—Report 1873, p. 193.—EDS. M. N.

It would be very desirable, if possible, to remove the "Holstone" to the grounds of the Leicester Town Museum, where it would be secure from destruction, and where its ponderous proportions would form an object well fitted to attract the attention of visitors, and to awaken a desire in their minds to study the science of Geology.

Many thanks are due to Mr. Kirby for his energy in the matter, and for the hospitable manner in which he entertained the party who came to inspect his "little stranger."

THE TAMWORTH TREASURE TROVE AND THE TAMWORTH MINT.

BY ARTHUR A. CLARSON.

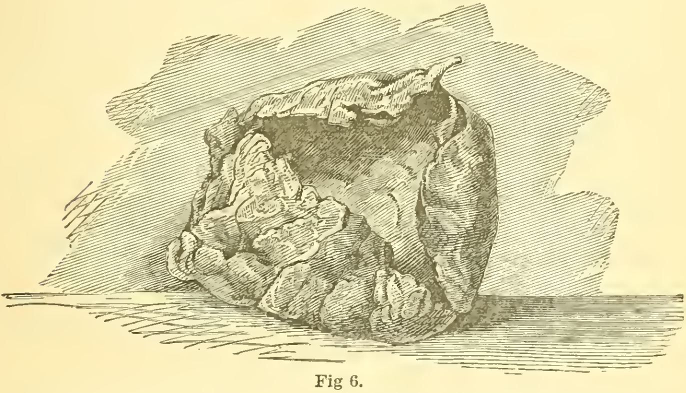


Fig 6.

The interest which has been excited by the recent discovery at Tamworth of coins of the date of the two first Williams, leads me to suppose that an account of the "find" would not be unacceptable. Nor do I think such an account out of place in a magazine especially devoted to the Natural History, Archæology, &c., of the district in which they were found.

A disquisition on the Antiquities of Tamworth would be foreign to the subject, yet some reference must be made, as they are indirectly connected with the discovery and rescue of the coins. Tamworth is the most ancient town in the county of Stafford, says the learned and pedantic Dr. Plot. We have, probably, an Ancient British mound, on which stands the present Castle, the keep of a former extensive fortalice. Roman remains are found in the vicinity, and the town itself is encompassed by a quadrangular castrametation, consisting of earthworks with a fosse, attributed to the Saxon period. It was also a seat of the Mercian Kings, an important place in the reign of Alfred the Great, the scene of the marriage of the sister of Athelstan, was thrice sacked by the Danes, and rebuilt by the "Ladie of the Mercians," Ethelfleda; few towns, indeed, can boast of such a history as the "ancient and loyal" borough of Tamworth.

The castrametation before alluded to is supposed to be of Saxon origin, but, with a view of further proving the question, some members of the Tamworth Natural History, Geological, and Antiquarian Society sunk a shaft in a mound in the north-eastern angle, the result of their efforts being somewhat indecisive. In the same field, however, but a short distance off, one of the workmen engaged in excavating for the foundation of a wall in connection with the new schools, turned up with his pick the leaden casket containing the coins. I had timely information of the discovery, and was fortunately enabled to rescue this valuable "find" from dispersion.

The casket, of which a representation is given, (through the kindness of Mr. B. V. Head, of the British Museum,) was formed of a piece of beaten lead, turned over on three sides, something like a "turn-over tart," and, on being opened, was found to contain 294 silver pennies of the reigns of William I. or William II. These were afterwards taken to London by the Vicar of Tamworth, the Rev. Brooke Lambert, and delivered up as "Treasure Trove." The authorities of the British Museum selected 103 for the National Collection, 41 were appropriated by the Royal Mint, and the remainder returned to Tamworth.

The coins were of four distinct types, Hawkins 242, 244, 245, (three coins only,) and 246. No. 242 is the well known "paxs" type usually attributed to William the Conqueror—the obverse, head, full faced, bust extending to edge of the coin, right hand bearing a sceptre is crossed over the bust, so that the sceptre appears on the right of the coin the proper left of the figure, sceptre has a cross *paté* at the top, the shaft foliated, on the head a crown with labels or "ear drops," over the right shoulder three mullets, inscription PILLELM REX. Reverse, cross *potent*, a small circle in each of the quadrants, one letter of the word P. A. X. S. in each circle; circumscribed is the moneyer's name and place of mintage.

The second type of coin, Hawkins 244, has the head in profile looking to the right, sword in right hand, mullets on each shoulder, bust extending to edge, inscription as before. Reverse, cross *potent* with fleur-de-lis in the quadrants, moneyer's name and place of mintage.

The third type, Hawkins 245, (three coins only,) I had not noticed before the collection left my hands.

The fourth type, Hawkins 246. Head full faced and crowned, labels at the ears, sword in right hand on proper right of figure, left side of coin, mullet on left shoulder, bust extending to edge, inscription as before. Reverse, cross *potent* in a compartment formed by four semi-circles having pellets at the intersections, moneyer's name and place of mintage.

The greatest interest is attached to the moneyer's name and places of coinage. No less than 42 towns are represented in the Tamworth find. In explanation of this it may be as well to mention that the Saxon Kings granted the privilege of coining to their subjects, and this custom was continued through the Norman period. Canterbury had seven mints, London eight, Rochester three, Winchester six, Lewes, Hastings, Wareham, Exeter, Shaftesbury, and Hampton each two, and in every good town one coiner, the stamp being provided by the King. The following is the list of the towns represented in the find, with the number of coins of each town:—

Bedford	4	Lewes	1	Stafford	6
Bristol	4	Leicester	16	Steyning	1
Cambridge	1	Lincoln	6	Sta (?)	1
Canterbury	2	London	52	Tamworth	33
Chester	9	Maldon	1	Thetford	2
Chichester	4	Malmesbury	4	Wallingford	6
Colchester	1	Norwich	5	Warwick	19
Derby	4	Nottingham	2	Wilton	5
Dorchester	3	Oxford	5	Winchester	10
Dover	1	Rochester	2	Worcester	12
Exeter	2	Salisbury	7	York	3
Gloucester	3	Sandwich	1	Wv (?)	1
Hastings	2	Shaftesbury	1		——
Hereford	7	Southampton	5	Uncertain Mints	14
Ilchester	3	Southwark	5	Illegible	18

The following is a list of the moneyers in, and the contractions used for, the towns in the midland district:—

William I. (Hawkins 242.)	William II. (?) (Hawkins 244.)	(Hawkins 245, 246.)
	Derby.	
	GODI . . . ON DERBI	GODPINE ON DERE
		GVDNIC ON DRBE
		LIFPINE ON DRBI
	Hereford.	
ÆGLPINE ON HRE	ÆLFPI ON HRFERI	ÆGLPINE ON HRI
LIESTIIII ON HRE		LIFSIIN ON HREF
	Leicester.	
	LIFPINE ON LEICGI	ÆLFPINE ON LEI
	LIFINC ON LECIEI	LIFIC ON LEIEI
	SENOLF ON LE . ST	LIFIC ON LEIECES
		LIFINC ON LEICEI
		LIFINC ON LEIECES
		LIFPINE ON LEICE*
		LIFPINE ON LEICI
		SVNOVLF ON LEG
		SVNOVLF ON LEIC
		SVNOVLF ON LEIEI
	Nottingham.	
	PI......ON SVOTINC(?)	VCERE ON SOTINGE
	Oxford.	
BRIHTRED ON OXN		BRVNRÆD ON OXEI
		SP . . . PINE ON OX
		PVLLPI ON OXNE
		. . . . PINE ON OXEI
	Stafford.	
	GODRIC ON STAFRE	ÆLFNOD ON STF
	GODRIC ON ST . . . D	ODRIC ON STFRDI
	Tamworth.	
	BRVNIC ON TAMPR	BRVNIC ON TAMP
	COLIN ON TAMPR	CVLINC ON TAMP
	COLINC ON TAMPR	
	Warwick.	
LIFRIC ON PERI	GOLDINC ON PER	GOLDINC ON PERE
	GOLDINC ON PERI	GOLDINC ON PERP
	LIFRIC ON PRPI	SPERMANIC ON PRI
	DIDRED ON PRPICE	SPERMANIC ON PRI
		DIDRÆD ON PRIP

* Hawkins, 245.

William I. (Hawkins 242.)	William II. (?) (Hawkins 244.)	(Hawkins 245, 246.)
	Worcester.	
	BALDRIC ON PIHR	BALDRIC ON PIHR
	ESTMÆR ON PIHR	ESTMÆR ON PIH
		ESTMÆR ON PIHR
		GODPINE ON PIHR
		SEPINE ON PHRI*

Speculation as to the cause of the deposit in the place where it was found would be futile. There is no doubt it was a local hoard from the number of coins of the Tamworth mintage, and a few notes on the Tamworth Mint will properly conclude this article.

The revered historian of Tamworth, Charles Ferrers Palmer, says that the name as a place of mintage first appears upon a penny of Eadweard the Martyr, (975,) as TANWO. A coin of Canute the Great is mentioned by Pitt in his History of Staffordshire, having on the reverse EDRIC ON TAM; *i.e.*, "Edric, Moneyer in Tamworth."

The next reign of which coins of Tamworth are extant is that of Edward the Confessor, in which the name appears as TONWVRTH and TONWYRTH. The only specimen of the Confessor's coinage issued from Tamworth with which Palmer was acquainted, is a silver penny, bearing on the obverse the inscription EDWARD REX, and on the reverse, BRVNING ON TAM.

I am indebted to Mr. J. Thompson for the use of the block of this coin, which was cut for Palmer's History of Tamworth.

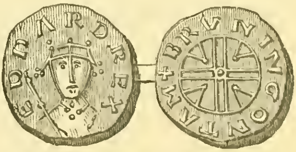


Fig. 7.—Silver Penny of Edward the Confessor.

Ruding mentions some coins of Harold bearing the contraction TAN, which he conjectured to be either Tamworth, or Taunton in Somersetshire.

After the Conquest, says Palmer, the Royal Mint at Tamworth was in activity until the time of Henry I., in whose reign it was discontinued. (Ruding). Through Mr. Thompson's kindness I am also enabled to give a representation of another Tamworth coin of William the Conqueror, (or William Rufus?), which differs from those in our recent find.

Fig. 8.—Silver Penny of William I. (or II.?).

* In each case the Saxon character, the Wen is used for W, and in this article the Roman P, which it resembles, is substituted.

On the obverse PILLEMV REX, and on the reverse BRVNING ON TANPI.

Bruning was a coiner, or moneyer, of Tamworth in the time of Edward the Confessor, and continued in the reign of William II.

Pitt mentions another silver penny of William II. having on the reverse IELFPINE ON TAM.

RAPHIDES AND PLANT CRYSTALS.*

BY MRS. G. R. COWEN.

Deposits of mineral matter in a crystalline form are frequently found in vegetable cells, where they are at once brought into view by the use of polarised light. They are commonly termed Raphides, or needle-shaped bodies, a term inappropriate to many of them, in which the crystals are of different forms, often prismatic or stellate.

As early as Malpighi's time, Raphides had been observed in plants, and at later periods they engaged the attention of Quekett, Lindley, Schleiden, and others, but they appear to have looked upon them as products of disease, or an accidental circumstance in the economy of the plant. The first to reduce to something like order, and to indicate the value of plant crystals, both as a constant and intrinsic result of the healthy life of certain plants, and also in determining the differences between species, was Professor George Gulliver, by whom they have been arranged in three groups, viz.: Raphides, Sphæraphides, and Crystal prisms.

The crystals are mostly composed of oxalate of lime, sometimes with magnesia. In other instances the calcareous base is combined with tartaric, citric, or malic acid, and the acicular crystals usually consist of phosphate of lime.

Raphides are slender, needle-shaped crystals, with rounded smooth shafts vanishing at each end to a point. About ten to fifty or more lie parallel together, so as to form a bundle which partially fills a cell, or intercellular space. When undisturbed, this bundle lies along its cell, but the Raphides are so easily displaced by slight pressure that either all or part of them cross the cell in various directions, sometimes escaping from the ends. The raphis-cell is commonly very distinct, often oval, and contains some viscid, semi-fluid substance, in the midst of which lies the bundle of Raphides. The raphis-bearing plants among our native exogens belong to three orders, Galiaceæ, Balsaminaceæ, and Onagraceæ, and there is not a single instance of any species belonging to these orders without Raphides.

The Fuchsia belongs to the order Onagraceæ, and is a great raphis-bearing plant, quantities being found in the leaves, the berry-pulp,

* Abstract of a paper read by Mrs. Cowen before the Natural Science Section of the Nottingham Literary and Philosophical Society, on April 3rd, 1878.

and even in the ovule. In this order, even the seed-leaves, fragments of stem, as well as parts still alive underground during the winter, may be easily known by their Raphides from plants of other and closely allied orders.

None of our exogenous trees or shrubs have, up to the present time, been found to produce Raphides, but they are present in many exotic trees and shrubs of this class. In the order Vitaceæ, of which the grape vine and American creeper are common representatives, we find both Raphides and Sphæraphides in the leaves, young shoots, ovaries, and ripe fruit. Our dictyogens abound in Raphides, as may be seen in the Black Bryony and Herb Paris. In the former they appear loose and destitute of a cell, both in the ripe berry-pulp, and the root stock. This root is like a little yam, and the yams so commonly used as food in the West Indies belong to this class, and contain Raphides.

The sarsaparilla of the shops affords Raphides, but not so the American or false sarsaparilla, which is one of the Araliaceæ, abounding in Sphæraphides.

In the other classes of our endogens, Raphides are more abundant than in our exogens. They are plentiful in the Hyacinth, the Star of Bethlehem, the Cuckoo-pint; also in the Lily of the Valley, the Asparagus, and in the Daffodil and other Amaryllids. We find them plentifully in most species of Duckweed, without the protection of a proper cell wall, the boundary of the space being formed merely by the outer walls of the contiguous tissue-cells. Raphides also occur in the English Orchidaceæ. They vary in length from 1-27th of an inch to 1-500th of an inch.

Sphæraphides are more or less rounded forms, made up of a number of crystals, commonly opaque and whitish. They are generally rough on the surface, from the projections there of the crystalline angles. They vary very much in size in the same plant, and still more in different orders, and are universally diffused through Phanerogamia. Some plants of the Cactus tribe, when aged, have their tissues so loaded with them as to become quite brittle. The leaves or stem of the Hop, Nettle, and many Goose-foot weeds, are good plants for Sphæraphides; and so are the Begonias of our greenhouses. They are very large in the Prickly Pear.

Crystal prisms are also acicular forms, but seldom occur more than two, three, or four in contact, and then closely side by side, as if partially fused together. They are more frequently strewed singly throughout the plant tissue, and sometimes, as in the bulb-scales of Shallot, they form crosses. They are generally larger than the Raphides, and can be plainly seen to possess three or four faces or angles; they do not taper at the ends like the Raphides, but their tips are either pyramids, or like a carpenter's chisel, or wedge-shaped, or the ends may be truncate, an appearance often caused by fracture. These crystals, when they lie in contact, are not easily separable from each other, or from the tissue in which they are seated, and when the cell can be seen it is closely investing the prism. In size they vary from 1-25th inch, and thickness of 1-532nd inch, in the Florentine Iris, to a length of 1-1000th inch, and thickness of 1-6400th inch in the ovary coat of *Centaurea nigra.*

These prisms are small but distinct in the ovary coat of many Compositæ, as the Thistle, Knapweed, &c., but large ones occur in many exotic exogens, of which examples may be seen in the barks of Quillaya and Guaiacum. They are frequent in endogens as in the common purple Flag, and many other Iridaceæ, and often appear in the same plant with Raphides, as may be seen in certain Amaryllids; they can be well seen with polarised light.

Although the precise use of these crystals in the vegetable economy is obscure, we may conclude that whatever is constant in a plant must be important. And when we consider how commonly plant crystals are composed of phosphate or oxalate of lime, or some other compound of this earth, and its value in the growth or nutrition of animals and vegetables; and that they are plentiful in many plants which form the food of birds and mammalia, and food and medicine for man, we get a glimpse of the use of these crystals. Raphides are useful in systematic botany in distinguishing between species. We can also easily see why the gardener collects decayed leaves for his composts, and why such plants as abound most in crystals are the most valuable for the purpose. The above account has been compiled from various articles by Professor Gnlliver, in the "Microscopical Journal," "The Annals of Natural History," and other scientific journals.

METEOROLOGY OF THE MIDLANDS.

THE WEATHER OF APRIL, 1878.

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

The weather of April last has elicited encomiums from nearly all our observers. The first ten or eleven days were cold and frosty, the night of the 1st being the minimum at nearly all stations. This frost cut off the apricots, early plums, and gooseberries. After the 10th a warm and genial period set in, which continued to the end of the month. Easterly winds prevailed, but the barometer was by no means high. Thunderstorms occurred on the 5th, 17th, 25th, and 30th. Rainfall again below the average, the only stations whose maximum fall exceeded one inch being Whitfield (1·25in.) and West Malvern (1·24in.,) both on the 10th, which day produced the extreme fall at several stations in the west and in the south of England generally. In London on the 11th from 2 to 2¾ inches fell in twenty-four hours, with a light easterly wind, but this was quite local. In the midlands generally the 20th gave the maximum fall, though this was not of very large amount. This was a very unsettled day, and marked by a change of wind from south-west to east.

As to vegetation all things look promising. The oak and elm are both leafing before the ash, giving promise (according to the proverb) of a fine summer. The apple, pear, strawberry, and late plum are making a wonderful show of blossom, and in the hedges the blackthorn has made a good show.

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.	3·92	·97	10 & 11	14	64·0	17	24·0	1
Cheltenham	R. Tyrer, Esq.	3·27	·84	10	18	66·0	27 & 30	22·4	1
Stroud	S. J. Coley, Esq.	3·56	·87	10	18	68·0	28 & 30	28·5	5
SHROPSHIRE.									
Haughton Hall, Shifnal	Rev. J. Brooke	1·93	·47	28	15	63·0	29	25·0	1
Whitchurch	A. B. George, Esq.	1·97	·50	20	13	67·0	30	32·0	25
Woolstaston	Rev. E. D. Carr	1·85	·27	17	20	69·0	30	24·5	1
Leaton Vicarage, Shrewsbury	Rev. E. V. Pigott	2·10	·59	23	19	66·0	28	25·0	1
More Rectory, Bishop's Castle	Rev. A. Male	1·50	·31	19	19	65·0	28 & 30	23·0	1
Larden Hall, Much Wenlock	Miss F. R. Boughton	1·66	·40	10	20				
Bishop's Castle	E. Griffiths, Esq.	1·33	·22	29	19	65·0	28	23·0	5
Cardington	Rev. Wm. Elliot	1·77	·31	10	16				
Adderley Rectory	Rev. A. Corbet	1·94	·50	19	15				
Stokesay	Rev. J. D. La Touche	1·22	·19	29	19	64·1	30	23·4	1
HEREFORDSHIRE.									
Whitfield	W. Wheatley, Esq.	3·36	1·25	10	20				
Stoke Bliss	Rev. G. E. Alexander	2·58	·62	10	17	64·0	30	31·0	3
WORCESTERSHIRE.									
Orleton, Tenbury	T. H. Davis, Esq.	2·56	·48	10	20	65·2	30	25·3	1
West Malvern	A. H. Hartland, Esq.	3·12	1·24	10	17	68·0	28	31·0	1
Pedmore	E. B. Marten, Esq.	2·24	·43	20	14	65·0	27 & 28	32·0	3 & 6
Stourbridge	Mr. J. Jeffries	2·37	·44	20	16	68·0	19 28 29	24·0	3
St. John's, Worcester	G. B. Wetherall, Esq.	2·55	·56	10	16	64·0	29 & 30	26·0	1
STAFFORDSHIRE.									
Thorganby Villa, Wolverhmtn	G. J. C. Broom, Esq.	2·27	·41	20	14				
Barlaston	W. Scott, Esq.	1·91	·41	20	11	66·0	29	21·8	2
Amblecote	Mr. J. Robins	1·95	·44	20	15	81·0	22 & 23	29·0	5
Dudley	Mr. J. Fisher	2·14	·42	20	14	68·0	28 & 29	28·0	1
Sedgley	Mr. C. Beale	2·11	·36	20	15	62·0	28 & 29	32·0	3
Kinver	Mr. W. H. Bolton	1·96	·33	20	15	69·0	29	27·0	6
Walsall	Mr. W. E. Best	2·06	·58	20	15	63·0	28	32·0	3 5 & 6
Grammar School, Burton	C. U. Tripp, Esq.	1·88	·42	19	15	68·0	28	25·0	1
Patshull Gardens	T. W. Dell, Esq.	1·95	·33	18	11	70·0	28	24·0	1
Weston-under-Lyziard R'tory	Hon. and Rev. J. Bridgeman	1·93	·47	23	17	68·5	28	25·0	1
Wrottesley	E. Simpson, Esq.	2·30	·50	30	11	64·6	29	24·5	1
Tamworth	W. Arnold, Esq.	1·97	·49	20	17				
Alstonfield Vicarage	Rev. W. H. Purchas	1·79	·37	19	10	65·2	29	19·0	25
Tean Vicarage, near Cheadle	Rev. G. T. Ryves	2·26	·43	19	15	65·0	29	25·0	1
The Heath House, Cheadle	J. G. Philips, Esq.	2·20	·45	19	14	64·0	29	25·0	1
WARWICKSHIRE.									
Coundon, Coventry	Lieut.-Col. R. Caldicott	2·21	·37	20	15	65·0	30	30·0	5
Coventry	J. Gulson, Esq.	2·01	·32	20	15	75·0	29	24·0	1
Bickenhill Vicarage	W. R. Capel, Esq.	1·97	·45	20	11	63·0	27	27·0	1
St. Mary's College, Oscott	Rev. S. J. Whitty	1·95	·41	20	14	64·1	28	26·5	1
Henley-in-Arden	T. H. G. Newton, Esq.	2·67	·52	21	15	67·0	28	23·0	1
Rugby School	Rev. T. N. Hutchinson	1·99	·49	20	18	66·0	29	23·0	1
DERBYSHIRE.									
Buxton	E. J. Sykes, Esq.	2·41	·50	20	13	60·1	14	28·4	1
Brampton S. Thomas	Rev. J. M. Mello	1·56	·65	20	11	65·0	29 & 30	24·0	1 & 5
Stoney Middleton	Rev. U. Smith	1·86	·45	20	13	62·0	28	20·0	5
Fernslope, Belper	J. G. Jackson, Esq.	1·47	·45	20	13	64·0	28 & 29	25·0	1
Matlock Bath	R. Chadwick, jun., Esq.	1·56	·53	20	12	60·0	28 & 29	23·5	1
Linacre Reservoir, Ches'field	C. E. Jones, Esq.	1·57	·59	21	12				
Willesley Gardens, Cromford	J. Tissington, Esq.	1·56	·74	20	7				
Stuffynwood Hall	Mr. R. Rolfe	1·56	·65	20	13	68·0	11 28 29	29·0	6
Spondon	J. T. Barber	1·20	·46	20	10				
NOTTINGHAMSHIRE.									
Hodsock Priory, Worksop	H. Mellish, Esq.	1·75	·99	20	10	65·8	29	21·0	1
Grove House, Mansfield	W. Tyrer, Esq.	1·53	·61	20	14	65·0	29	25·0	1
Tuxford	J. N. Dufty, Esq.	1·77	1·00	20		65·0	28	32·0	2 3 & 4
LEICESTERSHIRE.									
Loughborough	W. Berridge, Esq.	1·76	·49	20	12	66·8	28	21·0	5
Ashby Magna	Rev. E. Willes	1·58	·44	20	12	72·0	29	26·0	1
Market Harborough	S. W. Cox, Esq.	2·20	·55	20	12	63·0	30	24·0	6
Kibworth	T. Macaulay, Esq.	1·90	·56	20	13				
Town Museum, Leicester	W. J. Harrison, Esq.	1·57	·47	20	14	64·0	29	27·2	1
Belmont Villas, Leicester	H. Billson, Esq.	1·62	·49	20	14	67·	28	26·5	1
Syston	J. Hames, jun., Esq.	1·83	·66	20	16	70·0	28	26·0	1 & 6
Waltham-le-Wold	E. Ball, Esq.	1·63	·90	20	11	63·0	29	21·0	1
Little Dalby Hall	G. Jones, Esq.	1·72	·90	20	13	68·0	30	22·0	1
Coston Rectory, Melton	Rev. A. M. Rendell	1·56	·89	20	11	63·8	29	19·0	6
Belvoir Castle	W. Ingram, Esq.	1·48	·91	21	11	67·0	30	25·0	6
Thornton Reservoir		1·46	·40	20					
Bradgate Reservoir		1·51	·41	20					
NORTHAMPTONSHIRE.									
Towcester Brewery	J. Webb, Esq.	2·36	·46	20	16				
Castle Ashby	R. G. Scriven, Esq.	2·22	·51	20	15	67·0	30	31·0	5
Sedgebrooke	C. A. Markham, Esq.	1·95	·50	20	15	71·0	29 & 30	22·0	1
Kettering	J. Wallis, Esq.	1·94	·54	20	12	65·0	30	21·0	1
Althorp	W. F. Jakeman, Esq.	1·71	·41	20	14	67·0	30	24·0	6
Northampton	H. Terry, Esq.	1·84	·50	20	13	67·0	30	29·0	5
RUTLANDSHIRE.									
Burley-on-the-Hill	W. Temple, Esq.	1·92	·95	21	13	68·0	28	21·0	1
Tickencote	W. Hayes, Esq.	2·28	[illegible]	20	11	61·0	15	26·0	7
OXFORDSHIRE.									
Radcliffe Observatory	Mr. J. Lucas	2·30	·78	10	11	68·0	30	28·4	5
CUMBERLAND.									
Spital Cemetery, Carlisle	T. Bell, Esq.	2·89	1·27	20	11	68·3	21	27·3	4
ISLE OF WIGHT.									
Ventnor Hospital	Hartley Sagar, Esq.	2·86	·52	10	19	66·3	25	31·8	1
CORNWALL.									
Altarnun Vicarage	Rev G. Tripp	3·59	·58	1	21	68·0	28	29·0	2

We have received many interesting accounts of the arrival of our migratory birds, and, as the cuckoo and swallow are recorded by numerous observers, their respective times of arrival may be shown in a tabular form :—

	Stroud.	Woolstaston.	More Rectory.	Larden Hall.	Bishop's Castle.	Burton-on-Trent.	North Devon.	Malvern.	Tamworth.	Alstonfield.	Kibworth.	Coston.	Castle Ashby.	Sedgebrooke.
Cuckoo........		20	26	80	29	29	16	20			11	23	26	28
Swallow	30	22	22	22	22				22	26		23		25

The nightingale is also recorded from Sedgebrooke and Castle Ashby on the 23rd, and Kibworth on the 18th. At Oscott three sea-gulls were noticed flying from the N.E. at 2 45 p.m., on the 24th. A fine lunar halo was seen on the 12th.

Correspondence.

Brilliant Meteor on April 2nd, 1878, at 7 56 p.m.—Did any correspondent see anything of this last night. It was about 80° high, and of a bluish white colour, very fine and brilliant, and of large size, and came slowly down in a direction a little west of south. I did not see the end of it, on account of a high building blocking the view, but hope other observers were more fortunate.—William Arnold, Tamworth.

Primula Vulgaris.—We have in our garden a number of roots of *Primula vulgaris*, which, so far as I know, have not been moved for several years. Some retain their original colour and form, others have altered to different shades of red, whilst some are white, and in two cases the calyx has become petaloid, a green stripe remaining to represent each sepal. On one plant the inflorescence is an umbel and the flowers are dark crimson, with a cream-coloured spot on the margin of each petal; (I have found a similar inflorescence on the ordinary yellow primrose.) Can any of the readers of the "Midland Naturalist" tell me the reason of these changes?—M. E. C.

Prunella Vulgaris.—I observed the white variety of *Prunella vulgaris* pretty plentifully two years ago near Birnam, in Perthshire, but did not examine it sufficiently closely to say whether it corresponded with the description given of it by Mr. Mott at page 136.—H. F. Johnson, Nottingham.

Moss Catalogue.—It may be useful to the readers of Mr. Bagnall's papers on mosses to know that "The London Catalogue of British Mosses," compiled by C. P. Hobkirk and H. Boswell, 1877, can be obtained of Mr. T. B. Blow, Welwyn, Hertfordshire, price fourpence. It contains a list of the species found in Britain, including those discovered since the publication of "Bryologia Britannica," arranged according to the system of Professor Schimper, who is the greatest authority upon the mosses at the present day.—J. S., Bridgnorth.

The Direction of Rotation.—A small animal, which had received an injury to one hemisphere of the brain, was affected in such a way that it continually rotated upon its own axis, and some time ago a discussion took place as to the direction of this rotation. The question was whether it rotated from left to right or from right to left, and in the end there seemed to be an opinion that it depended "upon how you looked at it." In a similar way, if a climbing plant is said to twine from left to right in ascending, different meanings will be found to be attached to this simple statement by different persons. But such indefiniteness would be intolerable, and a clear, precise rule has long been laid down, which if well understood will speedily decide every question of the kind. When an object rotates or revolves, its motion must be performed about some central axis, which remains for the moment relatively fixed. Suppose yourself to be this axis, and fix your attention on some particular point of the object. This point will, during some part of its course, pass over your breast; if, while doing so, it crosses from right to left, the rotation or revolution is said to be from right to left, and *vice versa*. The hop and the honeysuckle are said to twine from left to right; this means that if you suppose the plant coiled round your own body, the growing point will move from the left to the right hand, in passing over your breast. Similarly, the scarlet runner and the passion flower twine from right to left. The hands of a watch, placed face upwards, turn from left to right, as also does the sun in our hemisphere, but in the southern hemisphere he moves from right to left.—W. B. G.

White Varieties of Plants.—Perhaps Mr. Mott will be pleased to know of another locality for the white variety of *Prunella vulgaris*. I found it growing near the shores of Llyn Coron, (the habitat of *Elatine hexandra* and *Hydropiper*,) in Anglesea, where it was rather plentiful and very showy; it certainly appeared to be a well-marked variety. In Nant Francon occurred the white form of *Digitalis*. I have also gathered it near Birnam Hill, Perth. The rare white *Lamium purpureum* may be found in Northants, on the site of Rockingham Forest; and some young friends of mine brought me specimens from cultivated fields, near Hardingstone, in this county. Perhaps the most singular albino ever found was *Papaver Rhœas*, perfectly white, but in other respects similar to the type. On the borders of L.'Ancresse and the Grand Havre, Guernsey, the white form of *Erodium maritimum* was prevalent, almost to the exclusion of the ordinary form; and, as Prof. Babington pointed out in the Prim. Floræ *Sarnicæ*, the flesh-coloured variety *carnea*, of *anagallis arvensis*, is frequent on the Quenvais, Jersey, and L'Ancresse, Guernsey. I have gathered white *Campanula rotundifolia* at Aberglaslyn, at Harleston, Northants, &c., &c. *Erica cinerea*, white, at Kingsthorpe, Northants; *Calluna vulgaris*, white, at Harleston, Northants; and Conwyl in Carmarthenshire. One of the most lovely albinos I ever saw was *Menziesia polifolia*, which I gathered in Kylemore Pass, Connemara. *Geranium Robertianum*, var. alb., occurs in Northants, at Rothersthorpe; *Scabiosa columbaria* on the Downs, between Lewes and Brighton; *Carduus arvensis* and *acanthoides* in Northants, at Yardley Gobion; *Campanula latifolia*, white, at Troutbeck, Westmoreland. In concluding these scattered notes, I might just add that the locality for the white form of *Erodium maritimum* and *moschatum*, the sandy shores of the Grand Havre, and portion of the Braye du Valle, Guernsey, was also the habitat for the *Silene quinquevulvera*, which exhibited there its richest colours and most type-like appearance, and for the variety *modestum*, of *geranium Robertianum*.—G. C. Druce.

Gleanings.

Mosses.—We have Mr. Bagnall's second article "On the Study of the Mosses" in type, but are reluctantly compelled to withhold it till next month, in consequence of the illustrative plate not being quite ready.

Dr. Cobbold.—We have much pleasure in stating that at a general meeting of the Birmingham Natural History and Microscopical Society, held on the 30th ultimo, Dr. Cobbold, F.R.S., F.L.S., &c., was unanimously elected an Honorary Vice-President of the Society. The appointment was made on the recommendation of the Committee, pursuant to the provision of Law VIII., in consideration of Dr. Cobbold's distinguished researches in Natural Science and of his liberality to the Society. Dr. Darwin is the only Naturalist who has received a similar honour.

Autographic Printing.—In reference to the plates at the end of the May number of the "Midland Naturalist," it is necessary to state that they are not perfect specimens of Mr. Pumphrey's process. Owing to the necessity of printing a large number, lithography had to be employed as an auxiliary, as mentioned in the description, (p. 132,) and the delicacy of the lines was thereby completely destroyed. Besides that, some of the drawings were unsuitable, for the process has its faults, like most others, and it requires a little experience to produce the best results by it.

"The Old Cross" is the title of a new shilling quarterly magazine for Warwickshire and the neighbouring counties. The first number has just been issued, and is published by Messrs. Curtis and Beamish, Coventry. It is edited by Mr. W. G. Fretton, F.S.A. The contents are varied and interesting, the range of subjects being wide enough to suit the tastes of all classes of readers. There are several articles on Archæology, local Topography, and History; a capital one on "Sand and Sandstones," a biographical sketch of Mendelssohn, several good tales, some poetry, notes and queries, chess problems, &c. We warmly recommend "The Old Cross" to the attention of our readers.

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—April 9th. Biological Section.—Mr. Blatch exhibited *Trichiosoma lucorum*, the large saw-fly of the hawthorn, and described the peculiarities of its metamorphoses, and its mode of extricating itself from the cocoon. Mr. J. Bagnall contributed and described microscopic preparations of the rare mosses, *Dicranella Schreberi*, Hedw., *Dicranella Grevilleana*, Br. and Sch., and *Trichostomum cylindricum*, Br. and Sch., and several other rare species; also, on behalf of Mr. Spinks, *Podura aquatica*, from the Lower Grounds, Aston. Mr. A. W. Wills then read a paper on "Freshwater Algæ," which will be found in the present number, being a continuation of one recently presented to the Society, and printed at page 113 of the "Midland Naturalist." The paper was illustrated by numerous specimens, living and mounted, which were shewn in the microscopes of the Society, and in those of various members who kindly lent their instruments for the evening. The thanks of the section were accorded to Mr. P. H. Gosse, F.R.S., for his kind present of a copy of his papers on *Bellidia Huntii* and *Hancockia eudactylota*, two supposed new genera and species.—April 30th. Special General Meeting.—It was resolved that a fund for increasing the apparatus and library be provided by a voluntary annual subscription amongst the members. The following exhibits were made:—By Mr. Bolton, spawn of a Mexican Lizard; by Mr. Slatter, spawn of the Perch *(Perca fluviatilis;)* and by Mr. Levick, *Stentor polymorphus* and *Cephalosiphon limnias*.—General Meeting, May 8th.—Exhibited by Mr. Southall, two leaves of *Calla Æthiopica*, with the petioles united; by Mr. Hughes, *Sepiola Rondeletii*, one of the smallest of the Cephalopoda; by Miss Hadley, a flower of *Primula Auricula*, with the calyx largely developed, the upper part being leaf-like, and the lower part coloured like the corolla; by Mr. Badger, specimens of *Aucuba Japonica* and *A. vera*, male and female, both in flower, female specimens with the flowers of the present year, and berries of the two preceding years. Mr. Lawson Tait read a paper on Cephalopoda, and illustrated it largely.

CHELTENHAM NATURAL SCIENCE SOCIETY.—March 21st, 1878.—Dr. T. Wright, M.D., F.R.S.E., President, in the chair.—F. Day, Esq , F.L.S., F.Z.S., &c., delivered an address on "Freshwater Fishes." He entered into the various questions—What is a Fish? How does it live, move, and continue its kind? Where do we find the first traces in the globe we inhabit? The importance of tracing out geological distribution; and, lastly, how fish have influenced human manners, customs, and commerce? By diagrams he explained the main divisions of the animal kingdom, and showed the several classifications that had been made from time to time, stating that the latest, dividing them into three, viz., Mammalia, Sauropsida, and Ichthyopsida, appeared to be the least objectionable. He gave a very interesting account of some recent experiments made with the *Salamandar* to prove that, though now it is normally born an air breather, it can be converted back again into what seems to have been its original form—one of the Amphibia having gills. He described the exterior skeleton of various fishes, their mode of progressing through the water by their fins, and how very strangely in some forms these become modified. He next took the scaleless forms, which he described. He then referred to the interior structure of fishes, noting the swim-bladder in its two distinct forms, both of which, by aid of specimens, he fully explained; then to the respiratory organs, giving the result of experiments that had been made to prove that some could not exist without air, particularly the Walking Fish, (Ophiocephalidæ,) and the length of time others could remain out of the water. He next reviewed the breeding of fishes. He exhibited some eggs taken from the mouth of male fishes. He referred to the fact that some species of frogs also carry the eggs in their mouths or pouches, not only until the young are hatched, but are old enough to take care of themselves; and as many as fifteen little tadpoles have been found in the pouch of the *Rhinoderma Darwinii*. He closed his remarks on this part by reference to the inter-breeding of fish, particularly amongst Carp and Herrings, and the difference that existed in such hybrids, adding that this fact deserved very attentive consideration, as new forms may be thus brought into existence, or that some of our genera do not deserve such a name, in fact may be but varieties, further remarking that if fishes of two genera can inter-breed, and the offspring is not barren, but can again inter-breed with one of the parents, he could scarcely imagine but that such a proceeding would rapidly efface the distinctive marks. He next took some of the senses, omitting hearing, sight, smell, and taste. He showed how fish have feelings and emotions, quoting observations of Dr. Cantor on the Fighting Fish of Siam, *(Macropodus pugnax,)* and the case of our own little Stickleback. He then referred to the geological features of his paper, and how there was a time when fish apparently did not exist. He showed that their distribution, and the appearance of the same species at distant places, were matters that would much interest the Geologist, and would tend to prove upheaval of parts of the Earth's crust. He concluded a very able and interesting paper by touching on the part fish may have played in early days in developing commerce, and furthering religious institutions particularly in India and Egypt, and how in later days it became a Christian emblem. Major Barnard, Rev. W. Symmonds, and others joined in the debate on the paper, to all of whom Mr. Day replied. The Rev. W. Symmonds also asked if the president would not give a paper on Fossil Fishes at some future day. This he agreed to do, and, after a cordial vote of thanks to Mr. F. Day for the paper, the proceedings terminated. April 18th.—Dr. T. Wright, M.D., F.R.S.E., in the chair. Auditors were re-elected, and F. D. Longe, Esq., F.G.S., read a paper on "The Relation of the Crust to the Interior of the Earth," a *resumé* of which will appear in a future number of the "Midland Naturalist."

DERBYSHIRE NATURALISTS' SOCIETY.—May 7th.—The Rev. W. H. Painter read a paper on "Fossil and Recent Cephalopoda." The species more frequently met with upon the coasts of England, the Cuttle-fish, *(Sepia officinalis,)* the Squid, *(Loligo vulgaris,)* and the Poulpe, *(Octopus vulgaris,)* having been alluded to, with their weapons of defence and offence, Mr. Painter described the arms and suckers of *Onychoteuthis Bartlingii* found in the West Indies, and compared them with those belonging to English species. The Cephalopods are divided by Prof. Owen into two orders, founded on the gills, *(branchiæ)*—Dibranchiata, and Tetrabranchiata, the latter of which comes first in geological time. Several genera were mentioned as occurring in the Cambrian Period, and specimens were exhibited of *Phragmoceras ventricosum*, *Orthoceras*

Ludense, *Lituites*, wherein they differed from each other being pointed out. The family of the Nautili was next traced, beginning with the *Nautili* of the Silurian, proceeding to the *Clymenia* of the Devonian, and the *Goniatites* of the Carboniferous, the differentia of each order being clearly shown. The family of the Ammonitidæ was dwelt upon at some length, the position of the siphuncle in the species being shown, and specimens exhibiting the foliaceous markings being produced. A specimen of the operculum of the Ammonite, from the lithographic stone of Solenhofen, was exhibited. Other genera, belonging to this family, were briefly touched upon, viz., the *Crioceras*, *Turrilites*, *Ancyloceras*, *Scaphites*, *Toxoceras*, *Hamites*, and *Baculites*. In treating of the Dibranchiata, the *Geoteuthis* of the Oxford clay, with its preserved ink bags, was mentioned; also, the *Ommastrephes*, represented by the recent *Ommastrephes sagittatus* of Newfoundland; the *Belemnites*, with their three component parts; the *Belemnitella*, the *Belemnoteuthis*, the Sepia, represented by *Sepia officinalis* of our coasts, the *Beloptera*, the *Belemnosis*, the *Spirulostra*, the *Argonaut*, the use of whose arms was fully explained, so exploding the pretty fable respecting them; and the *Spirula lævis* of New Zealand. This paper was illustrated by several choice specimens as well as by drawings.

DUDLEY AND MIDLAND GEOLOGICAL AND SCIENTIFIC SOCIETY AND FIELD CLUB.—The first Field Meeting of the season was held on Monday, April 29th, and included visits to the Netherton anticlinal, Hales Owen Church and Abbey, and the Leasowes. There were present Mr. Charles Cochrane (president) and about fifty other members, including many ladies. Assembling at Dudley Station, carriages were taken to Netherton Church, where the Rev. S. J. Marriot met the party. Walking down the hill to Brewen's Tunnel, over the canal, a fine section of the axis of the anticlinal was observed, which was well described in a paper read by Mr. G. Jones. Crossing the canal, Messrs. H. Doulton and Co.'s clay openwork was visited. Here a very fine section of the Coal-measures is exposed, and some good specimens of Coal-measure fossils were obtained. Re-crossing the canal, a walk was taken through the Saltwells Woods to the Saltwells Inn, where luncheon was provided. After examining the baths and mode of using the brine, the Rev. J. H. Thompson gave a short address as to the origin of the salt spring. Entering the carriages again, the way was taken to the outcrop of the Aymestry or Sedgley limestone at the Hayes, where Mr. Cochrane gave a short description of the fossils he had obtained there. Here also a very interesting, though now partially obscured, section of the Coal-measures was seen in the cutting of the Hayes branch of the Great Western Railway. From here the drive was continued to Hales Owen Church, where Archdeacon Hone met the party, and described the restorations that had taken place. After visiting (by permission of Mr. Green) the remains of the Abbey, a walk was taken (by permission of Mr. Gibbons) through the grounds of the Leasowes, after which the party returned to Dudley. A conversazione was held in the evening, at the Museum, by the invitation of the Dudley members, where a good selection of microscopes and other objects of interest were displayed.—On Tuesday, May 21st, the second Field Meeting took place, and was to Trysull, Pattingham, and the boulder district.

EVESHAM FIELD NATURALISTS' CLUB.—Meeting held Wednesday, May 1st, at the Evesham Institute, Mr. J. S. Slater in the chair. The first excursion of the club was fixed for Saturday, May 11th, to Ragley Park, and if that was impracticable to Mickleton. The following dates of the first appearance of some of the migratory birds were reported, almost all by Mr. A. H. Martin:—April 12th, Chiff-chaff, Wryneck; 15th, Sand Martin, Swallow; 16th, Nightingale; 19th, Whitethroat, Cuckoo, Sedgewarbler; 20th Sand-piper; 21st Goat-sucker, Swift; 25th, Nightjar; 30th, House Martin. Mr. Doeg produced some Blue-lias fossils from a brickyard, which had been given him by a workman there for the Club. Also a specimen of Testacella taken with several others in a piece of garden ground adjoining the town.

NOTTINGHAM LITERARY and PHILOSOPHICAL SOCIETY.—NATURAL SCIENCE SECTION.—May 8th.—MICROSCOPICAL MEETING.—A paper was read by Mr. J. Rogers, F.R.M.S., on "Mounting objects for the Microscope." May 22nd.—ANNUAL MEETING.

NOTTINGHAM NATURALISTS' SOCIETY.—April 17th.—A paper on the "The Teredo, or Shipworm," was read by Mr. B. S. Dodd. May 1st.—Lecture on "Australian Natural History," by Dr. Bancroft, formerly president of the society. May 15th.—"Fertilization of Plants," by Mr. C. L. Rothera, B.A.—Several afternoon excursions have been made during the month.

OSWESTRY AND WELSHPOOL NATURALISTS' FIELD CLUB AND ARCHÆOLOGICAL SOCIETY.—First Excursion for 1878 on Thursday, May 9th. A visit was paid to Selattyn, near which were found *Botrychium Lunaria*, *Havenaria bifolia*, and *Myrrhis odorata*. The route then lay along the line of Offa's Dyke, which is very plain here. A quarry of mountain limestone was also visited, where specimens of *Lithostrotion junceum* and *irregulare* were found, together with other mountain limestone fossils. The junction of the limestone with the millstone grit is shown near Carrybig, and from thence the party walked to the limestone quarries at Llawnt.

TAMWORTH NATURAL HISTORY, GEOLOGICAL, AND ANTIQUARIAN SOCIETY.—April 15th.—The Rev. Brooke Lambert, M.A., B.C.L., read a paper entitled "The Slough of Despond, and how to bridge it." An animated discussion ensued. May 6th.—A paper was read by Mr. Alfred Lucy on "Meteors and Meteorites," in which he pointed out that certain streams of these bodies occur periodically both on the same date, and coming from the same quarter of the heavens, owing to the earth's orbit crossing their tract. The high velocity of meteors protects us from the vast number which fall, by causing such friction with the atmosphere as not only to render them luminous but convert them into vapour by the intense heat. The connection between orbits of meteors and orbits of certain comets was shown and explained by Mr. Lucy, who also described the new theory of the origin of both meteor and comet streams. A discussion followed, and a hearty vote of thanks was awarded.—A rich collection of spring wild flowers was exhibited by Miss Harding.

WOOLHOPE NATURALISTS' FIELD CLUB.—April 23rd.—ANNUAL MEETING.—Mr. Theophilus Lane was appointed secretary in the place of the late Mr. A. Thompson. The President (Mr. J. Griffith Morris) delivered his retiring address. A large part of it was devoted to "Mycology," a subject to which the club has for many years devoted much attention. This portion of the address is so valuable and important that we shall in future numbers publish it in full.—The first Field Meeting of the year was held on Tuesday, May 28th. The members left Barr's Court Station at 9 40 A.M., to reach Ledbury at 10 23 A.M., where they were joined by members of the Malvern Club. They then proceeded to "The Wonder," where an address on "The Geological Features of the District" was given by the Rev. W. S. Symonds, M.A., F.G.S., &c.; and afterwards drove through Much Marcle, visiting Kempley Church, where some ancient "Mural Paintings" have been recently discovered; returning by Haffield to Ledbury. By Dr. Henry's kind permission, the members were allowed to visit the Camp at Haffield, and other objects of interest there.

WEST LONDON ENTOMOLOGICAL SOCIETY.—May 3rd.—HALF-YEARLY MEETING.—The following officers were elected for the ensuing six months:—President, Mr. Mapleson; vice-president, Mr. Smith; secretary, Mr. Timms, re-elected; curator, Mr. Silcock; treasurer, Mr. Dow, re-elected; librarian, Mr. Maycock, re-elected. On May 6th Mr. Meek took two specimens of that rare noctua, *N. conspicillaris*, at Darn Wood. On May 12th Mr. Russell took *N. trepida* at Highgate Wood.

EXCHANGE.

MIDLAND UNION OF NATURAL HISTORY SOCIETIES.

ANNUAL MEETING AT BIRMINGHAM.

The business of the First Annual Meeting of the Union commenced at Birmingham on Monday, May 27th. The Council met at twelve o'clock, and, having transacted the necessary preliminary business, adjourned to the Queen's Hotel, where, at half-past one o'clock, the President of the Union, Mr. Edmund Tonks, B.C.L., entertained them and the officers and past Presidents of the Birmingham Natural History and Microscopical Society, and some other of his Birmingham friends, at luncheon. At three o'clock the Annual Meeting of Members was held in the Lecture Theatre of the Birmingham and Midland Institute, the President in the chair. There was a large attendance, including Dr. Cobbold, F.R.S., (London,) Rev. W. H. Elliot, (Caradoc Field Club,) Rev. C. F. Thornewill, (Burton-upon-Trent Natural History and Archæological Society,) Rev. O. M. Feilden and Rev. G. G. Monck, (Oswestry and Welshpool Naturalists' Field Club,) Major Barnard, (Cheltenham Natural Science Society,) Mr. C. T. Musson and Mr. A. H. Simpson, (Nottingham Naturalists' Society,) Mr. I. Mosley, (Nottingham Literary and Philosophical Society,) Mr. E. B. Marten and Mr. E. Hollier, (Dudley, &c., Geological Society,) Mr. G. New and the Rev. J. C. Odgers, (Evesham Field Naturalists' Club,) Mr. T. Heath, (Derbyshire Naturalists' Society,) Rev. Dr. Deane, Rev. H. W. Crosskey; Messrs. W. R. Hughes, S. Allport, Sam. Timmins, T. Anderton, Lawson Tait, C. J. Woodward, W. G. Blatch, G. H. Twigg, W. H. Cox, C. E. B. Hewitt, and many others, including several ladies, and the Hon. Secs. to the Council, Mr. W. J. Harrison, (Leicester,) and Mr. Edward W. Badger, (Birmingham.)

The circular convening the meeting having been read, the President delivered the following

INAUGURAL ADDRESS.

As this is the first general meeting of the Associated Natural History, Philosophical, and Archæological Societies and Field Clubs of the Midland Counties, it is a matter of regret that the association at a period of its existence so critical has not as its President some member distinguished by his researches in Natural Science, and experienced in the organisation of scientific study, who might have guided its first steps in the right direction, and elaborated a scheme for its future action worthy of the occasion; whereas I, who am versed in no department of Science or Philosophy, and have only the accidental qualification for the office of being the President for the year of the Society, some of whose more active Members originated this Union, can only perform perfunctorily the duty devolved on me by my position.

Under these circumstances the time of the meeting will be more profitably expended in considering and discussing the best means of perfecting the organisation of the Society, than in listening to my crude remarks; it will therefore be my duty to make these remarks as brief as possible, in order that they who have schemes for rendering available for a common object the scattered energies of the large body of earnest students in the several societies of the Union may have an opportunity of submitting them for consideration.

Such views as I have on the subject I will lay before you. The Union now consists of twenty-one Societies, and is, under its existing constitution, managed by a Council consisting of two Members from each of the Societies: that is, of forty-two members, with the prospect of increase. This managing body is far too large for efficient work, and I suggest that the present Council be converted into an electoral body, who shall appoint a committee for the general management of the affairs of the Union, consisting of say ten members, the Editors of the organ of the Union—the "Midland Naturalist"—to be members *ex officio*. I believe by this means more concentrated attention to the work would be secured, and a larger attendance at the meetings, for when each individual member of a large committee has to travel far, and sacrifice much time to attend a meeting, he will be but too ready to excuse himself on the ground that with so many others his presence will not be necessary; the inevitable consequence will be meetings rarely attended, and probably by different members on each occasion. It is of the utmost importance that a careful selection of men interested in the work be made in the first instance, and as far as possible the same men be present when the continuous work of the Union is transacted.

I earnestly recommend that the subscription to the general funds of the Union be reconsidered; it was fixed at the ludicrously insufficient sum of one penny per member;* if it be intended that any real joint work shall be done, and the organisation utilised as it may be, a larger though still moderate subscription is absolutely necessary, and may be profitably expended; it is premature to enter into details of this expenditure, but I may mention as an illustration of the necessity that the cost of the programme of the proceedings of this meeting would alone exhaust the whole revenue of the Union, and this is only one of many other items of legitimate expenditure for which provision ought to be made out of a common fund.

The pages of the "Midland Naturalist" form an excellent medium of intercommunication for the Members of the Union, and all of them, for their own and the general interest, ought to subscribe to it. This journal at present is the only offspring of the Union; although young, it is lusty and full of promise; it may be safely prophesied that as long as it succeeds, so long will the Union flourish; it is, in fact, our Palladium, our existence depends on its success. Such as can must render its pages interesting by contributions of the results of their observations in the various departments in Natural Science; all must help to secure its commercial success; we are bound in honour to do this, for as we have

*At the first meeting of the representatives of the several Societies then proposing to join the Union there was a division of opinion as to the subscription which would be necessary to carry out its objects, and it was only by a majority fixed at a penny per member, upon the representation that such sum had been found to be sufficient by the experience of the Yorkshire Naturalists' Union; since which date the Yorkshire Union has, in a circular addressed to its members, (printed in this number, p. 180,) called attention to the obvious inadequateness of this subscription to defray the necessary expenses.

been relieved of the risk of its publication by the liberal action of the Proprietors of the *Midland Counties Herald*, no indifference on our part must leave loss to fall upon them ; a subscription is no mere contribution towards the common weal, full value is returned for it. Under the excellent editorship of Mr. E. W. Badger and Mr. W. J. Harrison, the journal has been so conducted that, if the progress exhibited in the first five numbers continues, it will speedily acquire more than a local fame, and the United Societies, when it is established on a firm basis, may with legitimate pride point to the "Midland Naturalist" as the first work of, and a sufficient reason for, their Union.

But we have other duties besides those which tend to secure the success of our local organisation; we are British as well as Midland Naturalists, and ought by all means in our power to aid in extending the usefulness of those representative Societies of our country, of world-wide reputation, whose reports, transactions, and other publications, form in a great part the basis of the knowledge we possess of the various subjects of our studies; probably many of you consult these reports and transactions for the valuable information they contain, well contented if your local library possesses them, without giving a thought to the cost of their production. But, however distinguished may be these Societies, they are maintained by the subscriptions of their members, and their publications are limited, and consequently their utility, by the measure of their funds; many precious treatises, the results of the long observation, and earnest thought of some of our best observers of Nature, are, for lack of the means of publication, lost to science, and the energies of succeeding Naturalists have to be wasted in going over the same ground again, which might have been more profitably expended in working out new discoveries. It is the duty of every true Naturalist, who can afford the few guineas necessary to constitute membership, to join these Societies, and aid the general cause of science by increasing their means of utility.

The Societies to which I especially refer are :—The Linnean Society, which was founded in 1788 for the cultivation of Natural History in all its branches, and more especially the Natural History of Great Britain and Ireland.

The Geological Society of London, instituted in 1807, for the investigation of the Mineral Structure of the earth.

The Zoological Society of London, instituted in 1826, for the advancement of Zoology, and the introduction and exhibition of subjects of the animal kingdom alive, and in a state of preservation.

The Entomological Society, founded in 1833, for the cultivation of the knowledge of the structure, uses, habits, and functions of the Insect tribes, both native and foreign.

The Ray Society, founded in 1844, for printing such works in Natural History as stand in need of extraneous assistance to secure their publication.

And the Palæontographical Society, established in 1847, for the purpose of figuring and describing the whole of the British Fossils.

The last two Societies are specially deserving of the support both of the several societies in the Union, and of the individual members; the subscription to them is extremely moderate, one guinea per annum; and, as they are purely publishing societies, and do not hold periodical meetings for the reading of papers and discussion, the subscriber in the country has the full benefit of their operations. Generally one or more elaborately illustrated monographs are issued by each Society every year, exceeding in cost the amount of the subscriptions, as these have frequently been supplemented by considerable pecuniary assistance from the learned authors, who also devote their time and knowledge to the preparation of the works gratuitously.

It appears to me that the individual members, or associations of them, of an organisation like this, who are scattered over a wide area, varying in its flora, fauna, and geological conditions, might turn to profitable account the peculiar opportunities afforded by their several districts in determining many unsettled problems in Natural History. What these problems are I must leave to the decision of such of you as are skilled in the various branches of science; but I will venture to suggest one as an illustration of the kind to which I refer: What is that which determines the sexes of Bees? Is the sex an inherent quality of the egg, or is it modified in the development of the larva by circumstances? Bees, always excepting their stings, afford very favourable opportunities of studying this question; and the knowledge we already possess of some of the peculiarities of the development of the one sex may help us in that of the other. Schirach, and afterwards Huber, taught us that the working bee is an imperfectly develcped female, and to make the perfect female from the egg, which, deposited in a worker's cell, would have produced a working bee, nothing more is necessary than sufficient room for its development, and special food during its growth from a certain stage. It appears a natural question to ask, if a modification of this kind will change a neuter into a perfect female bee, will a modification of another kind, that is, the peculiar size of the drone cell, and some unsolved treatment in nutrition, cause the egg to become a drone, which, deposited elsewhere, and treated otherwise, would have become a worker or a queen? It does not seem unreasonable to suppose that the determination of sex is only a question of room and nutriment, when we not only find these influences have such an effect in the arrested and perfected development of the female in bees, but we know that in mammals there is a period in the fœtal growth when the sex is not determined, and the fœtus may be called bisexual; and it is only at a further stage that the growth of the organ of the one sex is arrested, and that of the other developed.

Possibly this problem has been solved, but in my limited reading on the subject I have not met with its solution; however, solved or not, it will serve my purpose of suggesting a class of problems upon which the united power of the organisation may be usefully employed. As difficulties occur in the course of the investigations of individual members, they should be by them brought under the notice of the members of the Union generally, by publication in the "Midland Naturalist," when the investigations can be taken up by such as have the special opportunities of observation requisite, with the probable result of a satisfactory solution in many cases.

A wide field of investigation is open to the patient Naturalist who will devote his energies to the study of that strange class of organisms, the parasites of man. Dr. Spencer Cobbold, the most eminent of British Helminthologists, who has recently honoured our local society by accepting the office of honorary vice-president, is now engaged in publishing, in the "Midland Naturalist," a series of papers in which he brings before our notice the fact, that the complete life-history of many of these human plagues is yet untraced. Here is full and useful occupation for such of you as have the necessary patience and application. The full career of some of them has been clearly demonstrated, through a series of metamorphoses more strange and bewildering than any we have read of in the fabulous pages of Eastern tale; wonderful as are the records of the Thousand-and-One Nights, no story related by Sheherazade is so full of marvel as that of the varying phases of the life-career of a simple cestode worm. In unravelling the thread of such a career, and distinctly tracing it through all its changes, you may by some happy discovery of the peculiarities of one or other of these formidable guests, gain the proud distinction of having conferred a benefit on mankind. At present we know what fatal mischief they work upon their hosts; but our knowledge is not sufficient to enable us to guard effectually against their unwelcome visits. It must be that, in a union of so many desirous of penetrating the secrets of nature, some by education and tastes are eminently qualified for this difficult pursuit. Its utility ought to be a sufficient inducement to follow it, and the absorbing interest it would generate in its followers would be their sufficient reward.

This special field of observation is not limited, as to its objects, to the ordinary entozoa and epizoa, which hitherto have been included in the lists of the Helminthologist; most of these are distinctly visible without the assistance of the microscope, which is only required for the examination of the details of their structure; there is evidence of the existence of a large class of organisms, whose interference with our vital economy is far more fatal than that of ordinary parasites; these are so minute as to tax the skill of the most expert histologists, and require the most perfect instruments to detect their existence. The generally accepted theory of their action appears to explain satisfactorily the course of many fatal diseases, as scarlet and other fevers, measles, small-pox, and, in fact, most of the diseases attributed to contagion; but much more evidence is required to establish the theory on a firm basis. Already a large body of acute observers throughout the scientific world are engaged in pursuing this study; and the evidence obtained with reference to one particular form of disease—splenic or relapsing fever—appears to be conclusive, as numerous specimens of a peculiar form of Bacteria, called Spirilla, are always found to be present in the blood of persons while suffering from this fever, which disappear during the intermissions, and when the fever passes away. Other forms of Bacteria have been detected in the blood in other diseases; but much evidence is still required to distinguish and identify them as the several causes of the mischief in the varying forms of contagion, the search for which will afford a worthy occupation for the best Histologists and Physiologists amongst you.

It would be presumption on my part to attempt to teach Geologists their duty, but, subject to their correction, I suggest they might utilise their local knowledge in checking, and rectifying where necessary, the accepted geological map of the district; however correct it may be in its general arrangement, doubtless many details may be added to it which would materially increase its value. If the idea be thought worthy of adoption, the geologists of the Union may easily organise their labour so as to obtain the best effects from it, the district may be subdivided into sections, in each of which a sub-committee, bringing to bear its united local knowledge, could carry the work into effect with a completeness scarcely attainable in other ways. If the attempt should prove successful probably other districts would follow the example, and ultimately, through our initiation, the country might possess a general geological map, with an abundance and an accuracy of detail, such as could only be produced by the well-ordered work of an army of enthusiasts.

Our midland district is rich in the objects of the study of the Botanist and Zoologist; their branches of natural science are within the reach of every one, and the favourite pursuits of many. Of the almost infinite variety of vegetable and animal life, afforded by this fair field, much is unrecorded; aid in supplying this deficiency. Many great undertakings, which would be a tax too severe upon the individual member, burdened with the absorbing cares of his own vocation and family, may be successfully accomplished by division of labour, and the work devoted to their execution would be converted into recreation when subdivided and carried out in association with friends of congenial tastes, all equally eager to advance the progress of science.

A system of interchange of specimens should be arranged, to supply from the superabundance of one district the deficiencies of another. This might be effected by an exchange column in the "Midland Naturalist;" and I recommend that, when an object of singular interest has been exhibited at a meeting of any society, the fact should be published in the same medium, and, so far as possible, on application by the secretaries of other societies, the loan of the object should be granted for exhibition throughout the Union; and further, it may be desirable on special occasions to extend the principle to papers of exceptional interest. By such and similar means the interest of meetings may be largely extended, more especially to the advantage of the smaller societies, and the districts with fewest natural advantages.

The Union, if it contain a proportion of enthusiastic Naturalists equal to that of the Birmingham Society, as doubtless it does, will afford the means of organising extended marine excursions, such as to the coast of Ireland, the Mediterranean, or elsewhere, in search of new fields of observation in marine zoology, geology, and other branches of natural science, and realise the day dream of our distinguished marine zoologist, Mr. W. R. Hughes. As this class of excursion involves the necessity of chartering a steam yacht of capacity sufficient for open sea work, and consequently a large total expenditure, a single society rarely contains a number of members having the leisure and means sufficient to form a company which will subdivide the expenses so as to reduce them to a reasonable amount per head ; but in the larger association the necessary number ought to be easily found. Such excursions, independently of the direct results which may be expected from the opportunities they afford for investigations of new sources of knowledge, would have the inestimable advantage of intimately associating for a lengthened period the best Naturalists of the district, whereby many valuable friendships may be formed, and thence some indirect benefits to science be expected to accrue. I can speak with the more confidence on the subject, as I have enjoyed and witnessed the results of our own less extended excursions to such places as Teignmouth and Arran. I have heard the many expressions of satisfaction at the pleasure derived from the opportunities of friendly intercourse of members who previously were comparative strangers to one another, and noted with satisfaction the increase of practical knowledge gained of subjects, which before had been confined to the comparatively imperfect information to be derived from books. For the latter class of excursions association of the societies generally is not necessary, or even desirable, for the numbers of the members of the Union who would be willing to form a party to visit a place of such surpassing interest as Arran, where the botanist, zoologist, or geologist can revel in the superabundance of objects of his special pursuit, would become unmanageable, as the means of accommodation in such places, although often very good, are but small ; however, it may be convenient for two or more of the smaller societies to associate for these excursions; probably the best number for the purpose is twenty, and the best destination, if not previously visited, and even then so many fresh objects might not be found elsewhere, is Arran.

I have to the best of my ability endeavoured to show what may be usefully done by the Union. I have one suggestion to make to the individual members of the several societies. The Union is, speaking generally, strong in proportion to the number of societies of which it is composed; the societies in proportion to the number of their members. It is, therefore, the obvious duty of every member to induce his friends to join his society; he may meet with the objection on the part of his friends that they are not Naturalists ; he must urge in reply that, although working Naturalists are few, all are interested in natural phenomena, and all can, by subscribing to its funds, assist a society which is working much good in cultivating intellectual pursuits and disseminating valuable knowledge. It is without doubt true that many are deterred from entering on the most engrossing and enchanting pursuit, which has even banished *ennui* and melancholy from its happy followers, by the mistaken idea that no progress can be made in it without painful application to the study of the technical details of the refined distinctions, which are supposed to be the boundary marks between one and another species or variety, and of the too often unmeaning and barbarous names violating all rules of grammar and language, with which it has delighted many closet Naturalists to favour in such liberal profusion each individual in the organic and inorganic world as to render identification sometimes impossible; but knowledge of this kind is not requisite to constitute a Naturalist.

He who notes with intelligence the ever-varying phases of nature is a Naturalist. That title could not have been denied to Thomas Edward, whose charming biography by Smiles you all have, or ought to have read, before he had acquired in the later part of his life the art of classification; and he is not a perfect Naturalist who limits himself to the technical details of the science, but he who extends his observations to the habits, cultivation, use, and relation to the surrounding universe of every object of his scientific pursuit, may rightly claim that title.

I hope it will not be supposed that I depreciate in any way the value of the exact study of the technical details of a science; I merely protest against that view which would limit science to an index; books are comparatively useless without an index, but an index is absolutely so without the contents to which it refers; many scientists never get beyond the index; in fact, they often appear to take pains to avoid giving details of general interest for fear their writings, by becoming intelligible and popular, should be damaged in their scientific character. Our forefathers did not arrange their plants under a system of classification so perfect as ours; but they knew much more of the plants themselves, and if the eclectic physician in the present day wishes to learn something of their properties, he does not consult a modern treatise but has recourse to a black letter herbal.

Accurate knowledge of technical details is necessary as a foundation for the structure of the larger and more valuable knowledge of nature itself, and the acquisition of that technical knowledge brings with it other rewards; for the mental training, which results from the sustained exercise of the faculties upon a subject which requires so much application and precision, eminently qualifies the student for the business of life.

I hope some of the energies of the Union will be devoted to the repression of those pirates sailing under false colours, *soi-disant* Naturalists, who, preying on nature, hunt after every rare and beautiful plant, or bird, or animal to destroy it, nominally on the pretence of obtaining specimens, which in many cases are not preserved, and even when preserved are useless for the advancement of science, whose real object is to gratify that passion for destruction unfortunately common to many, and a morbid craving for notoriety, to which numerous journals pander by publishing the disgraceful fact, as if it were a subject of interest and congratulation for the world to know that a beautiful living object and all its possible offspring had perished for ever; I sincerely hope our "Midland Naturalist" will not soil its pages with any such records. The ultimate destruction of many of the most interesting of our *feræ naturæ* in a country where population, buildings, and cultivation are rapidly extending, is inevitable, and only a question of time, but still much may be done to prolong their stay with us, and the Naturalist ought to be their protector. Charles Waterton, the very type of the real Naturalist, proved at Walton Hall how much might be done by non-interference. The Park, under his care, was soon filled with birds and animals, who were attracted not by feeding and other artificial contrivances, but by its peaceful retreats, where they soon acquired the knowledge that they might abide there undisturbed ; no gamekeeper was employed, nor was any gun or trap used for the purpose of keeping down vermin ; birds and beasts of prey had full liberty to range through those real preserves, where nature alone determined the balance ; the result was, with no dearth of game, both great and small, a greater variety of other living creatures congregated on a limited area than can now be found in extended districts. There the Naturalist might study the habits of the various tribes which make the country beautiful, with an ease afforded in few other resorts, for freedom from interference had made them fearless and tame ; elsewhere, with good reason, they dread the sight of man, and so far as is possible keep themselves out of his range. We cannot turn the whole country into a preserve like this ; the necessities of a teeming population must take precedence ; but there will be yet for a long time many nooks and corners which will be frequented by the varied objects of our study, if we leave them alone, and content ourselves to—

> Look on this beautiful world, and read the truth
> In her fair page ; see, every season brings
> New change to her, of everlasting youth ;
> Still, the green soil with joyous living things
> Swarms, the wide air is full of joyous wings,
> And myriads still are happy in the sleep
> Of ocean's azure gulfs.

Dr. Spencer Cobbold, F.R.S., then addressed the meeting. He said he had listened to many addresses in years past, but he had never listened to one affording more pleasure, and more instruction and satisfaction, than that delivered by their President. He congratulated the President on his address, inasmuch as he had left no stone unturned in marking the course the Union should take. The range of the address they had just heard was very extensive. With whomsoever the idea of the Union of Midland Natural History Societies originated, he (Dr. Cobbold) must say that the thought was a most happy one ; he had no doubt that the origin in the first instance might be traced to the British Association for the Advancement of Science. Now the British Association had no doubt done much good work, but still its name was, to some extent, a misnomer. The British Association should be called "The British Association for the Diffusion of Science." It had done its work well, inasmuch as it had set going many persons, in places where it had established what he might call a temporary home, and perhaps in no town had its effects been more felt than in the town of Birmingham. He thought the union of the Natural History Societies of the Midlands would really prove a greater vehicle for the advancement of science than the projectors of the Union ever dreamt of, inasmuch as members would no doubt adopt what was insisted upon in the President's paper, and become actual workers in the cause of science. There was another object which he had no doubt would be achieved by the Union, namely the encouragement of native talent. Men who had hitherto not had the opportunities would endeavour to make them, and being encouraged by those around them would really begin work in some department of Natural History, and keep to it. These men when once interested would be untiring students. He concluded an admirable speech by proposing a vote of thanks to the President for his address.

Major BARNARD seconded the motion. The part of the address which elicited his warmest sympathies was that in which the President spoke of the duties of Naturalists and how they should endeavour to spread the knowledge of Natural History in general. He was of opinion that the Midland Union of Naturalists would become, in a few years, a Society of considerable influence in the country at large. He hoped one object would be kept in view by the members of the Union, namely, that of promoting the study of Natural History in our schools. No doubt a great many efforts were being made in that direction at the present time, but still a little gentle pressure would, he was sure, be productive of good. It was true that a great many schools professed to teach Natural Science, but when they came to look into the matter they found, somehow or other, that the teaching of Natural History occupied only a very small corner. Indeed, he had found, from enquiries he had made, that one lesson a week was the maximum. He thought, therefore, it might be a legitimate thing for the members to do, and he felt assured so large a number of members, with such an amount of influence as they possessed, would, if they brought that influence to bear, be able to achieve great results in that direction.

The motion was put and carried unanimously, and briefly acknowledged by the CHAIRMAN.

The report of the Council was then read by Mr. W. J. HARRISON.

After detailing the history of the formation of the Union, (see pages 1 to 4 "Midland Naturalist,") it went on to speak of the journal of the Union—the "Midland Naturalist"—and expressed the opinion that it had already fully realised the expectations of the Council, and urged all members who are not at present subscribers to become so at once. The report then proceeded as follows:—

"The Societies constituting the Union are—

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

"Your Council hope other local Societies will join the Union, and have reason to think that several contemplate doing so.*

"The objects of the Union may be broadly stated to be to extend the usefulness of Local Societies by affording facilities for inter-communication through an authorised and regularly published magazine, which records the more important work done by them; announces their forthcoming meetings and excursions; and assist in the interchange of notes and specimens; and, by providing opportunities for personal intercourse among the members at meetings to be held from time to time in various places of interest, and in other ways, to promote the study of Natural History, and other scientific subjects.

"Your Council desire to record their warm appreciation of the hearty efforts which the Birmingham and Dudley Societies have made to ensure the first meeting of the Union being successful and interesting. The Conversazione which will take place in the Town Hall this evening will give members of distant societies some idea of the scientific and other resources of local members and will afford an excellent opportunity for social and intellectual intercourse. The excursion to Dudley and neighbourhood to-morrow will supply an admirable opportunity for the study of some of the geological features of a most interesting and important district, while the archæological members will find much to occupy their attention. Your Council feel that the thanks of the members are due and are assured that they will be warmly tendered to the gentlemen who have with admirable foresight, much labour, and expense made these arrangements for their edification and instruction.

"Your Council recommend that they be empowered to appoint a small Committee of Management to transact the general business of the Union. They also submit bye-laws for your consideration.

"The present subscription of one penny per member is deemed by your Council as quite inadequate to enable the Union to engage in any real work, and they desire to have your opinion as to whether it should not be increased, and if so to what amount.

"It now only remains for your Council to state that it recommends this meeting to select Leicester for the next annual gathering of the Union, and to express the hope that this association of societies may be increasingly instrumental in fostering the study of Natural History and allied sciences."

The PRESIDENT moved the adoption of the report. He strongly recommended the meeting to adopt the suggestion of the Council, and empower them to select as a Committee of Management ten members of the Council and the editors of the "Midland Naturalist," *ex officio*. As to the amount subscribed by each member annually he for his part could not think what induced the promoters of the Union to fix the sum so low. The subscription would only pay the postage of two circulars to each of the members. He recommended the meeting to pass some resolution fixing the subscription at a reasonable amount. His own idea was one shilling per annum per member if the societies of the Union meant to do real work.

The motion was seconded by the Rev. W. H. ELLIOT, and carried.

The PRESIDENT then moved that the Council be empowered to appoint a Sub-committee of Management to conduct the business of the Union.

Mr. LAWSON TAIT seconded the motion, which was carried.

* "The Peterborough Natural History and Scientific Society" has since joined the Union.

The PRESIDENT next moved, that it be a recommendation of this meeting to each individual Society, that the subscription to the Union be raised to one shilling. He said he was unable to say what work the Yorkshire Union had done, when its members only contributed a subscription of one penny per annum. Such a subscription appeared to him to be ridiculously small and inadequate.*

The motion was not seconded; but an animated discussion ensued, in which Mr. C. J. WOODWARD, Mr. LAWSON TAIT, the Rev. C. F. THORNEWILL, Mr. G. H. TWIGG, the Rev. W. H. ELLIOT, Mr. E. HOLLIER, and others took part. It was ultimately resolved on the motion of the PRESIDENT, seconded by Mr. G. H. TWIGG, "That it be a recommendation from this meeting that the annual subscription be raised, and that honorary secretaries be requested to report to a future meeting of the Union the opinion of their societies upon the subject."

The Treasurer's report was then read by Mr. EDWARD W. BADGER, (in the unavoidable absence of Mr. E. D. Hamel.) It showed that the total receipts for the year, contributed by twenty-one societies, consisting of 2,683 members, were £11. 4s. 10d. The report was adopted.

Mr. LAWSON TAIT read the following

BYE-LAWS.

1.—That the Annual Meeting of the Midland Union of Natural History Societies shall be held, from time to time, in the towns in which the various Societies of the Union are located; that the President of the Society in connection with which the Annual Meeting shall be held, shall be the President of the Union for the year, and, *ex officio*, a member of the Council; and that where more than one Society in the same town is in the Union, the question of the Presidency shall be determined by those Societies.

2.—That the Annual Meetings of the Union shall be held in May, and that all the arrangements for the same shall be made by the Society or Societies of the town in which it is to be held.

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* This is a subject of so much importance, that we gladly print a circular which the Yorkshire Naturalists' Union have issued on the work to be done, and the necessity for an increased subscription:—

"THE YORKSHIRE NATURALISTS' UNION.—The Secretaries have been directed by the Council to call your attention to the desirability of a sufficient income being at once raised to enable the Union to commence the publication of reports and papers upon the Natural History of the county, as well as to defray the necessary expenses connected with the meetings.

"It is intended to issue the following papers, &c., which are now in preparation, as soon as the requisite funds have been raised—

"1. A history of the West Riding Consolidated Naturalists' Society, from 1861 to 1876 inclusive.

"2. A map of Yorkshire, showing the districts, based upon the river-drainage system, into which the county will be divided, for the purpose of investigating the fauna and flora. This map will be accompanied by an explanatory paper, describing in words the boundaries of the various districts.

"3. The reports and proceedings of the Union and of its Sections, together with such papers and catalogues as may be considered of sufficient value by the Council.

"It is perfectly obvious that the contributions paid by the affiliated Societies, of 1d. per member per annum, are quite inadequate for this purpose, and you will see that the total income required, more especially for the *first year*, when the map is to be published, is very considerable. The Council consequently have confidence in inviting you to contribute to the extent of your ability and inclination; and while large amounts are sought from all those who are able to give them, *they wish it to be understood* that small amounts are likewise acceptable. Among the sums already given are such amounts as Two Shillings, Half-a-Crown, Five Shillings, Half-a-Guinea, One Guinea, and Two Guineas. Subscribers of 2s. 6d. and upwards will be entitled to receive the publications of the Union.

"The Council trust that the response to this appeal may be such as to justify them in ordering the early publication of the map and reports."—[EDS. M. N.]

3.—That the Secretaries of the Council, and any other two members of the Council may summon a Special Meeting of the Council, and that the Secretaries shall summon a Special Meeting of the Council on the requisition of any five members.

4.—That the Council shall hold an Ordinary Meeting at the commencement of and another at the conclusion of the Annual Meeting of the Union.

5.—That the Secretaries and Treasurer shall present reports at the first of these meetings.

6.—That the time and place of the next Annual Meeting shall be decided by the Council at the first of their ordinary meetings.

7.—That the President of the Union shall be for the time the President of the Council; and that there shall be two Secretaries and a Treasurer elected annually.

The Bye-laws were adopted.

Mr. Edward W. Badger and Mr. W. J. Harrison were re-elected Honorary Secretaries, and Mr. Egbert D. Hamel Honorary Treasurer.

On the motion of the President, seconded by Mr. W. R. Hughes, it was resolved that the next annual meeting of the Union be held at Leicester.

The President having stated that a suggestion had been made that a joint excursion should be made to Castleton, next invited remarks from any of the members who desired to point out how the Union might be rendered most useful.

Mr. Harrison said it seemed to him the best thing to do was to place before themselves several definite objects. The only branch of science in which he was specially interested was that of Geology, and on that subject those members who took an interest in it, although they lived apart, could co-operate with each other. The subject of the glacial deposits was one which he thought might most advantageously be considered by the members of the Union. He moved the following resolution :—" That the subject of the glacial drift-deposits be referred to the Council as one well adapted for conjoint observation by the Societies in the Union."

Mr. Tait having seconded the motion, it was carried.

The Rev. C. F. Thornewill said he felt they ought not to separate without passing a hearty vote of thanks to the Birmingham and Dudley Societies for the excellent arrangements they had made for the instruction and enjoyment of members. It had been said that he was a bold man who first ate an oyster, and certainly it was a bold step to take to start the Union, and also to bring members together for a couple of days enjoyment and instruction.

Major Barnard seconded the motion, which was unanimously carried.

A vote of thanks to the President for his courteous conduct in the chair terminated the proceedings.

THE CONVERSAZIONE.

When it became known that the Midland Union of Natural History Societies would hold its First Annual Meeting at Birmingham, the local societies set vigorously to work to provide a hearty welcome for their visitors. The result was a most enjoyable conversazione, which was held in the Town Hall, on Monday evening, May 27, from 7 30 to 10 30, and attracted 700 visitors. Though we hope to afford some idea of the nature and variety of the exhibits brought together on that occasion they were so numerous as to preclude the attempt to do more than briefly mention the more important items.

The Microscopical display was unusually large and interesting. There were some seventy microscopes in use, including some kindly lent by Mr. T. W. Watson, Mr. E. Wheeler, and Mr. F. Enock, of London, and they were so excellently disposed at such convenient distances that all were easily accessible by the many visitors. Commencing with the living objects illustrating Pond Life we have to enumerate the following:—Freshwater Polyzoa—Alcyonella fungosa, Fredericella sultana, and Paludicella Ehrenbergii; Melicerta ringens, (the building rotifer,) and Epistylis natans, exhibited by Mr. Thos. Bolton; Lophopus crystallinus, by Rev. Dr. Deane; Conochilus volvox, and Actinosphærium sol, by Mr. T. J. Slatter; Hydatina senta, one of the largest of the British rotifers, by Mr. H. E. Forrest; and Hydra vulgaris and Hydra viridis, showing the reproduction by budding, by Mr. J. Levick.—Then there were among many mounted objects Anguinaria spatulata, (Snake's head Coralline,) and section of Pearl, exhibited by Mr. W. H. Pearson; Plumularia setacea, with tentacles expanded, Membranipora pilosa, and Alcyonidium hirsutum, with tentacles expanded, by Mr. A. W. Wills; larval forms of Crab, and Sertularia with tentacles expanded, by Mr. W. Graham; Star-fishes and Sea-urchins, (illustrations of structure,) young Oysters, and Entozoa, illustrating the Trematoda, Cestoda, and Nematoda, by Mr. W. R. Hughes; spines of Echinus, by Rev. Dr. Deane; Dog's Tongue,—section showing the glands and villi, Dog's Foot-pad,—section showing arterial vascularity, and Human Intestine,—section showing villi injected, by Mr. F. W. Spiller; Palate of Cuttle-fish, by Mr. C. Pumphrey. Mr. F. Enock, of London, (an old member of the Birmingham Natural History Society,) showed a number of insects, mounted whole, without pressure, by an entirely new process, which has taken Mr. Enock some years to bring to perfection. These insects retain all their natural form; some show their internal muscular structure; in these can be seen every minute muscle, and the purpose for which it is intended can be clearly traced out; others, such as tongues of various insects, are prepared so as to retain all the natural form, colour, and characteristic markings without any distortion whatever, thus rendering the preparations of the utmost value to the student. We may specially mention Stylops Spencii, parasite of the wild Bee; Polynema ovulorum, the Fairy fly, (its larva is born and matured within the egg of the Cabbage butterfly;) Atypus Sulzeri, English trap-door spider. Stylops Spencii, in the act of emerging from body of wild bee, was also exhibited by Mr. J. Potts. Mr. Edmund Tonks exhibited Spinnerets of Spider. Mr. E. Wheeler, of London, exhibited 1,000 microscopic objects, (no two alike,) representing every department of microscopy. His elaborate groups of Diatoms, Foraminifera from "Challenger" dredgings, Polariscope objects, Möller's Typen-platten, Webb's Micro-engravings, anatomical specimens, opaque objects Geological objects, and the Colorado Beetle, proved most attractive.

We come now to illustrations of Vegetable Life. Of Freshwater Algæ there were Spirogyra nitida, Mesocarpus scalaris, Zygnema lutescens, and Staurocarpus gracilis, showing formation of spores by conjugation; Batrachospermum alpestre and vagum, and Draparnaldia plumosa, all exhibited by Mr. A. W. Wills; Volvox globator, (living specimens showing the rotation,) by Mr. Levick and Dr. W. Hinds; spores of Equisetum, showing the contraction of elastic filaments by moisture and their expansion on drying, by Mr. W. B. Grove. Protonema of moss, showing germination of spore; section of Mnium subglobosum, showing male and female flowers of moss; Peristomes of mosses; sections of leaves of holly, grass, and fern;

capsules and perichætial loaves of moss, Cryphæe heteromalla, by Mr. J. E. Bagnall. Sections of stems and leaves of plants, differentially stained to show the structure, by Mr. W. Teasdale. Section of potato, with starch grains in situ, polarised; compound spiral vessels from rhubarb, polarised; group of fern scales, Nothochlæna lævis, polarised, by Dr. Deane; and Chara, showing the spurious circulation, by Mr. T. J. Slatter. Mr. J. E. Bagnall contributed a complete collection of the grasses and sedges of Warwickshire, (dried specimens;) Dr. W. Hinds a collection of the British poisonous plants, (dried specimens;) Mr. J. Morley a collection of nearly all the species of British ferns, (living plants;) and Mr. E. Wheeler a most instructive series of microscopical preparations, illustrating the histology and reproduction of plants.

The Conchological display made by Mr. G. Sherriff Tye was of marked interest, and consisted of part of his collection of British Shells, which numbers many thousand specimens. The series included fine selected examples of nearly all the land and freshwater shells hitherto found in the neighbourhood of Birmingham, viz., about eighty species and fifty varieties; also many very local and some rare shells. Among the former may be mentioned Sphærium corneum, *var.* flavescens; S. lacustre, *var.* Ryckholtii; Anodonta cygnea, *var.* pallida; A. anatina, *var.* complanata; Planorbis lineatus; P. dilatatus; Limnæa peregra, *var.* lacustris; L. peregra, *var.* maritima, &c., &c. Among the rare shells were albinos of the following species:—Anodonta anatina, Bythinia tentaculata, Limnæa peregra, L. palustris, L. trunculata, Helix sericea, H. virgata, H. Pisana, Pupa secale, Clansilia rugosa, and others. The rare Vertigo Moulinsiana, Helix obvoluta, Succinea oblonga, Limnæa glutinosa, and Limnæa involuta were noticeable species. We might specify many rare or uncommon forms in the marine portion, but want of space forbids it; we will only add that the collection was characterised by neatness and clearness of arrangement, and is the result of years of labour. Dr. Schwarz also exhibited shells from Celebes and Ceylon. Mr. W. H. Pearson exhibited Japanese and Chinese Silk-worm Moths with Cocoons; while cases of insects collected in Brazil, comprising moths, butterflies, and beetles, showing the brilliant colouring characteristic of tropical insects, were exhibited by Mr. S. Allport.

The Geological exhibits were very numerous and interesting. There were sections showing junction of Igneous and Sedimentary Rock, and section from Bone Bed of Rhætic age in South Wales, exhibited by Dr. Deane; Pitchstone from Arran showing plumose crystals arranged in lines forming contorted weather markings, by Mr. C. Pumphrey; sections of Volcanic Rocks, illustrating their microscopic structure, by Mr. S. Allport; Fossil Animal Life: Eozoon Canadense, the earliest known form of animal life, specimens showing the canal system and tubular wall of the chambers, and decalcified specimens showing serpentine casts of the canals, by Rev. H. W. Crosskey; Trilobites from Wenlock shale and limestone, Dudley, by Mr. E. Hollier; Crag Fossils and Devonian Fossils, by Mr. W. Graham; Pleistocene Animals from Cresswell Crags, by Mr. T. Heath; Chalk and Lias Fossils, by Mr. H. A. Vincent; Agates, Jaspers, Porphyries, &c., collected from the Drift, near Redditch, by Mr. W. T. Heming; and a very extensive collection of specimens, illustrative of the Glacial epoch, by the Rev. H. W. Crosskey. This collection must be referred to at some length. It illustrated both the physical action of ice and the changes of fauna connected with the epoch. The illustrations of the physical action of ice comprised (1) a specimen of encrinital limestone taken from beneath a mass of boulder clay. The stems of encrinites were shown, cut into sections and polished by ice action. (2) Ice-marked boulders, covered with balani, showing that they had been dropped by icebergs into the sea. (3) A large collection of boulders of North British and Welsh rocks, found in the midland counties, and brought from considerable distances by the icebergs that drifted over the Midland sea. The extensive collection of the fauna exhibited might be divided into three groups:—(A) Specimens of the fauna of the extreme Glacial Epoch, from Scotland, Norway, and Canada, including Leda arctica, Pecten aratus, Pecten islandicus, Panopæa Norvegicæ, Astarte borealis, Velutina lævigata, Trophon clathratus, Littorina limata, and very many extremely rare Arctic species. A mass of the northern coral, Lophohelia prolifera, was also exhibited, taken from a glacial bed in the Christiania Fjord. (B) Specimens of the fauna that immediately succeeded that of the Glacial Epoch, showing the coming of milder climatic conditions, both in Britain and in Norway. (C) Specimens of the fauna of the most modern raised sea beaches. Any one who carefully examined the numerous and very interesting specimens contained in these three great groups of beds could readily trace the physical and climatic changes of the epoch.

The Biological specimens were numerous and very fine. Mr. D. W. Crompton exhibited a complete collection of British Hawks, (excepting the Jer-falcon, now supposed extinct in Great Britain:) foreign pheasants, including Gold and Silver Pheasants, East Indian; Lyre Bird, Australian; Lady Amherst Pheasant, having remarkable long tail; Peacock Pheasant of Thibet, having two embossed eyes on each feather of tail; Impeyan Pheasant, from Himalayan Mountains, fine colouring and metallic lustre; Scarlet and White Ibises of South America; Sacred Ibis of Egypt; Glossy Ibis of Europe; Egret, from South America, very delicate white feathers in two plumes from shoulder. Mr. Montagu Browne, Naturalist, Birmingham, made a magnificent display with an extensive collection of Animals, Birds, Fishes, Reptiles, Insects, &c., including the following:—Animals.—Badger, (Meles Taxus, L.,) from Northampton; Otter, (Lutra Vulgaris,) with young, from Ireland; Wild Cat, (Felis Catus,) from Scotland; Ermine, (Mustela Erminea, L., from Sutton Park; Mole, (Talpa Europea,) with cream-coloured variety of same, from King's Norton; Fox, (Canis Vulpes,) and young, from Scotland; pair of Duck-billed Platypus, (Platypus Anatus,) from Gipp's Land, Australia. Birds.—Pair of Imperial Eagles, (Aquila Adalberti,) from Spain; pair of Peregrine Falcons, (Falco peregrinus, Briss.) Scotland; pair of Snowy Owls, (Surnia nyctea, L.,) Labrador; Eagle Owl, (Bubo ignavus, Forst,) Archangel; pair of Little Owls, (Athene noctua, Retz,) Spain; pair of Bee-eaters, (Merops apiaster, L.,) Spain; Great Grey Shrike, Lanius excubitor, L.,) Wylde Green; pair of Long-tailed Tits, (Acredula rosea, Blyth,) with nest, Lichfield; pair of Pintail Sand Grouse, (Pterocles alchata, L.,) from Spain; pair of Willow Grouse, (Lagopus albus, Gm.,) Norway; pair of Greek Partridge, (Caccabis Græca, or Chucar?) Cyprus; pair of Buff-backed Herons, (Bulbulcus ibis, Hasselq.) Spain; Phalarope (Phalaropus fulicarius, L.,) Hampshire; common Swan (Cygnus olor, Gm.,) District; common Sheldrake (Tadorna cornuta, Gm.;) Pintail Duck (Dafila acuta, L.;) Teal (Querquedula crecca, L.); Eider Duck (Somateria mollissima, L.;) pair of Puffins, (Mormon Arctica, L.,) Wales; little Auk, (Mergulus alle, L.,) Handsworth; Pomarine Skua, (Stercorarius Pomarinus, Temm.,) from Lichfield Racecourse; pair of Arctic Tern (Sterna Hirundo, L.,) from District, and many others; three ornamental mounts, illustrating Birds of Australia, South America, and the Malayan Peninsula, respectively; some of the latter very rare. Eggs.—Cetti's Warbler with nest, (Potamodus Cetti, Marm.;) Griffon Vulture (Gyps fulvus, Gm.;) Osprey, (Pandion haliætus, L., and other rare ones. Fish.—Pike, (Esox lucius, L.,) weight 20lbs., from Sutton. Reptiles.—Gangetic Crocodile, (Gavialis Gangeticus,) 12ft. long, from India. Insects.—The whole of the British Butterflies in one mount; the whole of the British Hawk-moths, including the very rare Sesia Andreniformis, in one ornamental mount; various rare exotic insects. Skulls and horns of Tiger, various Deer, &c., &c. Other exhibits in this department were:—Long-eared Owls, living specimens, by Mr. C. E. B. Hewitt; Pike, 28½lbs. and 20½lbs., from Langorse Lake, Wales, and Barbel, 8½lbs., from Thames, by Mr. Adams Parker; Pike, 34½lbs., from Langorse Lake, Wales, and Goosanders, Male and Female, from Langorse Lake, Wales, by Mr. G. R. Hill; Pike from Earl's Wood Pool, by Mr. John Allday; a fine specimen of Deer's Head, (mounted,) by Mr. Henry Griffiths, jun.; Articulated Human Skull, a remarkably fine specimen, by Mr. W. R. Hughes. Mr. A. Franklin, Taxidermist, Birmingham, showed a collection of Birds, including Argus Pheasants from India, Capercailzies from Scotland, Heron in fine adult plumage, blue and yellow Macaw, sooty and snowy Owls, Swallow-tailed Kite, white Robin, and cream-coloured Sparrow, a large collection of British Coleoptera and Lepidoptera, and eggs, cocoon, and living specimens of Bombyx Pernii.

General Science was represented by the Phonograph, Telephones, and Microphone, exhibited in operation by Mr. Lawson Tait; a Microphone (new construction) and various optical and scientific apparatus, by Mr, W. J. Lancaster; microscopic mounting and collecting apparatus, and various scientific instruments, by R. Bailey; Chance's Compound Glass Lenses for the electric light for forts and ships of war, for defence against torpedo boats at night and other purposes in war, by Mr. J. Kenward; a working Model, illustrating the rigidity of the positions assumed by an endless chain suspended from a pulley and put into rapid motion, by Dr. Hopkinson; Geometric Pen, consisting of an arrangement of wheels and levers producing a combination of the compound pendulum curves with straight lines and circles or spirals, giving an infinite series of harmonic curves, by Mr. C. Pumphrey; and a series of interesting scientific experiments were exhibited by members of the Birmingham and Midland Institute Scientific Society, and comprised Diffusion Figures, Vortex Rings, Terrestial Magnetism Experiment, Arago's Disc, Weld's Sound Experiment and Chladni's Figures, Syren and Galton's Whistle, Nörremberg's Polariscope, Spectroscope, Determination of Oxygen in Air, Reciprocal Combustion, &c.

Art and Archæology furnished much that was attractive and interesting. Mr. Allen E. Everitt contributed from the riches of his portfolios fifty of his charming drawings, chiefly illustrative of "Old Warwickshire." Thus he showed sketches of Birmingham:—Old Houses, Deritend; Digbeth Tripe House, Town Hall and Ann Street, Dog and Duck, Holloway Head; Aston: Great Staircase of the Hall, the Gallery ditto, Monuments inside of Church, ditto S. side of ditto, Holte Monuments N. aisle, Church from S.E.; Castle Bromwich: Hall from S.W.; Chimney Piece at Sheldon Hall; High Street, Solihull; East End of N. Aisle Solihull Church; Berry Hall, two views; Maxtoke Priory: The Gatehouse, Central Tower of Church; Little Packington: Church from N.W.; Berkswell: Church from S.E., Interior (under repair,) South Porch; Coombe Abbey: Queen Elizabeth's Room, Entrance to Chapter House; Stratford-upon-Avon: Chancel (two views,) Interior of Shakespeare's Kitchen; Wixford Church, Interior; Quadrangle, Coughton Court; Old Cottages at Haselour; Old Cottages at Tiddington; Interior of Coughton Church; Interior of Curdworth Church, Old House in Village; Water Orton: The Bridge, Old House near ditto; Hoggerell's End, an Old Farm House; Kingsbury Church from S.E.; Sutton Coldfield: Old Cottage in ruins and Yew Tree; Interior of Baddesley Clinton Hall; Temple Balsall: Church from S.W., Interior of Old Hall; Rowington: Village and Church, Shakspeare House; Entrance Hall, Tamworth Castle; Old Stalls, Astley Church; The Old Hall, Packington; Interior of Baddesley Clinton Church; Iron Gates in Garden, Packwood; Tower of Edgbaston Church. Mr. J. R. Holliday exhibited Photographs, selected from a large number which have been taken during the last three years, of Warwickshire Churches, and Old Houses in the Midland Counties, principally Warwickshire, Worcestershire, and Gloucestershire. The two last-named counties furnished several specimens of the very interesting class of houses built in the seventeenth century, of stone and timber. The photographs of these, exhibited at the Conversazione, were taken at Laverton and Child's Wickham; and there were some of a fourteen century house at Broadway. The Laverton and Child's Wickham houses are being rapidly improved off the face of the earth, and several have entirely disappeared since Mr. Holliday photographed them, their places being supplied by hideous modern erections. The Warwickshire houses, of which there were photographs exhibited, were mostly of the sixteenth century, and comprised a very interesting example from Knowle, and Goscot Hall, near Redditch. Of Churches, there were photographs of Hampton-in-Arden, Brailes, Packwood, Curdworth, Wotton Wawen, Wappenbury, Lapworth, Whitchurch, and others. There were also the *Nature* series of Portraits of Scientific Worthies, exhibited by Mr. W. R. Hughes; a set of tinted etchings from old Dutch paintings, by Mr. W. P. Marshall; photographs of Pumping Engine Stations of the Birmingham Corporation Waterworks, by Mr. R. M. Lloyd; old engraved copper-plates, by Mr. C. T. Parsons; Greek and Roman remains from Fayoum, Egypt, by Mr. J. Courtenay Lord; Roman Pottery, from Leicester, by Mr. W. J. Harrison; Stone Hatchets and Indian Pottery from the Cordilleras, Central America, by Dr. Schwarz; and Rubbings from Ancient Brass and Stone Cross, and Flint Implements, by Mr. Lawson Tait.

Of other exhibits which contributed to the interest of the Conversazione we can only specify Mr. A. Pumphrey's ingenious method for producing in exact fac-simile an unlimited number of copies of pen and ink drawings, &c., (see "Midland Naturalist," p. 132,) which was exhibited in operation all through the evening; another, but quite different process, exhibited by Mr. J. Pumphrey, for easily and rapidly producing a number of copies of letters and other manuscripts, written with the exhibitor's special "aniline ink;" Diving Apparatus and Dress used in submarine operations and flooded mines, &c., exhibited by Mr. J. Place; and a steady and useful revolving table for microscopical work, with slate top and substantial iron stand, exhibited by Mr. T. Bolton.

In concluding this account of a most pleasant and instructive exhibition, we must not omit to state that the success of the Conversazione was mainly due to the excellent arrangements made by Mr. W. P. Marshall, (who undertook the general management,) and Messrs. J. Morley and C. Pumphrey, Rev. H. W. Crosskey, Messrs. W. B. Grove, J. Levick, and others.

EXCURSION TO DUDLEY.

On the following day, Tuesday, May 28th, Members of the Union and their friends, to the number of nearly 400, made an excursion to Dudley and the neighbourhood, under the auspices of the Dudley and Midland Geological and Scientific Society and Field Club, representatives of which received the party at the Tipton Station of the Great Western Railway, and conducted them in the first instance to the Open Coal Work at Foxyards, where the Ten-yard Coal Seam exposes its point of outcrop on the east side of the obtruding ridges of the Dudley Castle Hill and the Wren's Nest. Mr. Thomas Latham, the Earl of Dudley's Mine Agent, gave interesting information as to the mode of getting the coal, and under his direction a fall of coal was displayed. The excursionists, who were joined by a numerous body of the general public, next proceeded to the Wren's Nest Hill, which is picturesquely situated on the north side of Dudley, is remarkable in its formation, which is that of an elevated elliptical dome, for the extent of the mining operations in the Limestone strata and for the wild and rugged beauty of some of its scenery. The inspection of the "Daylight Caverns" afforded much pleasure. The party next passed through the private grounds of E. Fisher Smith, Esq., and thence to the Priory Ruins. The Priory was founded in the middle of the twelfth century by Gervase Paganel. A description of the ruins was given by Mr. Rupert Smith, C.E. The celebrated silurian caverns, which were illuminated, were next visited. Passing shady dells and sylvan hills, the company afterwards reached the ancient Court Yard of Dudley Castle. After Luncheon came the crowning event of the day—the descent by more than 400 persons, including many ladies, of the famous Lye Cross Coal Pit, at Rowley, which was superintended by Mr. Latham. This pit is remarkable as being the first sunk through the Basalt, or Rowley Rag. Where the pit was commenced the thickness of the basalt was unknown; it proved to be no more than 68 yards, when the rock binds of the coal measures were reached. At 168 yards the Two-foot and Brooch coals were met with, and at 228 yards the Thick coal was cut into. The pit is 258½ yards deep. The gate roads are very wide, high and dry. Mr. Rupert Smith and Mr. Thos. Latham and his son did all in their power to interest and instruct their many visitors, and they certainly succeeded to admiration. The warmest thanks of the members of the Union are due to them for their kindly courtesy, and for the trouble they took. The excursion was made by special permission of E. Fisher Smith, Esq., on behalf of the Right Hon. the Earl of Dudley. The arrangements of the day were carried out by Mr. Marten, Mr. Hollier, and others connected with the Dudley Geological Society.

THE MICROPHONE, MAGNOPHONE, PHONOSCOPE, AND PHONEIDOSCOPE.

BY W. J. LANCASTER, F.C.S., F.R.A.S.

Having exhibited a Microphone of my own construction, and noticed with much pleasure the great amount of interest displayed by the visitors to the conversazione of the Union of Scientific Societies in our Town Hall, I have thought a short description of the Microphone, together with a description of its associated scientific instruments lately discovered, would not be out of place in "The Midland Naturalist." The Microphone, as discovered by Professor Hughes, consists essentially of several pieces of charcoal, connected in circuit with a few cells and a telephone, a simple form being made by having two plates of gas carbon glued to a thin piece of wood and being about 1¼in. apart, and a cylindrical piece of gas carbon, ¼in. diameter, sufficiently long to fit loosely in an indentation in lower part of top carbon plate, and in the upper part of bottom plate, the ends of the rod being tapered to a point; the thin board containing this Microphone may be glued to the end of a stronger piece of board, so that the rod is in a vertical position; by connecting the upper and lower plates in the circuit from two screws, sounds are immensely amplified. A form of Microphone which serves equally well for the detection of minute sounds as for the transmission of speech is the Pile Microphone, which I refer to above. This instrument consists of a polished box, about 5in. by 4in. by 1in., without a bottom board, on the top of this a plate of zinc, 4in. by 2½in., is screwed, this forming the bottom element ; then above this is a plate of carbon of equal dimensions. To one end of this plate an upright turned piece of wood, 1in. long, is either screwed or glued, and on the top of this a second plate of carbon, 2in. by 1¼in., is screwed. This plate has a binding screw connected with it, and is connected to the lower plate by means of a thin rod of carbon, 1¼in. long, pointed at the bottom end. Having the instrument finished, all that is necessary is to moisten a pad of blotting paper with a solution of sulphuric acid and bichromate of potash, in the proportion of one each acid and bichromate and ten of water. Place the pad between the carbon and zinc plates, and the instrument will detect the most minute sounds. For minute sounds the carbon rod should be nearly upright, and for speech should be inclined as much as possible. The Telephone is to be used in circuit, but this may be dispensed with by using a few electro-magnets, made of ⅛in. iron and bent into the form of a triangle, so that the poles will nearly touch each other. Four of such magnets make a very good receiver. Mr. Blyth has obtained a receiver consisting merely of a box of cinders, with a plate of tin at each end; but although I have repeated his experiments I have failed to obtain favourable results. A simple form of receiver will be obtained in a few weeks, and will at once supersede the Telephone.

The Magnophone is an addition to the Telephone, by W. L. Scott, and consists in the application of small particles of iron on the back of an ordinary Telephone plate, (the plate itself being in the circuit from a series of Daniell's or other cells,) and in the use, as transmitters, of the particles of either iron, silver, gold, or platinum in a state of minute subdivision, or if pieces of asbestos, pumice, or other bodies be saturated with *(e. g.)* mercury, these phonophoric tablets may be placed in the circuit with pointed ends touching each other, and will then transmit sounds in a similar manner to the Microphone. In fact, the Magnophone resembles the Microphone in so many details that it ought rather to be called a Microphone.

The Phonoscope is a very beautiful adaptation to an induction coil and rotating vacuum tube. This may be done in the following manner:—At the end of a conical tube a thin membrane is stretched, and behind it a thin plate of platinum, about one-eighth of an inch wide, is attached in a bowed form ; immediately behind this strip of platinum a third point of platinum is fixed into a brass spring. The instrument is a simple form of contact breaker, and contact is made by speaking into the conical tube. Supposing now the tube to be revolving, and the two terminals from secondary of induction coil to be connected to the two pieces of platinum, it is evident that by speaking into the conical tube contact is made and broken in proportion to the period of vibration of the stretched membrane, and the tube will be illuminated when contact is made, and will thus reveal the peculiar condensations, &c., of a sonorous wave. This simple though beautiful adaptation to the induction coil was exhibited by Mr. H. Edmonds, jun., at the conversazione of the Institution of Civil Engineers.

The Phoneidoscope is simply a tube bent at right angles, and having an orifice, which may be of any form, covered with a thin film of soap. The film should appear coloured, and then, by speaking into the tube, or sounding a tuning fork, the colours arrange themselves in a manner very similar to the sand in Chladni's figures. The experiment is an instructive one.

Conjugation, as the term implies, consists of the yoking together of two contiguous filaments which, by some mysterious means, approach one another and assume a position of strict parallelism. Projections are then thrown out between opposite pairs of cells, and gradually increase till they finally meet and form connecting tubes. At the same time the endochrome loses its spiral arrangement, and becomes an irregular, confused mass. [Plate III., Fig. 14.] It then passes, as in *Zygnema* [Plate III., Fig. 12] and *Spirogyra*, [Figs. 13, 14,] into the opposite cell and there, mingling with the contents of the latter, forms a round or oval spore with distinct cellulose coating; or, as in *Mesocarpus* [Fig. 15] and *Staurocarpus*, [Fig. 16,] meets the contents of the opposite cell, which move forward to join it, in the connecting tube, and there forms a spherical or cruciate spore.

A curious modification of this process occurs in some species of *Spirogyra*, where the spores are formed not from the contents of two opposite cells of different filaments, but by the union of those two contiguous cells of the same filament, the mingling of which is effected through a little tube bridging over, as it were, the septum between them. [Plate III., Figs. 17 and 18.] It is asserted by some writers that this phenomenon is abnormal, and occurs in species which usually conjugate in the ordinary way; but the writer has only once seen the two processes occurring simultaneously in the same plant, and has always observed this form of conjugation in specimens the proportions of which stamp them as distinct species.

The most striking point about the operation just described is the assumption by the contents of the cells of *different* plants, or by those of *special* cells in the *same individual*, of the opposite properties upon which depend respectively the powers of *imparting and receiving fertilisation*, although the most careful scrutiny under the highest powers of the microscope fails to reveal the least difference in their condition. It has been stated that this polarisation, as it may fitly be termed, in the ordinary form of conjugation, is capricious, the cells of the two filaments assuming indiscriminately these converse functions, but in the many hundreds of specimens which we have examined and mounted, we only remember finding one exception to the rule that all the cells of one conjugating filament assume "male" and those of the other "female" sexual functions; this exception occurred in the specimen already referred to, in which conjugation of contiguous cells of the same individual also took place, and in this case the spores formed in one filament were large, while those in the other and alongside of the cells which had discharged their contents were much smaller, and apparently imperfectly developed.

It now remains to answer the two last questions which we proposed in the outset, viz.:—How are the Algæ best collected? and how should observations on their structure, &c., be recorded?

The larger filamentous Algæ are best brought home in small glass tubes of thick glass well annealed.

A compact form of collecting apparatus consists of a number of pieces of strong glass a couple of inches square, to each of which is cemented with gold size or marine glue an indiarubber ring about one-eighth of an inch thick. These, when piled on one another, and held together by indiarubber rings, take up but little space. Lastly, for these coarser plants nothing answers much better than to screw them up in bits of strong paper and bring them home in a wide-mouthed bottle, tin box, or even loose in the pocket. A specimen need, at any rate, never be left behind for want of a more elaborate vasculum.

The *Desmidiaceæ* require more care, and the gathering should be transferred with as little shaking as possible to one of the glass tubes which should be *filled* with water.

It is a useful plan, when out for a long walk, to number the specimens, and note down their exact habitat in a pocket book. Some years ago the writer returned from a five and twenty mile walk across the Welsh Mountains, with some fifty "dips" of all sorts. Next day was devoted to their examination, and in one tube, among a quantity of common species, were found two frustules of *Docidium nodosum*, a Desmid hitherto recognised as exclusively an American species, but which has been since found, we believe, by Mr. Archer, in Ireland. Unfortunately, no such record as we suggest had been kept; and, although the writer started off next morning at daybreak, took exactly his previous route, and searched sedulously till nightfall in every tiny pool in which he remembered dipping in his previous ramble, not a trace of the new plant was found.

The specimens being brought home, each should be transferred in turn to a small saucer, or watch-glass, and portions of it examined under a convenient power, generally about half an inch. If any new species is spotted, it should be set aside for mounting, duly labelled temporarily; but, if the gathering seem to contain nothing but old friends, it is a useful plan to give it a parting squeeze between the fingers, and catch the drippings in a watch-glass. Small Desmids and Diatoms, previously entangled, are pressed out in this way, and new species often reward the examination. The squeezed mass should not be thrown away till the washings have been searched over. *It often pays to repeat the process.*

A specimen should never be thrown away because it is a poor one, or consists of one individual, where a dozen would be acceptable. The rarest plants are naturally often met with singly. Once, in examining a mass of very dirty stuff from a Welsh bog, the writer pounced in his first dip on the rare Desmid, *Micrasterias radiosa*. Rashly concluding that there were sure to be plenty more, he swilled back the contents of the slide into the mess. But dip after dip, and washing after washing, were examined in vain; and, as the species was too rare to be lightly lost, it cost the work of two long nights to hunt over the entire mass, drop by drop, till the individual plant, whose diameter was about 1-140th of an inch, was recovered.

We say, therefore, *mount a poor specimen rather than none. If you find a better you can throw it away, or give it to a friend, who will value it.*

It is worth adding that the Desmids are easily separated from other plants by shaking the gathering up in a tube and pouring the whole into a watch glass, when, from their higher specific gravity, they sink to the bottom, and, by a little careful manipulation, may generally be recovered quite clean and free from dirt.

The methods of mounting the various classes of Algæ we reserve for discussion in a subsequent paper. For the present let it suffice to state that, by attention to certain indispensable details of manipulation, these plants may be preserved for *indefinite* periods.

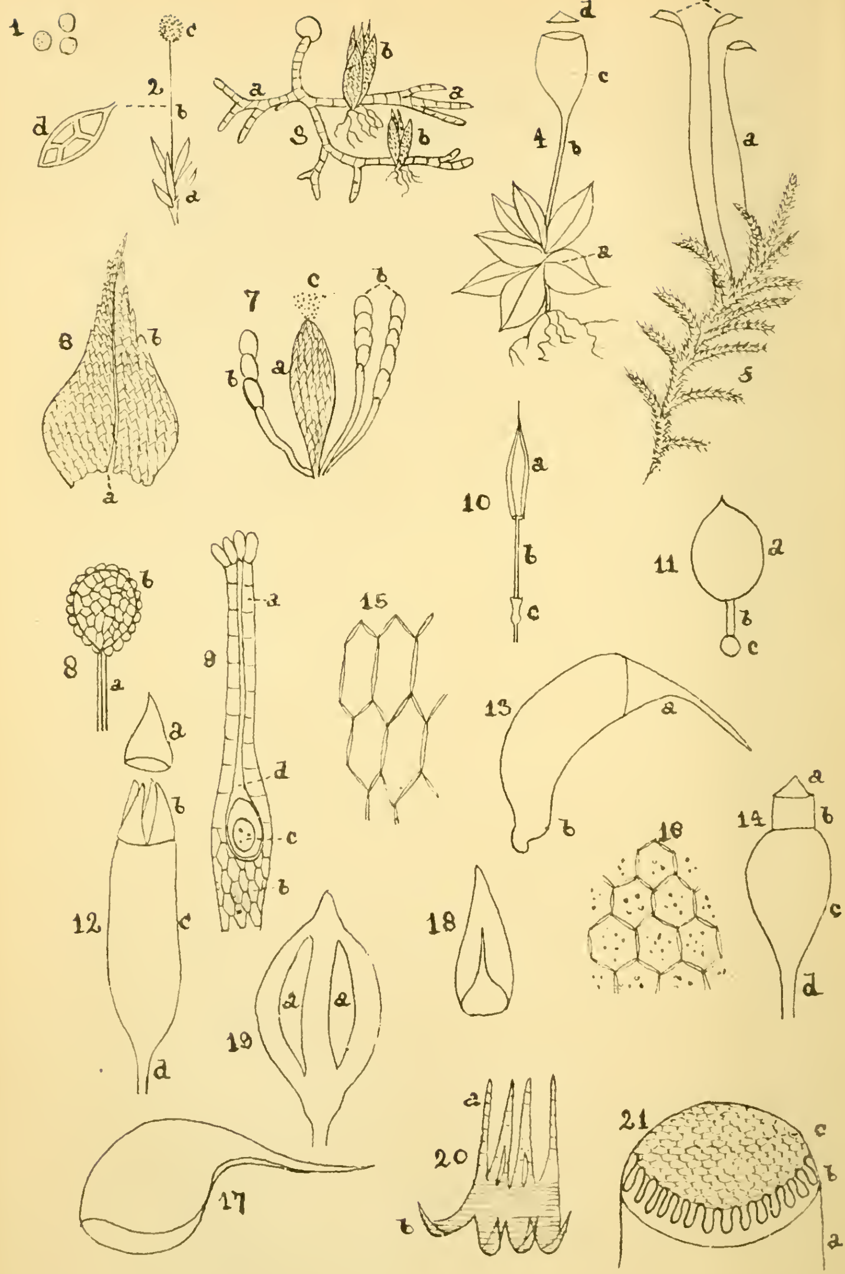
A few words, in conclusion, on the subject of recording observations made under the microscope. All Algæ, however carefully mounted, do, in course of time, more or less lose their exact form and natural appearance. Hence it is most desirable to supplement their collection by sketches in pencil, pen and ink, or other material, *made from the living plant.* Various ways of doing this are recommended, but we have found the use of what is known as a neutral-tint reflector, to be by far the easiest and most effectual. This apparatus consists simply of a piece of the thinnest possible microscopic glass, fitted into a cap, which replaces that of the ordinary eye-piece, and holds the glass-plate at an angle of 45° to the axis of the instrument. It is, in fact, a miniature Pepper's ghost arrangement; and the microscope being clamped in a horizontal position and focused, upon looking down upon the glass-slip the observer sees the image of the object reflected to the eye, but apparently at a distance below the reflector equal to that between it and the object itself. By placing a sheet of paper on the table underneath, and adjusting the *relative* illumination of the object and the paper, so that the point of a pencil is clearly seen on the latter, it becomes easy, with a few hours' practice, to trace the smallest details. In practice, it is best, however, to obtain an accurate outline in this way, and the *spirit* of the object is better given by filling in details from direct vision in the microscope.

This method gives a drawing perfectly accurate, and to a scale easily ascertained.

Many of the descriptions given in Hassall's "Freshwater Algæ,' the only systematic work upon this subject in the English language, are wholly useless from the absence of all dimensions, and it is impossible to decide whether the species described are really distinct ones or are needlessly multiplied, by reason of this vital defect. It is of primary importance that dimensions should be in all cases recorded in fractions of an inch or in millimetres; and the following method of ascertaining them at a glance will be found simple and satisfactory.

A plain circle of strong glass may be obtained from any optician, of size to drop into the focal point of the eye piece, and ruled into squares, conveniently of 1-50th of an inch. A glass slip ruled into thousandths of an inch is placed on the stage, and each of the objectives in ordinary use, say from ¼ to 2 inch, being screwed into its place in turn, it is only necessary to observe which divisions of the ruled eye piece correspond with the actual thousandth-lines in the slip to obtain a gauge of the dimensions of an object corresponding to each division of the eye-piece.

Plate IV.



H. E. Forrest, del.

On the study of Mosses.

For example: the slip being so arranged that the left hand 1-1000th line corresponds accurately with one of those on the eye-piece, suppose that the 5th line of the eye-piece corresponds with the 9th 1-1000th line from the left on the slip. Hence five divisions of the eye-piece = 9-1000ths or 1 division = 9-5000ths = 1-555th of an inch. In this manner the actual value of one division of the eye-piece for *each power* should be registered once for all: it is then the work of a moment to record the actual dimensions of any object under examination.

If such records were kept systematically by observers, a comparison of their observations would go far to facilitate a harmonious classification of a large and beautiful tribe of plants, the bibliography of which is at present most unsatisfactory, and has suffered grievously from a needless multiplication of supposed species, consequent upon imperfect observations still more imperfectly recorded.

The object of this paper will be amply fulfilled if it induces some of the Naturalists of the Midland counties to engage in the study of these minute organisms, and to do their share towards elucidating the many points in their physiology which are still obscure.

ON THE STUDY OF THE MOSSES.—II.

BY JAMES E. BAGNALL.

In my last paper (page 59) the material and apparatus required for the collecting and study of these plants were treated of. In the present I purpose giving some account of the development of Mosses.

Mosses are cellular plants, having distinct stems, leaves, and roots, (the Sphagnums or bog-mosses are exceptional, as they do not possess roots;) they have a capsular fruit, and are developed from spores, (*seed-like contents of ripe capsule*, Plate IV., fig. 1,) or gemmæ, (*cellular bodies capable of becoming plants*, fig. 2*d*.)

Description of Figures.—Plate IV.

1.—Spores of moss.
2.—Gemmiform state of *Aulocomnion*, *a* stem, *b* stalk, *c* gemmæ, *d* gemma detached and magnified.
3.—*A* protonema, *bb* young mossplants.
4.—Species of *Pottia*, to show terminal fruited moss, *a* stem, *b* fruitstalk, *c* capsule, *d* conical lid.
5.—Species of *Hypnum*, to show lateral fruited moss, *a* fruitstalk, *b* capsules.
6.—Leaf of *Hypnum*, to show nerve, *a* nerve, *b* margin.
7.—Male flower of moss, *a* Antheridium, throwing off a number of Antherozoids *c*, *bb* paraphyses.
8.—Antheridium of *Sphagnum*.
9.—Archegonium of moss, *a* neck, *b* pear shaped body, *c* germ cell, *d* canal.
10.—Fruit rudiment, *a* calyptra, *b* rudimentary fruitstalk, *c* vaginula.
11.—Indehiscent capsule of *Phascum*, *a* capsule, *b* fruitstalk, *c* vaginula.
12.—Simple peristome of *Tetraphis*, *a* conical operculum, *b* peristome, *c* capsule.
13.—Strumose capsule of *Dicranum falcatum*, *a* rostrate operculum, *b* struma.
14.—Capsule of *Splachnum*, *a* operculum, *b* capsule, *c* apophysis.
15.—Prosenchymatous cells from leaf of *Bryum*.
16.—Parenchymatous cells from leaf of *Pottia*.
17.—Inflated dimidiate calyptra of *Funaria*.
18.—Dimidiate calyptra of *Tortula*.
19.—Capsule of *Andreæa*, dehiscing by valves *a a*.
20.—Part of double peristome of *Hypnum*, *a* inner peristome, *b* outer peristome.
21.—Capsule of *Polytrichum*, *a* capsule, *b* peristome, *c* diaphragm.

The spores are minute, round, cellular bodies, varying in size, colour, and external marking, and are composed of two membranes or coats, an inner and an outer one, enclosing a thickened granular mass. Though similar in function to the seeds of flowering plants, they differ from those organs, in being capable of germinating from any part of their surface, and in possessing no embryo, *(the young plant contained in the seed;)* hence plants developed from spores are termed Acotyledons, (Gr. *a*, without, and *kotuledon*, a seed-lobe.) The spores which are formed in the capsule are the bodies from which the moss-plant is normally developed.

But many even of our common Mosses rarely produce their fruit, and are perpetuated in other ways, as, for instance, by gemmæ, which may be seen forming little globular heads (2*c*) on the top of a pale, naked stalk (2*b*) in *Aulacomnion androgynum*, (2,) so frequent on wayside banks,* or from thread-like cellular bodies, abundant on the leaves of some Mosses, *Orthotrichum Lyellii*, for instance, frequent on poplars, elms, &c., or from bud-like bodies formed in the axils of the leaves, as in *Bryum annotinum*, found on sandy banks, or even detached leaves may give origin to a new plant, as in *Campylopus pyriformis*, frequent on heath lands.

When the spores germinate, they give rise to a green thread-like body, called the protonema, (3*a*,) which is formed by the protrusion of the inner membrane of the spore through the outer one. This, by frequent cell-division, becomes elongated and branched. The primary branch, at first green, frequently turns brown, and, in some cases, penetrates the ground and performs the function of a root. The secondary branches are well charged with chlorophyll, *(green, granular matter in the interior of the cell,)* and branch frequently. On various parts of the protonema bud-like bodies arise, (3*b*.) These are the rudimentary moss-plant. From the buds roots are sent down into the medium, on which they grow. By frequently repeated cell-division these buds develope into the leafy moss-stem. Mosses, like Ferns, Horsetails, &c., grow at the apex only, and are hence termed Acrogens, *(plants which increase at the summit only.)*

The protonema, which looks very like masses of green conferva, may be seen forming a velvety mass on the ground in the neighbourhood of Mosses; and if a portion of such masses is examined with the microscope, all the stages of growth may frequently be seen. In most Mosses the protonema is short lived, perishing before the moss-plant is fully grown; but in some of the lower forms, as in *Phascum serratum*, it lasts throughout the plant's lifetime. This Moss may be found in fallow fields in Autumn and Spring. The gemmæ, above-mentioned, germinate much in the same way as spores, forming first the thread-like protonema, upon which the leafy stem is developed.

The stem varies in length considerably; in some Mosses it is imperceptible without a lens, as in *Phascum serratum*, but in many others it is very apparent. It may be erect, as in *Polytrichum*; or prostrate, as in some of the *Hypnums*, or feather-mosses; simple, as in *Pottia*, (4); or

* (2*d*) is one of the gemmæ detached and magnified.

branched, as in *Hypnum*, (5). In some of the terminal-fruited mosses it branches by what are termed innovations; these are extensions of the stem, often arising at the top of the old stem, and such branching is usually forked, each fork representing a year's growth. This mode of branching may be seen in many *Bryums*, and other mosses; a convenient example occurs in *Grimmia pulvinata*, the little hoary, cushion-like patches of which may be seen on wall-tops and thatch.

The stem and branches are more or less densely clothed with leaves, which are always simple, (undivided,) and vary in shape from awl-shaped to round, the most frequent forms being lance-shaped, or oval. The leaves vary in structure, but are usually formed of a single layer of cells; exceptions occur, as in *Leucobryum;* in this case the leaves are formed of three layers of cells.

The cells forming the leaf assume a variety of forms, but may be referred to two types—I. Parenchymatous, *(having the cells placed end to end,)* as in *Pottia*, &c., (16); II. Prosenchymatous, *(having cells which overlap one another at their ends;)* these have pointed ends, and are longer than broad, as in *Bryum*, (15). The study of these leaf-cells is one of great importance, as the generic and specific differences of many Mosses are often made out by the character of the cells forming the leaf. Among other forms assumed by cells we have round, as in *Zygodon;* quadrate, as in *Pottia;* hexagonal, as in *Tetraphis;* oblong, as in *Isothecium;* rhomboid, as in *Bryum*, &c. The cells at the base of the leaf are frequently of different form from those of the upper part of the leaf, and are often colourless and transparent.

The centre of the leaf is often occupied by elongated cells, forming what is called the nerve or midrib (6*a.*) This nerve is usually simple, but may be forked as in *Isothecium myurum*; or there may be two nerves, as in *Hypnum triquetrum*, common on marly banks; or the leaves may be nerveless, as in *Hypnum stellatum*. The nerve is of variable length, in some cases vanishing below the tip of the leaf, in others projecting beyond the tip and forming a short point or mucro, as in *Tortula marginata;* or it may form a long transparent hair-like point, as in *Tortula muralis*, a Moss very frequent on wall-tops.

The leaves are placed spirally upon the stem and branches, their arrangement being various, as ½ or distichous in *Fissidens*, ⅓ or tristichous in *Anœctangium*, 2-5ths in *Pottia*, or ⅜ as in *Bryum*. Their direction is variable, and it is advisable to pay attention to this. Sometimes they are crowded and imbricate, *(overlapping like tiles,)* as in *Bryum argenteum*, common on walls; or they may be spreading as in *Tortula fallax*, which may be seen on sandy or clayey banks. In some species secund, *(curved to one side,)* as in *Dicranella heteromalla*, frequent on wayside banks; in others remarkably recurved at the tips or what is termed squarrose, as in *Hypnum squarrosum*, to be found on heath lands and in woods.

When dry the direction of the leaves is often very different from that assumed when the plant is moist. Thus in *Bryum capillare* the leaves are spreading when moist, but much twisted when dry; in *Tortula spadicea* much spreading when moist, but closely imbricate when dry;

but experience will soon show that these characters vary in different species of Moss. The margin of the leaf, (6*b*,) is sometimes plane, at others formed of a double row of cells and hence thickened, as in *Tortula marginata;* in some cases entire, in others variously toothed. In some species, *Weissia controversa*, for instance, it is involute, (*rolled over towards the upper surface;*) in others revolute, (*rolled over towards the lower surface,*) as in *Tortula revoluta*, to be found on wall tops; or the leaf may be rolled upon itself from side to side, or convolute, as in the leaves surrounding the base of the fruit-stalk of *Tortula convoluta*, and in some case as in *Atrichum undulatum*, the margin is undulated. The leaf-surface is usually smooth, but in some species, such as *Thuidium tamariscinum*, it is covered with minute projections, and is termed papillose. The leaves vary in colour, being of every shade of green, in some cases reddish, in others brown, or again, as in *Leucobryum glaucum*, nearly white.

Mosses are often termed flowerless plants, which is a misnomer, as both male and female flowers occur on these plants, and may readily be found in most species when the leafy stem has arrived at maturity. In many of our Mosses, as in the *Bryums* and *Polytrichums*, they occur as star-like bodies at the top of the stem; in others, such as the common *Hypnum rutabulum*, both male and female flowers may be found as bud-like bodies in the axils of the stem-leaves. In the bog-mosses or *Sphagnums* they occur in pendulous catkins, which are often tinged with red or brown.

If these flowers are dissected it will be seen that they consist of a number of leaves surrounding or enveloping the organs of reproduction, the Antheridia, (*bodies which perform the function of an anther, 7a,*) *i.e.*, the male; or the Archegonia, (*bodies which perform the function of a pistil or ovary, 9,*) *i.e.*, the female reproductive bodies. The leaves surrounding the antheridia form what is termed the perigonium, (*that which surrounds the male organ;*) those surrounding the archegonia form the perigynium, (*that which surrounds the female organ.*) The male flowers are sometimes developed in the axils of the ordinary leaves, and have no perigonium, as in *Sphagnum.*

[TO BE CONTINUED.]

METEOROLOGY OF THE MIDLANDS.

THE WEATHER OF MAY, 1878.

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

The first few days of May were tolerably fine and clear, but on the 7th rain began to fall, and continued daily until the 29th, thus giving twenty-three consecutive days of rain! As one observer succinctly puts it, this downpour "spoilt the promise of April; damaged the crops, and put everybody out of temper."

ERRATUM.—In remarks for April, read Swallow for Cuckoo at Kibworth on April 11th. Cuckoo did not appear there till May 2nd; very late.

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, Strond	W. B. Baker, Esq.	6·65	1·63	10	23			34·0	21
Cheltenham	R. Tyrer, Esq.	4·99	1·08	10	24	70·0	10	33·0	21
Stroud	S. J. Coley, Esq.	6·01	1·65	10	24	72·0	1 & 10	38·0	20
SHROPSHIRE.									
Haughton Hall, Shifnal	Rev. J. Brooke	5·9	1·08	10	26	67·0	1	36·0	21
Whitchurch	A. B. George, Esq.	5·23	1·10	8	23	66·0	17 & 19	42·0	22 & 24
Woolstaston	Rev. E. D. Carr	5·60	·83	9	24	69·0	1 & 2	35,0	22
Leaton Vicarage, Shrewsbury	Rev. E. V. Pigott	4·86	·86	8	23	68·6	12	34·0	21
More Rectory, Bishop's Castle	Rev. A. Male	4·92	·72	7	26	66·0	31	32·0	21
Larden Hall, Much Wenlock	Miss F. R. Boughton	5·38	·98	8	25				
Bishop's Castle	E. Griffiths, Esq.	4·93	·74	7	21	69·0	31	35·0	21
Cardington	Rev. Wm. Elliot	5·86	·86	8	26				
Adderley Rectory	Rev. A. Corbet	5·43	·95	7	24				
Stokesay	Rev. J. D. La Touche	5·69	·77	7	24	67·7	1	33·9	5
HEREFORDSHIRE.									
Whitfield	W. Wheatley, Esq.	5·41	·99	10	27			32·0	5
Stoke Bliss	Rev. G. E. Alexander	5·56	1·06	10	25	66·0	12 & 18	38·0	21
WORCESTERSHIRE.									
Orleton, Tenbury	T. H. Davis, Esq.	6·12	1·23	10	25	68·0	18	33·8	21
West Malvern	A. H. Hartland, Esq.	6·30	1·31	10	27	69·0	1	34·0	20
Pedmore	E. B. Marten, Esq.	6·26	·96	10	24	70·0	1, 5, & 12	36·0	20
Stourbridge	Mr. J. Jeffries	6·02	·98	10	24	74·0	2	30·0	20
St. John's, Worcester	G. B. Wetherall, Esq.	6·56	1·28	10	24	69·0	1 & 13	36·0	21
STAFFORDSHIRE.									
Thorganby Villa, Wolverhmtn	G. J. C. Broom, Esq.	5·57	1·12	10	25				
Barlaston	W. Scott, Esq.	5·20	·69	7	24	69·2	31	28·8	20
Amblecote	Mr. J. Robins	6·07	1·00	10	24				
Dudley	Mr. J. Fisher	5·66	·84	7	24	74·0	12	32·0	20
Sedgley	Mr. C. Beale	5·66	·90	8 & 10	25	65·0	5,12,& 18	36·0	20
Kinver	Mr. W H. Bolton	5·71	1·15	10	25	73·0	1	36·0	4 & 20
Walsall	Mr. W. E. Best	5·36	1·06	8	25	70·0	12	37·0	20
Grammar School, Burton	C. U. Tripp, Esq.	5·83	·80	7	25	73·0	2	35·0	21
Patshull Gardens	T. W. Dell, Esq.	6·50	1·03	11	26	72·0	6 & 30	33·0	21
Weston-under-Lyziard R'tory	Hon. and Rev. J. Bridgeman	5·85	1·05	10	25	74·0	12	35·0	21
Wrottesley	E. Simpson, Esq.	6·43	1·03	10	22	68·4	13	33·5	21
Tamworth	W. Arnold, Esq.	4·57	1·12	8	24				
Tean Vicarage, near Cheadle	Rev. G. T. Ryves	4·61	·74	7	24	68·0	2 & 18	34·0	21
The Heath House, Cheadle	J. G. Philips, Esq.	4·70	·73	7	24	66·0	6	38·0	21
WARWICKSHIRE.									
Coundon, Coventry	Lieut.-Col. R. Caldicott	5·93	·86	7	25	75·0	11	42·0	20
Coventry	J. Gulson, Esq.	6·11	·88	7	24				
Bickenhill Vicarage	W. R. Capel, Esq.	5·95	1·20	10	22				
St. Mary's College, Oscott	Rev. S. J Whitty	4·73	1·12	10	25	68·2	12	35·0	21
Henley-in-Arden	T. H. G. Newton, Esq.	5·78	1·33	11	27	70·0	1, 4, 5, 31	35·0	21
Rugby School	Rev. T. N. Hutchinson	5·12	·78	7	24	70·0	2	35·0	21
DERBYSHIRE.									
Buxton	E. J. Sykes, Esq.	6·04	·52	7	24	65·0	2	31·2	21
Brampton S. Thomas	Rev. J. M. Mello	4·09	·73	23	19	68·0	1	35·5	30
Stoney Middleton	Rev. U. Smith	5·07	·61	18	22	68·0	2	25·0	20
Fernslope, Belper	J. G. Jackson, Esq.	5·74	·75	8	24	69·0	12	36·0	21
Matlock Bath	R. Chadwick, jun., Esq.	5·94	·71	16	25	68·3	12	34·5	21
Linacre Reservoir, Ches'field	C. E. Jones, Esq.	5·48	1·99	23	25				
Willesley Gardens, Cromford	J. Tissington, Esq.	5·71	·76	9	20				
Stuffynwood Hall	Mr. R. Rolfe	4·94	·71	18	25	71·0	2	35·0	20
Spondon	J. T. Barber, Esq.	5·88	1·32	7	25				
YORKSHIRE.									
Tickhill, Rotherham	B. J. Whitaker	2·91	·46	7	23	72·0	14	34·0	21
NOTTINGHAMSHIRE.									
Hodsock Priory, Worksop	H. Mellish, Esq.	3·73	·55	6	25	72·7	27	32·9	21
Grove House, Mansfield	W. Tyrer, Esq.	4·87	·65	8	23	70·2	5	35·8	21
Tuxford	J. N. Dufty, Esq.	4·65	1·09	24	..	74·0	12	35·0	20
LEICESTERSHIRE.									
Loughborough	W. Berridge, Esq.	3·90	·89	7	23	74·8	17	37·1	20
Ashby Magna	Rev. E. Willes	4·79	·88	8	24	76·0	1	36·0	21
Market Harborough	S. W. Cox, Esq.	5·31	·90	8	25	68·0	2, 7, & 18	34·0	21
Kibworth	T Macaulay, Esq.	4·98	·86	7	24				
Town Museum, Leicester	W. J. Harrison, Esq.	4·71	1·14	7	25	69·5	18	36·9	21
Belmont Villas, Leicester	H. Billson, Esq.	4·74	1·16	7	25	71·8	5	36·8	21
Syston	J. Hames, jun., Esq.	5·02	·99	7	26	76·0	6	37·0	21
Waltham-le-Wold	E. Ball, Esq.	3·72	·67	8	23	68·0	6	35·0	20
Little Dalby Hall	G. Jones, Esq.	3·80	·85	7	23	75·0	5	33·0	21
Coston Rectory, Melton	Rev. A. M. Rendell	3·76	·83	8	23	70·0	17 & 18	31·0	21
Belvoir Castle	W. Ingram, Esq.	4·40	·66	9	25	71·0	13	34·0	21
Foxton Locks	Union Canal Company	5·07	·82	8	22				
NORTHAMPTONSHIRE.									
Towcester Brewery	J. Webb, Esq.	4·32	·82	7	21				
Castle Ashby	R. G. Scriven, Esq.	4·33	·90	7	24	72·0	12	40·0	20
Sedgebrooke	C. A. Markham, Esq.	4·56	·98	7	24	76·0	11 & 19	33·0	21 & 22
Kettering	J. Wallis, Esq.	4·37	1·00	7	23	70·0	7	37·0	21
Althorpe	W. F. Jakeman, Esq.	4·30	·93	7	21	71·0	12	35·0	5 & 21
Northampton	H. Terry, Esq.	4·06	·92	7	22	72·0	12	36·0	20
RUTLAND.									
Burley-on-the-Hill	W. Temple, Esq.	4·26	·83	9	26	75·0	12	30·0	21
Tickencote	W. Hayes, Esq.	4·34	·80	8	21	66·0	12	38·0	4
West Deyne, Uppingham	Rev. G. H. Mullins	5·15	1·35	7	23	71·3	6	34·6	21
Spital Cemetery, Carlisle	T. Bell, Esq.	2·40	·40	7	20	71·8	6 & 12	33·6	20
Ventnor Hospital	H. Sagar, Esq.	2·60	·69	28	15	67·2	31	42·2	21
Altarnun Vicarage	Rev. G. Tripp	7·80	1·28	15	24	70·0	19	34·0	5 & 21

There is no doubt that the month was one of the wettest, if not *the* wettest May on record in the Midland Counties. Observations going back more than forty years show nothing to surpass it, although an approach is made by the May of 1869, which, we may hopefully note, was followed by a very dry summer. At every Midland station, however, the rainfall of May, 1878, may be taken as from two to three times the average amount for that month. At many points on the west and south-west, the 10th was the day of maximum fall, but in the centre and east most fell on the 7th and 8th. Owing to the superabundance of moisture, the foliage and grass are unusually forward, luxuriant, and green; but wheat begins to suffer, garden seeds have decayed in the ground, and slugs and grubs are very abundant. Bees, however, have had a bad time of it. The barometer has been low and fluctuating; temperature equable, with hardly any frost, but little sunshine and south-westerly winds. Thunderstorms have been frequent, those on the 1st, 13th, 17th, 18th, and 27th may be specially noted. The Swift was seen at Tamworth on the 4th, Kibworth on the 5th, and Castle Ashby on the 15th. Corncrake heard at Burton on 1st, and Castle Ashby on 4th; also, at last place, White-throat on same day. Horse-chestnut flowered at Stroud on 5th, at Burton on 3rd; Hawthorn and Laburnum came out about the 7th, but the show of each has been brief and poor.

Correspondence.

White Ragged Robin *(Lychnis Flos-cuculi.)*—Allow me to record that I have this day found a pure white form of this plant.—S.

Chelidonium majus.—Whilst on a visit to a village on the borders of Notts last year, one of the party said he remembered the spot in a lane where a plant of *Chelidonium majus* grew when he was last there thirty-eight years before. On going to the spot to our surprise we saw a plant of the same kind. Is it not rather curious that the habitat had not been destroyed during the course of so many years?—H. Johnson.

Freshwater Aquarium.—I should feel much obliged for detailed directions how to maintain a freshwater aquarium in good condition. Is it possible to keep alive for any length of time such beautiful and interesting creatures as the freshwater polyzoa, melicerta, conochilus, &c.? If so, how?—M. Beete.

Cuckoo.—A few evenings ago, as I was standing in the garden listening to the Cuckoo, one bird very much astonished me, by several times singing "Cuck-cuck-cuck-cuck-cuck-cuck-coo," repeating the first note, as near as I could count, half a dozen times, but it may have been oftener. Is this a common variation of the bird's usually almost monotonous song? To me it seemed a clear case of "too many 'cucks.'"—N.

Redpoll.—Can any of your ornithological readers tell me what bird is distinguished by the above name? I find, on referring to the "Wild Birds' Protection Act, 1872," that the "Redpoll" is mentioned in the schedule. Would it be considered that under this name is included the brown linnet, which some early ornithologists have, I believe in error, called the "Greater Redpoll?" I shall also be glad to have an opinion as to the correctness of that term, "Greater Redpoll." Is the brown linnet known by that name now? If so, would it be covered by the term "Redpoll," or is that name so generally applied to a particular species as to preclude such an extended signification being given to it?—Fred. W. Rothera.

Glacial Drift Deposits.—I was present at the Annual Meeting of the Union, and was sorry to see so much time frittered away against the good sense of the majority in discussing whether the obviously inadequate subscription of one penny annually per member should be increased to a sufficient sum for carrying on real work by the Union ; while one of the most important subjects brought before the meeting, namely, Mr. Harrison's excellent suggestion, that the Societies should one and all take up and investigate, under proper regulations, the subject of the glacial drift deposits of the Midlands, was barely glanced at. Will Mr. Harrison be kind enough, in an early number, to point out what he recommends the Societies to do ?—F. L., Shrewsbury.

Thirlmere.—Naturalists and lovers of the picturesque must be grateful to the House of Lords for rejecting the Bill for the alteration of Thirlmere by the Manchester Corporation, although, doubtless, another and stronger attempt will be made next year to force the Bill through both Houses of Parliament. If so, I think some strong protest should be made against the proposed scheme by all Natural History Societies. If the scheme be carried out, *Juncus filiformis* will be destroyed in one of its few English localities, and the most secluded, yet accessible, of our "hunting grounds" must be damaged most materially, not to mention other and more powerful objections against an unnecessary destruction of the peculiar charms of a district round which so many pleasant memories are entwined.—G. C. Druce.

Entomology.—I have often wondered how it is that so little space is devoted in the "Midland Naturalist" to Entomology. Botany seems the favourite science, but surely there are many points in Entomology which require elucidation, and I should think there must be, in various parts of the Midland Counties, original observers who have something to tell about the habits and peculiarities of insects of all kinds, which have not yet been recorded.—M. T. L., Leicester.

Death's Head Moth and the Spindle Tree.—On August 6th, 1877, whilst seated on the tail board of a pleasure van driving through a most lovely lane leading to the ancient "Friends' Meeting House," at Jordan's Wood, Buckinghamshire, (where the philanthropist, Wm. Penn, is buried,) I noticed a large larva feeding upon a shrub in the hedge. Jumping from the van, I soon gained possession of it, a most beautifully marked larva of the Death's Head Moth, *(Acherontia Atropos.)* The plant I had never seen before, so brought a good supply home with me, and though I enquired at the British Museum no one could tell me the name, and by a strange coincidence Mr. Fred Smith (of the British Museum) had a larva feeding upon the same plant, the name of which he had been unable to obtain. I set some of the twigs in my garden, and was much pleased to find it growing, and throwing out vigorous shoots and flower buds, which opened just in time for me to take down to Birmingham to show my old friend Mr. J. E. Bagnall; he at once recognized it as the the Spindle Tree, *(Euonymus Europæus.)* I shall be glad to know if other entomologists have noticed *Atropos* feeding upon this rare plant.—Fred. Enock, 30, Russell Road, London, N.

Organised Work for Scientific Societies.—Your correspondent F. T. L.'s suggestion is one which, it seems to me, should commend itself to the attention of all scientific societies which profess to have any regard for the working out of the Natural History of the districts in which they happen to be situated. Committees might be formed in each society, consisting of those who were prepared, and were deemed competent, to take part in the work. This would enable the workers in each department of science respectively to become acquainted, and to make arrangements as to the areas and the sub-divisions of the work which they preferred to undertake. It would also enable workers to arrive at more satisfactory conclusions. In Geology—for that is the only subject on which I will venture to speak—good sections, sometimes of more than local interest, such as the junctions between formations, are often lost to science for want of the necessary funds to have them photographed while they are fresh, or before they become grass-grown. When original observations are made, and perhaps local discoveries—which, of course, can scarcely be hoped to happen at very short intervals—the results are communicated to the local scientific society, and beyond a necessarily brief newspaper notice they seldom find their way into print, and are soon beyond the reach of reference. Geology, above all subjects, has to depend so much on artificial openings being made in the rocks that vigilant observers, who will be ready at all times, and often at no little personal inconvenience, to take advantage of any artificial exposures that may be made, are needed in every district. Of course very much of the value of such scientific work as is proposed depends on its thoroughness. Mere flimsy, or "kid glove," observers, who seem to imagine that the more ground they can contrive to cover, no matter how imperfectly, the greater their achievements, should be as far as possible avoided.—J. S.

Gleanings.

A Sturgeon, 8ft. long and 230lbs. in weight, was recently caught in the Estuary of the Severn. This magnificent specimen has been purchased by Mr. Montagu Browne, Naturalist, Birmingham. We understand he purposes mounting it and presenting it to the Birmingham Aquarium.

Geological.—Readers of Mr. J. Shipman's paper in the "Midland Naturalist" for January and February last, entitled "Some new Features in the Geology of East Nottingham," in which several important errors in the geological map of the survey were pointed out, will, we feel sure, be glad to learn that Mr. Aveline, the district surveyor of the geological survey, has very recently gone over the ground examined by Mr. Shipman, and will shortly issue a corrected map and memoir of this district.

The Colouring Matter in the Plumage of Birds.—Mr. H. C. Sorby, F.R.S., recently delivered a lecture on this subject before the Selby Naturalists' Society. He commenced by explaining the cause of colour in general, stating it to be due to the absorption of some of the prismatic colours and the reflection of others. White is produced when all the colours are reflected and none absorbed, whilst black is the result when all are absorbed and none reflected. The colours of feathers are due, first, to the presence of a colouring matter called pigment, which may be extracted and used as a paint; second, to the reflection of the prismatic colours of light by the peculiar construction of the laminæ in the structure of the feathers. Feathers of the first kind are those which show the same colour both by reflected and by transmitted light. The lecturer exhibited a number of water-colour drawings, painted with the pigments extracted from feathers, and observed that in one instance copper was found to be one of the elements in the composition of the colour, which is, perhaps, the only case known in the animal kingdom where copper forms part of the normal structure. A connection had been observed between birds having bright coloured plumage and the flowers on plants on which they feed, the colour of the flowers apparently being developed in the feathers of the birds, especially in the yellow colour, whilst birds of prey were usually devoid of yellow colouring. Grey was shown to be diluted black pigment. The second kind of colours are those which, like the iridescence of a soap bubble are caused by the reflection of light from two surfaces nearly parallel; examples of this kind are found in the feathers of the peacock, pheasant, humming bird, &c., the colours not being caused by pigment, but due to a curious optical phenomenon.

Paris Exhibition.—*Nature* says, "We learn, with pleasure, that at a meeting held at Barrow-in-Furness, on June 3, the Committee of the Naturalists' Field Club belonging to that town determined to organise a scheme for sending representatives (artisans, if possible) to the Paris Exhibition, with the view of collecting information in connection with the various branches of science which are there practically illustrated, one of the conditions being that the result of the observations should be imparted to the club in the form of lectures during the ensuing winter. Promises of substantial support have been received from several of the leading men in the district, and the scheme is expected to be shortly in working order.

Tame-bred Mallards.—Mr. W. H. Roach says in the *Field*:—"I reside between two and three miles from the Liverpool Exchange, so you may guess my place is not very secluded. About ten years ago I brought from Ireland nine or ten wild ducklings that had been hatched by a hen, turned them out on the pond in our garden, never interfered with their wings, but fed them regularly. They remained on the pond, (70ft. by 40ft.) quite tame, and used to come to the hall door for food. However, in the course of time and occasional rambles, they all got shot or otherwise put an end to, with the exception of one mallard, and he for several years past has left me at Christmas, goes I don't know where, but returns as certainly the last week in May, and as tame as ever, taking bread almost from my hand. I have met no one acquainted with a similar case."

Crusade against Sparrows.—From the *Toronto Leader* we learn that the English Sparrow is no longer a favourite in some parts of America. The Nuttal Ornithological Club, of Cambridge, Massachusetts, has made the bird the subject of grave deliberation, and having duly weighed the evidence pro and con. have decided that it ought to be exterminated. It is alleged that the native birds are driven away wherever the sparrow has gained an ascendancy.

Microscopy.—Mr. Dudgeon makes the following suggestion as to examination of small organisms in water:—"Inclose the objective in a brass or other metal tube, having its lower end closed by a piece of thin microscopic glass, coming close up to but not touching the object glass. With this protection we can plunge the end of the microscope into a small tank, filled with water, containing the small livings organisms, and examine them at leisure."

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—Biological Section.—May 14th.—Dr. Rickards read a valuable paper "On the Ear in Man and other Vertebrates," in which he pointed out that, as a descent was made in the scale of vertebrates, the external and middle ears differed in important particulars. In referring to the functions of different parts of the internal ear, he ascribed to the cochlea that of estimating the quality of sound, and declared himself a believer in the view warmly advocated by Professor Crum-Brown that the semicircular canals were the organs of a special sense apart from that of hearing, viz., the sense of rotation. Dr. Rickards expressed the opinion that important light would some day be thrown on the functions of the different parts of the internal ear in man by a comparative study of the anatomy of the organ of hearing in vertebrates in connection with their varying hearing powers. The paper was illustrated by excellent diagrams and wax models, as well as by a fine collection of specimens, amongst which some lent by Mr. W. R. Hughes were considered by the author to be unique.—Mr. Lawson Tait made some interesting observations on the varying powers of perception of sounds in different persons, and in regard to the organs of hearing in lower animals remarked that, though he had seen many cases of total deafness in cats, he had never found this to be accompanied by muteness.—Among specimens contributed by members of the section the following may be mentioned:—Mr. Blatch described a very rare beetle, *Miscodera arctica*, from Hednesford, and exhibited both the male and female, the species never having been hitherto recorded further south than Yorkshire; Mr. J. Bagnall various rare plants from Warwickshire habitats; Miss Hadley specimens of *Bellis perennis*, showing phyllody of various parts of the flower; Mr. Slatter the male, exceedingly rare, of *Conochilus volvox*. May 21st.—General Meeting.—Mr. J. Bagnall exhibited *Ophioglossum vulgatum*, from Hamstead; Mr. T. J. Slatter exhibited *Achlya prolifera* on the dead larva of a gnat—a microscopic fungus; also, *Ulva crispa*, (Confervoid Alga,) both from Redditch. Mr. A. W. Wills read his third and concluding paper of the series on "Freshwater Algæ." June 4th.—General Meeting.—Mr. J. Bagnall exhibited *Carex fulva*, from Sutton Park; *Poterium muricatum* and *Alopecurus agrestis*, from near Marston Green; Mr. H. E. Forrest exhibited *Alcyonella fungosa*, (Polyzoa,) from Sutton Park; Mr. J. Morley exhibited *Alchemilla alpina*; Mr. M. Browne exhibited nine species of Papilionidæ, including the rare *Papilio zalmoxis*, from West Africa, (unknown three years ago;) Mr. Bolton exhibited Embryo of the Roach, *(Cyprinus rutilus.)* June 11th.—Biological Section.—Mr. W. R. Hughes presented, on behalf of Mr P. H. Gosse, F.R S., the papers reprinted from Philosophical Transactions "on the Structure, Functions, and Homologies of the Manducatory Organs in the class Rotifera," and "On the Diœcious Character of the Rotifera." The following specimens were exhibited:—By Mr. Montagu Browne, a white variety of common Starling, *(Sturnus vulgaris,)* from Hamstead. By Mr. J. Bagnall, *Polystichum angulare*, from Rowington; *Sanicula Europœa*, and other plants, from Fillongley, &c. By Mr. C. E. Crick, *Aquilegia vulgaris*, *Cynoglossum vulgare*, and other plants, from Llangollen. By Mr. W. Southall, *Equisetum arvense*, *E. limosum*, *E. palustre*, and *E. Telmateia*, all from one pool at Edgbaston, in which they occupy distinct situations corresponding to the different aspects of its various parts. By Mr. A. W. Wills, the very rare Rotifer, *Melicerta pilula*, (Cubitt,) more correctly *Œcistes pilula*, first observed by Mr. J. G. Tatem in 1868, and subsequently named and described by Mr. C. Cubitt in 1872. The peculiarity of the species is its mode of building up its theca from its own excreta, and Mr. Wills exhibited specimens in which, by feeding the animal on alternate days with carmine and indigo; he had obtained tubes built of alternate courses of red and blue bricks. In referring to this Rotifer, Mr. T. Bolton showed drawings of a tube-building Rotifer, probably another species of the same genus, recently described as a new one at a meeting of the Royal Microscopical Society, but which he thought to be identical with one sketched by a friend some years ago, and provisionally named *Œ Anacharis*. In consequence of an unavoidable engagement Mr. W. R. Hughes, F.L.S., was obliged to postpone his paper on *Hippocampus brevirostris*. June 18th.—General Meeting.—Mr. J. Bagnall exhibited *Geranium Columbinum*, *Onobrychis sativa*, *Galium tricorne*, *Helminthia echioides*, *Carex acuta*, and a number of other plants, found between Binton and Stratford-upon-Avon. A number of plants were also exhibited by Mr. J. Butterfield. Mr. W. R Hughes, F.L.S., read, on behalf of Dr. Spencer Cobbold, F R.S., a continuation of his valuable communications on "The Parasites of Man," which will appear in the "Midland Naturalist" for August. The paper was illustrated by numerous remarkable microscopic preparations.

BURTON-UPON-TRENT NATURAL HISTORY AND ARCHÆOLOGICAL SOCIETY.—The first excursion made by the members this year took place on May 22nd, and was to Bardon Hill, under the leadership of Mr. W. Molyneux, F.G.S. The granite quarries were first visited and the processes of quarrying, &c., inspected. A good general notion of the geology of the district was obtained. The party next made for the top of Bardon Hill, and enjoyed the glorious landscapes visible therefrom. After collecting numbers of geological and other specimens, the monastery of St. Bernard was visited. After tea at the Forest Rock Hotel, the party returned by train to Burton.

CHELTENHAM NATURAL SCIENCE SOCIETY.—The first session was brought to a successful close on May 16th, when the President, Dr. T. Wright, F.G.S., F.R.S.E., delivered a most instructive address on "Fossil Fishes," for an abstract of which we regret to say we have no room this month.—The Rev. W. S. Symonds and Mr. Francis Day also delivered addresses of much interest, the former discussing the question whether the older fishes lived in freshwater lakes or in salt water seas; and the latter dealing with the subject of "Classification." The next meeting of the Society will be in the autumn.

EVESHAM FIELD NATURALISTS' CLUB.—May 30th.—Mr. J. S. Slater in the chair. It was reported that the Excursion to Mickleton, arranged for May 11th, had, after several times being postponed on account of bad weather, been abandoned for this season. A vote of thanks was passed to Mr. T. Latham for his courtesy on the occasion of the Excursion to Dudley, on the 28th May. The following plants were mentioned by Mr. Doeg as having been found lately in the neighbourhood:—*Saxifraga hypnoides*, *Polygonatum officinale*, *Ophrys muscifera*, and *Polypodium Robertianum*. An Excursion took place on Saturday, June 8th, by break, to Tiddesley Wood, near Pershore. There was not a large attendance. The following plants were found:—*Habenaria bifolia*, *Iris fœtidissima*, *Hypericum androsæmum*, and *Viburnum Opulus*. June 13th.—Mr. A H. Martin in the chair. Mr. Doeg brought a very large specimen of the Lamprey, *(Petromyzon marinus,)* 26½in. long, and weighing 1¾lb., taken in River Avon, near Cropthorne, last week. Mr. Martin showed an egg of the Night-jar Mr G. New reported that *Lathyrus Nissolia* and *Lathyrus Aphaca* were both growing in great abundance on the side of the Worcester Road.

NOTTINGHAM LITERARY AND PHILOSOPHICAL SOCIETY.—NATURAL SCIENCE SECTION.—May 11th.—A geological excursion was made to Annesley. Near the station a section of Lower Bunter red sandstone, capped by drift, was examined. The party then visited (by permission of C. Musters, Esq.) an old quarry in the park. Here are several interesting exposures of highly calcareous and cemented drift May 22nd.—ANNUAL MEETING.—The following officers were elected for the year 1878-9:—President, Mr G. B. Rothera; Vice-Presidents: Mr. E. Smith, M.A., Mr. A. H. Scott White, B.Sc., B.A., F.G.S.; Hon. Secretary, Mr. Isaac Mosley; Committee: Rev. G. E. C. Casey, M.A., F.G.S., Messrs. E. Parry, C. J. A. Crawley, B.A., E. Wilson, F.G.S., A. L. Kohn.—May 25th.—Geological excursion to Stanton-on-the Wolds.—June 10th (Whit-Monday.)—A geological excursion (under the guidance of Mr. E. Wilson, F.G.S.) was made to Miller's Dale. The party visited a marble quarry in Tideswell Dale, where the Toadstone is seen resting upon carboniferous limestone. Description of the section and general geological features of the district by Mr. Wilson. The party then visited a quarry in Monsal Dale and other places of interest.

NOTTINGHAM NATURALISTS' SOCIETY.—June 5th.—An ordinary meeting was held, at which various Natural History objects collected during the present year were exhibited.—Afternoon walks were taken every Saturday during the month.

OSWESTRY AND WELSHPOOL NATURALISTS' FIELD CLUB AND ARCHÆOLOGICAL SOCIETY.—Thursday, June 20th, was fixed for the second Excursion of this Club. Meeting at Forden Station the party proceeded first to Munlyn Farm, where there is a large mound, surrounded by a moat, and close by the Severn. Then crossing the river they came to S. Benno's Stone, a large, upright boulder, standing by the roadside. Next they visited the Church at Berriew, (a handsome modern building,) and admired the view of the Rhiw from the bridge in the village. They followed the road up the beautiful Valley of the Rhiw as far as Pontyffrid, and then struck across the hills, past an old camp, to the top of Powys Castle Park, from which there is a magnificent view of Shropshire and Welsh scenery, including Cader Idris, Plynlimmon, the Arans, and the Berwyn range. Thence the road lay through the Park, with its splendid trees, past the Castle, to Welshpool. The day was all that could be desired, and among the plants found we may mention *Inula Helenium*, *Lamium maculatum*, *Habenaria bifolia*, and *Trifolium striatum*.

SEVERN VALLEY NATURALISTS' FIELD CLUB.—The first meeting of the Club this year was held at Great Malvern, the visit lasting from Tuesday to Friday, June 4th to 7th. On the first day visits were made to the quarries and sections of the North Hill. In the evening papers were read by Mr. F. Day, of Cheltenham, on "Fish Life;" and the Rev. W. S. Symonds, of Pendock, on "Some of the historical associations around the Malvern Hills." Wednesday, June 5th, the party, joined by members of the Malvern, Woolhope, and Cotteswold Field Clubs, drove to the Herefordshire Beacon and Eastnor. A walk of seven miles, commencing at Wind's Point, was undertaken under the guidance of Mr. Symonds. The route was by way of the Great Camp and Hermit's Cave to the Camp on Midsummer Hill, thence by the quarry of Greenstone and Diorite in the Holly Bush Pass, by the valley of the white-leaved oak and a series of quarries to the Somers' Arms Inn, Eastnor, from whence the party drove back to Malvern. In the evening Dr. Thos. Wright, F.R.S.E., of Cheltenham, commenced an address on the Palæontology of the Malvern Hills, and Mr. G. W. Hastings described the structure of the hills. On Thursday, June 6th, a visit was first paid to Dr. Grindrod's fine collection of Silurian fossils, &c. Afterwards the party went by train to Stoke Edith, and Mr. Symonds again acting as guide led the way through the Park to Seager Hill, from which there is a fine view of the Woolhope Valley. Mr. Symonds described the remarkable geological features of the district. The quarries at Dormington were next visited. After tea at the Foley Arms, Tarrington, in the room where Sir Roderick Murchison wrote great part of his "Siluria," the party returned to Malvern, where Dr. Wright finished his address on the Palæontology of the district, and Mr. Symonds narrated the weird legend of the "Shadow of the Rugged Stone." On Friday the party dispersed, after a most enjoyable meeting.

WARWICKSHIRE FIELD CLUB.—At a recent meeting, Mr. Andrews read a paper, of which the following is an abstract:—"Many years ago I made a commencement to examine the glacial or drift formation in the neighbourhood of Coventry, and collected a great number of specimens, but I was not able to continue the investigation. Recently, however, I have returned to the subject, and having studied most of the works on the question which have appeared during the last few years, I became convinced that it was quite hopeless to make any systematic examination of these formations without a much better knowledge of the topography of the district than we at present possess. I therefore resolved to make a new survey of the county, or if that were not possible, at least of the whole of the district round the city of Coventry, and the map now shown is the first instalment of the work. The method adopted in making the survey was very simple, viz., by collecting all the published information that I could as to the altitudes that have been measured, such as the various Ordnance bench marks, the levels of the various canals, railways, &c., by using this information as a basis for the survey, and finally by walking over the district, and examining the altitudes by means of an aneroid barometer, and sketching the contour lines on the spot. I have tinted the map with a series of tints in Indian ink, on the principle that if the waters of the ocean were 200 feet above their present level, they would exactly occupy the space covered on the map by the deepest shade, and which is indicated by the figures, 100, 200. If the waters were 300 feet above their present level, they would also occupy the space covered by the next paler shade which is indicated by the figures, 200, 300, and so on. The district covered by my survey, up to the present moment, (December, 1877,) extends from Hinckley on the north, to Harbury Railway Station on the south, and from Branston on the east, to Knowle on the west, and consequently includes about half of Warwickshire." The map is now placed in the Reading Room of the Free Library, Coventry.

EXCHANGE.

Wanted, *Carex stricta*, *Carex endistans*, *Scirpus triqueter*, for rare plants.—G. C. Druce, Northampton.

RECENT DISCOVERIES IN THE GEOLOGY OF SHROPSHIRE.—I.

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

Introduction.

This paper, furnished at the desire of the Editors of this Journal, gives a brief outline of a paper read by me before the Geological Society, in March, 1877, and published in Vol. XXXIII. of the Society's Journal. Its object is to announce the discovery of a new area of Tremadoc and Pre-tremadoc rocks, near the Wrekin, with a fauna mainly composed of new species. Papers will probably be communicated on the quartzites of Shropshire, and on a recently discovered Pre-cambrian volcanic series of great interest and importance, when the rocks have been more completely worked out. Sir R. I. Murchison has described the area under consideration, from the Wrekin on the north-east to the May Hill sandstone at Kenley on the south-west, as composed of strata of Caradoc age, the Wrekin itself being an igneous outburst altering the Caradoc sandstone on its flanks into quartzite.

The Geological Survey has followed Murchison, but has included, under the name of "quartzite," certain sandstones in which I have detected fossils in abundance.

In the Journal of the Geological Society (Vol. X., p. 62,) Messrs. Aveline and Salter describe this area as Caradoc, and Salter gives a list of fossils from (so-called) Lower Caradoc shales at Harnage and Shineton, mixing up Cambrian forms, such as *Olenus*, from Shineton, with Cambro-Silurian genera, such as *Trinucleus*, from Harnage, the shales at Shineton and at Harnage evidently being considered identical.

Salter, in the "Geological Magazine" for 1867, refers to the shales at Shineton, which he there regards as "the top of the Llandeilo Flags proper." The same writer seems, in after years, to have been struck with the incongruous association of Cambrian and Cambro-Silurian forms; for, in "A Catalogue of the Collection of Cambrian and Silurian fossils contained in the Geological Museum of the University of Cambridge," published in 1873, while describing what he supposes to be a *Triarthrus* from Shineton, he suggests, "it is possible that the locality may include some *Tremadoc* beds." With this exception, geologists have regarded the rocks of the area under consideration as of Caradoc age.

I shall endeavour to prove that the shales at Shineton are of Tremadoc age, and that a part of the so-called "quartzite" between the shales and the Wrekin represents the Hollybush Sandstone of Malvern. The true quartzites are probably Pre-cambrian; and the igneous chain of hills, from Lilleshall Hill through the Wrekin, the Lawley, Caer Caradoc, and on to the south-west, are clearly stratified, and underlie unconformably the Cambrian rocks.

Lower Caradoc Rocks.

Mr. Salter noticed at Harnage and on Cound Brook certain shales containing *Trinucleus concentricus*, Eaton, *Beyrichia complicata*, Salt., *Diplograpsus pristis*, His., *Orthis testudinaria*, Dalm., and other Cambro-Silurian fossils; and as these shales are very similar in lithological characters to the shales at Shineton, and have the same general strike, both shales were lumped together by him as Lower Caradoc. This lithological resemblance is evidently the chief cause of the errors of the surveyors. On closer inspection, however, it is seen that the shale at Harnage contains a distinct fauna from the Shineton shales. The most abundant fossils of the Harnage shales, collected near Broomcroft and in the Harnage and Cound-Brook area, are *Trinucleus concentricus*, Eaton, *Beyrichia complicata*, Salt., *Primitia bicornis*, R. Jones, *Orthis testudinaria*, Dalm., *Theca*, several species of Lamellibranchs, *Diplograpsus pristis*, His., and *Favosites fibrosus*, Goldf. These are common Caradoc forms, and it is perfectly clear that the shales containing them are of Caradoc age. In no case are these fossils found in the same beds as those which contain the older fauna presently to be described. It is necessary to call attention to this point, as the Rev. J. D. La Touche, president of the Caradoc Field Club, in his annual address in February last, has suggested some criticism on my conclusions, basing it on a supposed admixture of the older and younger faunas. There are no signs whatever of such admixture. The Tremadoc fauna ends abruptly upwards; the Caradoc fauna ends abruptly downwards; and not a single distinctively Arenig or Llandeilo species has been found in the district.

The Caradoc rocks of this area are much disturbed and faulted, and on Cound-Brook they are inverted, the older resting on the younger at a considerable angle, and, in one or two spots, Shineton shales are strangely wedged in between Harnage shales. Further details may be seen in my published paper (p. 656); but the Caradoc formation in South Shropshire deserves to be the subject of a separate memoir, recent observations having considerably modified some of the conclusions of Aveline and Salter.

The Shineton Shales.

The locality where I first observed these shales is the spot near Shineton marked on the Geological Survey Map with an arrow dipping to the south-east at 50°. The rocks are there exposed in two good sections on the left bank of the stream. It is from these sections that most of the characteristic fossils have been obtained; and I have, therefore, named the formation from this locality.

1.—*Area.*—These shales cover an area extending from near Evenwood, on the south-west, to within a mile of Wellington, on the north-east, a distance of eight miles. Their greatest breadth, from Shineton to Dryton, is about two miles; but where they range towards Wellington it is contracted almost to a point. The area is roughly triangular in shape, the apex of the triangle pointing to the north-east. Its north-west side is bounded by a fault or faults for probably its entire length, various formations from the Hollybush Sandstone to the Trias abutting against the shales. On the south-east side the triangle is covered in by intrusive basaltic rocks for one-third of its distance from the apex, and the remainder by the May Hill Sandstone. The base of the triangular area is limited by the Hoar Edge Grits, the lowest beds of the Caradoc. I have recently detected the shales in the hollow between the Lawley and Hoar Edge, on the south-east side of Caer Caradoc, and west of the Longmynd, at the base of the Stiper Stones.

2.—*Lithological Characters.*—The Shineton Shales are dark blue, weathering to olive and yellow, the colouring iron-oxide sometimes separating as a stain or film. They are micaceous, thin bedded, soft, and rather fissile. I have rarely had any difficulty in distinguishing them from the Harnage Shales, either *in situ* or in hand specimens.

3.—*Dip and Strike.*—The general strike of the shales is about south-west, agreeing with the direction of the great fault and of the so-called igneous elevations of the district; but towards the south-west end of the area it bends round to the west, corresponding with the strike of the overlying Caradoc. The mean dip of the greater part of the shales is about 30° to the south-east; but in the lower part of the series, where they approach the fault, it becomes higher, then vertical, than dips steeply to the north-west, the evidence pointing towards the existence of an anticlinal. The thickness of the shales is probably not less than 1,500 feet.

4.—*Stratigraphical Position.*—The Shineton Shales underlie the May Hill Sandstone unconformably; they are therefore older than that formation by an interval. They underlie the Caradoc, and are, of course, of greater antiquity. They overlie, probably unconformably, the Hollybush Sandstone. I shall endeavour to show that they are of Tremadoc age.

(a.)—*Evidence from Fossils.*—Most of the Shineton forms are new specifically, and some of the genera are also new. The species which are of geological value are the following:—*Conocoryphe monile*, Salter. *Conocoryphe* proper is distinctive of Lower Cambrian rocks, and this species is truly typical of the genus. *Olenus Salteri*, Callaway, and *O. triarthrus*, Call., new species of a genus which usually characterizes strata of the age of the Lingula Flags. *Agnostus dux*, Call., similar to certain St. David's forms, (Menevian.) *Lingulella Nicholsoni*, Call., resembling *L. lepis*, a Tremadoc species. *Asaphellus Homfrayi*, Salt., common in the Upper Tremadoc at Portmadoc.

(b.)—*Evidence from Correlation with Rocks in other Localities.*—*Dictyonema beds at Pedwardine.*—Shales identical lithologically with the Shineton Shales, and containing *Lingulella Nicholsoni*, one found at Pedwardine, twenty-five miles to the south-west of Shineton, on the same line of strike. They also contain *Dictyonema sociale*, which has not yet been found at Shineton.

Dictyonema Beds at Malvern.—Overlying the Olenus Shales near White-leaved Oak, are light-coloured shales, similar to the Shineton and Pedwardine beds, and containing two Shineton forms, *Platypeltis Croftii*, Call., and *Conophrys salopiensis*, Call., together with *Dictyonema sociale*, Salt.

A comparison of the three formations at Shineton, Pedwardine, and Malvern is very interesting. The Shineton beds are connected with the

Pedwardine shales by lithological resemblance, stratigraphical position, and the occurrence of *Lingulella Nicholsoni*. The Pedwardine rocks are correlated with the Malvern *Dictyonema* shales by lithological resemblance, stratigraphical position, and the link of *Dictyonema sociale*. The Shineton Shales are *directly* connected with the Malvern beds by lithological resemblance, stratigraphical position, and the occurrence of two species of Trilobites in common; and *indirectly* through their correlation with the Pedwardine Shales. I think I may fairly conclude that the *Dictyonema* beds at Pedwardine and Malvern are representatives of the Shineton Shales.

The occurrence of *Dictyonema sociale* in the Shineton Shales at Pedwardine and Malvern furnishes another link in the chain of palæontological evidence. This species is common at the base of the Lower Tremadoc of North Wales, and helps to connect that formation with the Shineton Shales. Taken by itself, the occurrence of a single species may not be decisive; but, when other lines of evidence converge to the same point, this fact is of value.

The Black Shales of Malvern are correlated by their fossils with the Dolgelly group, the uppermost zone of the Lingula Flags.

It may be concluded from a review of the evidence that the Shineton Shales are at least as old as the Lower Tremadoc.

The Hollybush Sandstone.

Forming a continuous band between the Shineton Shales and the quartzite which rests upon the Wrekin, is a series of thin-bedded, micaceous, green sandstones, holding the same geographical relation to the Shineton Shales as the Hollybush Sandstone of Malvern holds to the black *Olenus* Shales. The identification of this rock with the Hollybush is placed beyond doubt by the further evidence of *Kutorgina cingulata* and *Serpulites fistula*, which occur in good preservation at Neves Castle, at the south-west end of the Wrekin. The sandstone is also found at Lilleshall, five miles to the north-east of the Wrekin, where it forms an inlier a mile long by a quarter of a mile wide. Since the reading of my paper I have also discovered it on the south-east flank of Caer Caradoc, near Church Stretton. It is well exposed in a quarry at the north-east end of the hill, and contains a thin band of limestone with *Kutorgina cingulata*, *Serpulites fistula*, and other fossils, and holds its normal place betwen the quartzite and the Shineton Shales.

Details of the Hollybush Sandstone as well as of the Shales will be found in my published paper.

Fauna.

I append a list of the Upper Cambrian fossils found in South Shropshire, most of which it will be seen are new to science. They are described and figured in my paper:—

Crustacea.

Asaphus (Asaphellus) Homfrayi, *Salt*. Shineton Shales.

Asaphus (Platypeltis) Croftii, *Call.*, gen. et sp. Shineton Shales.

Agnostus dux, *Call.* Shineton Shales.

Conocoryphe monile, *Salt*. Shineton Shales.

Olenus Salteri, *Call.* Shineton Shales.
—— triarthrus, *Call.* Shineton Shales.
Conophrys salopiensis, *Call.*, gen. et sp. Shineton Shales.
Lichapyge cuspidata, *Call.*, gen. et sp. Shineton Shales.
Primitia, sp. (more than one.) Shineton Shales.

ANNELIDA.

Serpulites fistula, *Holl.* Hollybush Sandstone.

PTEROPODA.

Theca lineata, *Call.* Shineton Shales.

HETEROPODA.

Bellerophon shinetonensis, *Call.* Shineton Shales.

BRACHIOPODA.

Lingulella Nicholsoni, *Call.* Shineton Shales.
Obolella sabrinæ, *Call.* Shineton Shales.
Kutorgina cingulata, *Bill.* Hollybush Sandstone.

ECHINODERMATA.

Macrocystella Mariæ, *Call.*, gen. et sp. Shineton Shales.

HYDROZOA.

Dictyonema sociale, *Salt.* Shineton Shales.
Dendrograptus. Shineton Shales.

PARASITES OF MAN.*

BY T. SPENCER COBBOLD, M.D., F.R.S., HON. VICE-PRESIDENT OF THE BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.

[*Continued from page 121.*]

Although the twenty-four parasites already brought under the notice of the Section may be fairly regarded as exhausting the list of human trematodes and cestodes, yet several other species of tapeworm have from time to time been indicated on what are probably insufficient grounds. In this doubtful category I place Weinland's *Tænia megaloon*, and also another tapeworm which Dr. Ransome concludes to exist from the diagnostic evidence furnished by the finding and examination of a particular form of cestode ovum. In Weinland's case both loose proglottides and eggs were examined; consequently the strobile may turn out to represent a good species. Weinland figures the ova (in *Zoolog. Garten Frankf., 1861, s. 118.)* Respecting a variety of manifestly spurious entozoa, such as Frèdault's *Trachelocampula* and the like, I have nothing to say.

* Read before the Microscopical Section of the Birmingham Natural History and Microscopical Society, June 18th, 1878. On Dr. Cobbold's behalf, Mr. Hughes exhibited examples of *Trichina spiralis*, both in the sexually mature and larval states (capsuled and free.) He also showed specimens of *Trichocephalus dispar* and *T. affinis*, together with their ova. As regards hæmatozoa, specimens from human blood, and also from the dog, were shown in contrast, from slides prepared and presented by Dr. Lewis, of Calcutta. A full-grown example of *Filaria Bancrofti* and numerous larvæ were also exhibited. These were from Australia.

The nematoid group of parasites, next to be considered, are probably better known than any other helminths. This arises partly on account of the excessive frequency of the little threadworm, *(Oxyuris,)* partly from the circumstance that the large round worm *(Ascaris)* bears a marked resemblance to the common lob-worm of our gardens, *(Lumbricus,)* and partly, or perhaps chiefly, because the spiral flesh-worm *(Trichina)* plays an important *rôle* in the production of epidemic disease *(Trichinosis.)* Endless mistakes have arisen from the error of confounding parasitic roundworms with earthworms. The mischievous character of unscientific or inexact knowledge may be illustrated by the fact that I have known nervous persons so seriously alarmed at the appearance of lumbricoid entozoa that they have regarded their presence as an omen of approaching dissolution. I have even known a spurious nematoid to be dreaded as "the worm that dieth not." It is very important that correct views should be entertained respecting the nature and sources of the various members of this group of parasites. Nothing is more absurd than the popular notion that nematoid entozoa, especially threadworms, *(Oxyurides,)* arise or make their appearance in consequence of an impoverished state or cachexia of the body of the host. This ridiculous conception, which is as old as the hills, is ever and anon re-asserted with all the pride and confidence which should only be displayed when any real and valuable discovery has to be announced. The notion, as it now stands, is a feeble remnant of the theory of equivocal generation. For the establishment of the truth of this theory the spontaneous generationists always pointed, triumphantly as they supposed, to the mode of origination of the entozoa. The truth is, neither threadworms nor helminths of any other kind arise from diseased conditions. They often produce constitutional disturbance in their victims, this bad effect being misinterpreted as a cause of the appearance of the entozoa themselves. A healthy person is just as likely—nay, he is even more likely to entertain parasites than a feeble person. True, the strong host may suffer comparatively little, whilst the weak host succumbs to his guests. The host is the entozoon's native territory. What our native island is to us, our bodies are to parasites. To attack, to invade, to infest, is their legitimate prerogative; and for this end it must be admitted that their organisation is admirably adapted. To be sure, it is equally our prerogative to refuse the would-be guests admission, but any method of resistance likely to prove effectual must be based upon scientific conclusions resulting for the most part from experimental research. Ancient dogmas and preconceived opinions too often operate to obscure the mental vision, and thus prevent the adoption of measures calculated to check not a few of the many evils to which our common flesh is heir.

NEMATODA.

25.—*Trichina spiralis*, Owen.

Synonymy.—*Pseudalius trichina*, Davaine.

Larvæ.—Commonly spoken of as muscle-trichinæ, capsuled or encysted trichinæ, and fleshworms.

Intermediate Host.—All warm-blooded animals, especially mammals, and of these the hog and rat more especially. Man himself may become an intermediate bearer.

Experiments.—These are of two kinds, as referring either to the larvæ or to the full-grown worm. The larvæ were first reared by Herbst (1850) and the adult worms by Virchow (1859.) These results were subsequently verified and extended by Leuckart, Claus, Küchenmeister, Pagenstecher, and many others abroad; and they were confirmed by Thudichum and myself in this country. The worm-feedings administered by Prof. Simonds and myself infected four dogs, two cats, one pig, one guinea pig, one hedgehog, and probably several rats which, unfortunately, made their escape.

Remarks.—The original discovery of the capsules, as "little bodies" or "concretions," was made either by Tiedemann, (1822,) or by Peacock (1828.) Their parasitic character was first indicated by Hilton (1833.) The actual discovery of the worm was first made by Paget, (1834,) and afterwards scientifically named and described by Owen (1835.) The most brilliant discovery of all was that of Zenker (1860.) He it was who demonstrated that migrating Trichinæ were productive of disease (Trichinosis.) Finally, the most complete account of the migrations and structural changes undergone by the worm are due to Leuckart.

Literature.—Althaus, Essay on Trichinosis, 1864; Boehler, Die Trichinenkrankheit in Plauen, 1863; Gerlach, Die Trichinen, 1866; Cobbold, On the History of the Discovery of *Trichina spiralis* in Supp. to "Entozoa," 1869; *Idem*, Experiments, Proceedings Linn. Soc., 1867; Leuckart, Untersuchungen ueber *T. spiralis*, 1866; Luschka, Zeitschrift für Wissensch. Zool., 1851; Owen, in Zool. Soc. Trans. 1835; Pagenstecher (and Fuchs,) Die Trichinen, 1865; Thudichum, Government Report "On Parasitic Diseases," &c., 1865; Virchow. Darstellung der Lehre von den Trichinen (u. s. w.,) 1864; Zenker, Zur Lehre von der Trichinenkrankheit, in Deutsches Archiv f. Klin. Med., Bd. VIII., and in Virchow's Archiv., 1855.

26.—*Trichocephalus dispar*, Rudolphi.

Syn.—*T. hominis*, Goeze; *Trichuris*, Buttner; *Ascaris trichiura*, Linn.

Larvæ.—Küchenmeister and Meissner supposed that Trichinæ were the young of Trichocephalus. This view was controverted by Virchow.

Int. Host.—Unknown. The experiments of Davaine render it probable that infection takes place in a direct manner some time after the eggs have escaped the human bearer.

Experiments.—Davaine finds that dryness does not destroy the ova, and that a period of six months elapses before embryonic formation commences. The embryos will live for many years in the freed eggs.

Remarks.—The Dublin helminthologist, Bellingham, was one of the earliest to attest the frequency of the whipworm in Great Britain. He found it in eighty-one out of ninety *post mortem* examinations. Davaine has stated that not less than half the Parisians are victimised by this worm. Mr. Cooper, of Greenwich, found it present in eleven out of sixteen autopsies. Either this worm or its congener (infesting ruminants) has been anatomised by Dujardin, von Siebold, Mayer, Eberth, Erasmus Wilson, Busk, Bastian, and myself.

Lit.—Bastian, in Philos. Trans., 1866; Bellingham, in Dublin Journal, 1838; Busk, in Annals Nat. Hist., 1841; Cobbold, in

Linn. Trans., 1859; Eberth, in Sieb., and Köll, Zeitschr., 1860; Mayer, *ibid*, 1858-60; Siebold, in Wiegm. Archiv., 1845; Wilson, E., in The Veterinary Record and Transactions, 1846.

27.—*Filaria Bancrofti*, Cobbold.

Syn.—*Filaria sanguinis hominis*, Lewis; *F. Wüchereri*, Cobbold, (conditionally;) *Filariose dermathemica*, O'Neill; *Filaris sanguinis*, Bancroft; *Trichina cystica*, Salisbury.

Larvæ.—The synonyms above given all originally referred to the embryonic condition; but the embryos have also been described as nematoid hæmatozoa, micro-filariæ, hæmatochylous helminths, (Corre,) worms of Guadeloupe, (Crevaux,) worms of Brazil, (Wücherer,) probably embryos of Stronglidæ, Leuckart,) anguillula-like microscopic nematodes (Sonsino.)

Int. Host.—Dr. Bancroft originally suggested and Dr. Manson actually discovered that the hæmatozoal micro-filariæ were passively transferred to the stomach of mosquitoes. Dr. Manson has described the transformations undergone by the larvæ within these insects.

Experiments.—Dr. Manson induced an infected Chinese to sleep in a mosquito-house, and thus procured on the following morning a number of mosquitoes that had gorged themselves with blood containing human filariæ. A relatively far greater proportion of hæmatozoa existed in a drop of the insucked blood taken from the mosquito than in a drop taken from the Chinese in a direct manner. The construction of the proboscis of the female mosquito seems to be especially adapted for drawing the worms out of the capillary bloodvessels.

Remarks.—There is every reason to believe that the microscopic hæmatozoa of man are capable of producing a variety of diseases, some of which are endemic. In this category must be placed certain forms of hæmaturia, chyluria, varix, elephantiasis, and other lymphoid affections, and likewise the African cutaneous disorder termed craw-craw. The whole of them have been characterised as constituting varieties of one disorder which Dr. Bourel-Roncière terms Wücherer's helminthiasis. The adult worm was first discovered by Bancroft and first described by myself. It was afterwards found and described by Lewis, and subsequently our "finds" were verified by Dr. Araujo and by Dr. F. dos Santos. The larvæ were first discovered by Wücherer, whose observations were afterwards verified and extended by Salisbury, by myself, and especially by Lewis. Free microscopic nematoids very closely resembling these larvæ have been found in the potable waters of Rio (aqua da Carioca) by Dr. Magalhaes. Their genetic relation with *F. Bancrofti*, however, is very doubtful.

Lit.—Wücherer, in Gaz. Med. da Bahia, Dec., 1868, and Sept., 1869, and in Hallier's Zeitschrift, 1869, and in Arch. de Méd. Navale, 1870; Salisbury, in Hay's Amer. Journ., 1868; Cobbold, in Brit. Med. Journ., July, 1872, and in Lectures on Helminth., 1872; in B. M. J., June, 1876; in the Lancet for July and Oct., 1877; in Reports of the Proceedings of the Linnean Soc.; of the Pathological Soc.; of the Medical Society of London; in the Lancet for March; in Nature of the same month, and in the Popular Science Review for April, 1878; Leuckart, Die Mensch. Par. Bd. II., 1876; Corré, Rev. des Sci. Nat., Sept., 1872; Crevaux, De l'hématurie chyleuse, &c., Paris, 1872; Silva-Lima (with Crevaux,) Mem. sobre a hematuria chylosa ou gordurosa, (Bahia, 1876,) and in Gaz. Med. da Bahia, Sept., 1877, and in the Lancet for March, 1878; Foncervines, in Robin's Lécons, 1875; Lewis, on a hæmatozoon in human blood, in Gov. Rep. for 1872, and separately (Calcutta 1874,) in Indian Annals, 1873, in Med. Press, 1873, in Lond. Med. Record (rep. by me,) 1873, in Nature, 1873, and in his memoir on the Path. significance of the nematode hæmatozoa, Calcutta, 1874; see also Lewis's recent "Remarks regarding the Hæmatozoa found in the stomach of Culex Mosquito," in Proceed. of the Asiatic Society of Bengal, for March, 1878, (p. 89); Sonsino, Richerche intorno, &c., in Rend. della R. Accad. di Napoli, 1874, and in Arch. Gen. de Méd., June, 1876; Araujo, in Arch. d. Méd. Navale, 1875; Magalhäes, P. S. de, in Gaz. M. da Bahia, 1877, and in O Progresso Medico for Dec., 1877; O'Neill, on Craw-craw, in Lancet, Feb., 1875; Bourel-Roncière, in Arch. de Méd. Navale, March, 1878, (see Araujo); Manson, Report on Hæmatozoa, in the 6th part of the Customs Gazette, Shanghae, 1877, and rep. in Med. Times and Gazette, also additional cases in M. T. and G. for March, 1878, also (in a joint communication with me) in rep. of the proceedings of the Med. Soc. of London, in the Lancet, March 30, 1878; Le Roy de Méricourt, in Appendix to Nouvelle phase de la question relative à la nature parasitaire de la chylurie, (Découverte du représentant adulte de la Filaire de Wücherer,) being a translation of Silva Lima's memoir, quoted above, (Arch. de Méd. Navale, Dec., 1877.) See also translations, with additions, in the Veterinarian for Feb., 1878; Araujo, A. J. P. da S., Memoria sobre a Filariose, &c., (Bahia, 1875,) see also Bourel-Roncière's analysis of and commentary upon the writings of Silva Lima and Silva Araujo in the Archives above quoted; Santos, F. dos, in Gaz. Med. da Bahia for March, 1877; Moura, J. de, Thèse de concours, 1877

[TO BE CONTINUED.]

ON THE STUDY OF THE MOSSES.—II.

BY JAMES E. BAGNALL.

(Continued from p. 196.)

Mosses are said to be synoicous when male and female organs occur in the same enveloping leaves, as in *Mnium subglobosum;* monoicous when these organs occur in different buds on the same plant, as in *Hypnum rutabulum;* dioicous when the male organs occur on one plant and the female on another plant of the same species, as in *Ceratodon purpureus.*

The antheridia, (see Plate 4, fig. 7 *a.*,)* are sac- or sausage-shaped bodies, and are usually surrounded by a number of thread-like jointed bodies, called the paraphyses, (7 *b*,) (Gr. *para* beside, and *phuo* I grow.) The function of these bodies is probably that of nutrition. In the Sphagnums these paraphyses are absent, and the antheridia are very differently shaped, consisting of a short stalk, (8 *a*,) surmounted by a globular head, (8 *b*,) the antherozoids being developed in the globular

* All the references in this article are to Plate IV., facing page 193.

head; these antheridia may be readily obtained by carefully dissecting away the leaves of the catkins, which are usually reddish or brown, and often occur near the summit of the stem. If the antheridia of ordinary mosses are examined microscopically with a ¼ or ⅛-inch objective, they will be seen to contain a number of closely packed cellules, and in each of these cellules a spiral thread-like body may be seen. This spiral body is the antherozoid or fertilising principle of the antheridium; and, supposing that the antheridium is ripe, a very slight pressure of the cover glass will cause it to burst at the apex, and the enclosed cellules will be seen swarming out with a sort of jerky motion, (7 *c*.) In a few minutes the cellulose coat of the cellules is dissolved, and the spiral bodies, the antherozoids, thus liberated, commence moving about in the water, much like some infusoria.

This beautiful sight may be seen readily, and the star-like male flowers of Polytrichum are the most easily examined. These should be got about the end of May or in June. The outer leaves of the flowers should be dissected away, and some of the ripe antheridia should be examined in water with the 4-10th or ¼-inch objectives.

The archegonia, (9,) (which, with the exception of the Sphagnums, are also surrounded by paraphyses,) are somewhat flask-shaped bodies, the upper part consisting of a slender neck, (9 *a*,) the lower part being somewhat pear-shaped, (9 *b*.) In the centre of the pear-shaped body, and near the top, is a small cavity, within which a nucleated cell is developed, called the germinal vesicle, (9 *c*;) and after the archegonium has acquired some size, a closed canal will be seen passing down the neck, (9 *d*,) into that part of the pear-shaped body in which the germinal vesicle, (9 *c*,) is situated. After a while, as growth goes on, the cells bounding the top of the neck fall away, thus leaving an open passage down the canal to the germ cell. Down this canal the antherozoids pass, and reaching at length the germ cell bring about impregnation.

After impregnation has taken place cell-division commences in the germinal vesicle, and continues until by frequent repetition the fruit rudiment is formed. During this time the archegonium increases in size, the rudiment growing longitudinally, and striking deep down into the base of the archegonium. This continued upward and downward pressure on the delicate tissues of the archegonium causes it to rupture near the base; the upper part being carried upwards by the growing fruit rudiment, (10 *d*,) forms the hood or calyptra, (10 *a*,) the lower part is left surrounding the base of the rudiment and forming a sheath, which is called the vaginula, (10 *c*,) (Lat., a little sheath.) At the top of the fruit rudiment the capsule is formed within which the spores are developed.

By virtue of the insertion of the fruit-stalk mosses are divided into two sections, Acrocarpi, or those mosses which have the fruit-stalk terminating the main stem, (4,) as in *Pottia truncata*, and Pleurocarpi, or those mosses which have the fruit-stalk arising from the side of the stem, (5,) as in *Hypnum rutabulum*.

The fruit-stalk, which is always present, varies in length; in some cases, as in *Phascum serratum*, it is very short, in other cases it may be long and conspicuous; it is usually smooth, but sometimes the surface is distinctly roughened or granulated as in *Hypnum rutabulum.* It may be straight or variously curved.

The base of the fruit-stalk is surrounded by leaves which in some species differ remarkably in both form and structure from the other leaves of the plant. These are the perichætial leaves, and the character of these leaves often forms a special feature in the description of mosses. If these leaves are carefully removed it will be seen that the base of the fruit-stalk is surrounded by a membranous sheath, the vaginula, (10 *c*,) already mentioned; this is usually smooth, but in some species it is more or less clothed with hair-like processes, and these minute differences are in some cases great aids in the discrimination of nearly allied mosses.

At the top of the fruit-stalk is the capsule or urn, (4 *c*, 5 *b*,) and this organ presents great variety in its form, in some cases globose, *Phascum cuspidatum ;* pear shaped, *Leptobryum pyriforme ;* cylindrical, *Tortula aloides ;* straight, curved, or erect, *Tetraphis pellucida*, (12 ;) cernuous (curved to one side) as in *Hypnum rutabulum*, (5,) or pendulous as in many of the Bryums ; it may be smooth, striated, or furrowed.

In some species the capsule, (14 *b*,) is swollen all round at the base (14 *c*,) and this swollen part is called the apophysis, as in *Splachnum sphæricum* ; this apophysis may be seen at the base of the capsules of *Polytrichum commune*, but not so exaggerated as in Splachnum, sometimes the swelling is confined to a little bulging out of one side of the base of the capsule as in *Dicranum falcatum*, (13 *b*,) or in *Dicranella cerviculata* or *Ceratodon purpureus*, &c. ; the capsule is then said to be strumose.

The capsule is surmounted by a membranous hood called the calyptra, already mentioned as being developed from the upper portion of the fertilised archegonium, (10*a*, 17, 18.) In some genera, such as the Bryums, this hood falls away early, and hence is not seen upon the mature capsule, but in many other genera, such as Tortula, Hypnum, &c., it is persistent and may readily be seen. In the act of separation from the lower part of the archegonium, or vaginula, the calyptra is sometimes irregularly torn at its base as in *Grimmia apocarpa*, or it may be evenly torn as in *Encalypta vulgaris.* In both cases the calyptra is termed mitriform or mitre-shaped (10 *a*.) In many other mosses it is slit up one side, and is then said to be dimidiate, (Lat., *dimidium*, a half,) (18,) or it may be inflated as in Funaria, (17,) and these characters are constant. Usually the outer surface is smooth, but in some species it is papillose, and in others more or less densely clothed with hairs as in Orthotrichum and Polytrichum.

The mouth of the capsule is closed with a little lid called the operculum, (12 *a*, 13 *a*, 14 *a*,) and between the lid and the mouth of the capsule a ring of minute, highly hygroscopic cells frequently occurs called the annulus, (Lat., a ring.) The function of this ring is that of casting off the lid when the spores are ripened, and thus aiding their dispersion, but in many mosses, such as *Tortula unguiculata*, there is no annulus, and the lid is then cast off by the swelling of the contents of the capsule. The operculum is not always present, and here nature adopts other means to bring about the dispersion of the spores ; in the Andreæas or split-mosses, (19,) the capsule splits into four valves, (19 *a*,) and in the Phascums or earth-mosses the capsule bursts irregularly, or rots away and in its decay liberates the spores.

The lid or operculum varies in form, being sometimes convex, as in many of the Bryums, or conical, (4 *a*, 12 *a*,) as in *Physcomitrium pyriforme*, *Tetraphis pellucida*, &c., or it may be rostrate, (beaked.) (13 *a*,) as in *Dicranella heteromalla*, &c.

When the lid is removed, or has been cast off naturally, the inner structure of the capsule may be seen, and in some mosses, such as *Pottia truncata*, the mouth will be found to be naked, (4 *c*,) but in many other cases it will be seen to be surrounded by a delicate fringe-like appendage, called the peristome, (12 *b*, 21 *b*,) (Gr. *peri* around, and *stoma* a mouth.) This fringe consists of minute tooth-like processes, which are always some multiple of 4 in number, from 4 to 64, and the number is always constant in the species. This fringe may be either single. (12 *b*,) or double, that is there may be an outer, (20 *a*,) and an inner row, (20 *b*,) of these tooth-like processes. The teeth of the peristome vary in form and structure; in some cases, as in certain of the Weissias, they are very rudimentary; in others, as in Funaria, they are elaborately developed, and beautifully marked with transverse and longitudinal striæ or markings. The teeth are often simple, (12 *b*,) but may be cloven, as in *Dicranella heteromalla*, sometimes straight, as in *Didymodon rubellus*, or much twisted, as in *Tortula muralis*, &c. In the Polytrichums the mouth of the capsule is closed by a beautifully reticulated diaphragm, to which the teeth of the peristome are attached, (21 *c*.) This is peculiar to the family of Polytrichaceæ, so far as British mosses are concerned.

The study of the development of mosses is one of very great interest, and worthy of the attention of all biological students. Space is too limited to allow the matter to be dealt with here in anything like fulness, and I must, therefore, refer those students who desire fuller information to that grand work of Hofmeister (Ray Society's publications) on the Germination, Development, and Fructification of the Higher Cryptogamia, pp. 129-181, where a most elaborate and exhaustive account will be found.

ON THE RELATION OF THE CRUST TO THE INTERIOR OF THE EARTH.*

BY FRANCIS D. LONGE, F.G.S.

The interior of the earth is beyond the reach of direct observation, but Nature brings within our limited scope much evidence upon which a general theory may be founded as to the relation between it and the crust. That the earth was once in a fluid state from heat is an essential part of the theory of cosmogony established by Laplace, Newton, Herschell, and others.

* Abstract of a Paper read April 18, 1878, before the Cheltenham Natural Science Society.

This doctrine has for a long time been accepted by geologists as a fundamental principle of their science. Their researches not only corroborate this theory, but supply evidence which, coupled with the results of observation as to movements now going on in the earth's crust, shows that the process of cooling and consolidation is still in operation.

The phenomena of volcanoes would appear to afford direct evidence of the interior of the earth being still in a state of intense heat. In a paper submitted to the Royal Society in 1874, Mr. Robt. Mallet attributed the heat by which volcanic eruptions are produced to the effect of friction resulting from the crushing of solid rocks in the cooled surface. This view had not met with much acceptance; but, as Mr. Mallet accounted for the crushing of the crust by the contraction of the interior in the process of cooling, his theory was not inconsistent with the general theory of a cooling earth.

The undulatory movement of the earth's crust, shown by the elevation and depression of the surface, is conclusive evidence that the interior of the earth is not solid. There is abundant evidence of such movements in former geological periods, and at the present time. In the Malvern area a great part of the older rocks have sunk, and new red deposits have taken their place. At Swindon, in Wiltshire, the quarries disclose the remains of an old land surface, which first sunk and became covered with deposits of the cretaceous sea, and was then re-elevated for the enjoyment of terrestrial beings. The Suffolk coast shows similar movements in recent geological times. Sir C. Lyell, Professor Ramsay, and other authorities testify to similar movements in recent times in Africa, South America, Northern Asia, British Columbia, and the Pacific, and particularly to the elevation of Sweden and the Baltic, now progressing at the rate of 2½ feet in a century.

At a recent meeting of the Geological Society, Captain Fielden, the Naturalist to the recent English North Polar Expedition, stated that at the present time the coasts of Greenland and Grinnell Land are steadily rising from the sea. These movements prove conclusively that the earth is not yet solid. They would be explained, if the earth consisted of a mass of mixed substances, such as we are acquainted with as forming its crust, still for the most part in that viscid or yielding condition, which we know that they assume when passing from the molten to the solid state in cooling, such for instance as lava, glass, iron, basalt, &c.

Can the earth's pristine heat be still retained in it? Assuming that it was once heated, its heat could only escape through the crust. If the crust consisted of absolutely non-conductive materials it would never lose its heat. The crust is not of such a character, but the materials which form its bulk are slow conductors. The escape of heat would become slower as the crust thickened.

Observations of underground temperature show that the heat increases at the rate of one degree Fah. for every 60 feet. This gives a temperature of 2,500 F. at about thirty miles from the surface. At such a temperature lava would be as liquid as water. Pressure may condense heated matter but cannot convert matter which is in a fluid or viscous state from heat, into a solid. It would retain the moving property of a fluid so long as it retained its heat.

If the behaviour of the internal mass of the earth during the process of cooling was similar to that of lava or basalt,

(1.)—The solidification would commence at the surface.

(2.)—The matter in passing from the liquid or viscous to the solid state would attach itself to the parts already solid, *i.e.*, to the under surface of the already solid crust.

(3.)—The matter in becoming solid from loss of heat would for the most part contract.

(4.)—The process of cooling and solidification would not take place regularly, owing to the difference in temperature at which different substances become solid, and the difference in the conductivity of different parts of the crust overlying the heated matter.

(5.)—The solidified portion or the crust would press on the liquid or viscid interior until it became self-supporting.

(6.)—Gravity would require the several parts of the crust to be in equilibrium. The disturbance of the equilibrium of the crust by irregularity in its growth would be restored by the action of gravity upon it.

The elevation of continents and mountain chains, and the formation of deep oceanic areas and other synclinal depressions, are produced by the long continued action, in a particular direction, of lateral or horizontal pressure or compression resulting from the sinking of the crust on the contracting internal mass on which it rests. The effect of lateral pressure is shown both by the minute plication of laminated strata, as in the cuttings through Lias clay of the new railway between Cheltenham and Banbury, or in the folding of a large expanse of surface as shown by Professor Dana to have been the way in which the Alleghany Mountains were formed. The parallelism of mountain ranges, and of the outcrop or strike of strata in the same area, which results from the action of lateral pressure upon the crust in the same direction, is well illustrated in England.

The change in the movement by which any area which has been previously elevated undergoes depression, or *vice versa*, implies a change in the conditions by which the action of lateral pressure is directed. Such changes are caused by irregularity in the growth of the crust and the consequent disturbance of its equilibrium. Such changes could not be produced by the mere settlement of dead materials into a more compact state. Such a process of consolidation would commence at the centre and progress upwards, and when the interior had once become compact, no undulation of the surface would be possible. With such a condition of the interior the surface of the earth could not be changed. It would be levelled by denudation, and the ocean would spread over the whole. Terrestrial life would cease to exist for want of a footing. A self-supporting crust would be equivalent to a solid earth. The undulatory movement of the crust was greater in early geological periods than now. The Cambrian and Silurian strata comprise deposits of some six miles in thickness, which were evidently laid in shallow seas. Their great thickness was attained by the rapid and long-continued subsidence of the sea bottom, at a time when the crust was thin, and the contraction of the interior from the radiation of heat was progressing more rapidly than afterwards.

Volcanic phenomena have also changed in respect of the amount of igneous rock erupted, which is much less now than in early geological periods. This change would be the natural result of a thickening of the crust, and the consequently increased distance through which the molten matter has to pass before it reaches the surface.

The question is being much discussed by geologists at the present time, owing to the evidence which recent researches in the Arctic regions have furnished of a temperate or sub-tropical vegetation having flourished there in recent geological periods, which can only be satisfactorily explained by a change in the geographical position of the poles. Such a change would result from the displacement of the axis of figure under the process of cooling referred to in this paper, and its readjustment to the axis of rotation by the rotatory force.

METEOROLOGY OF THE MIDLANDS.

THE WEATHER OF JUNE, 1878.

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

The wet period which caused such an excess of rainfall in May continued until the middle of June. About the 18th of the latter month, however, (Waterloo day,) a welcome change set in. The continuous rains ceased, and the temperature rose steadily until on the 26th and 27th it exceeded 90° at several stations. From one or two places returns of 95° and upwards have reached us, but these can scarcely be true shade temperatures. Unless the thermometers are placed in a clear and open space, at a fair distance from walls, &c., and thoroughly screened by double louvres both from the sun's direct and reflected rays, their indications are not to be relied upon. The solar radiation thermometer (black bulb *in vacuo)* indicated 142° at Leicester, on the 23rd; 141° on the 21st and 26th; and 150° at Spondon, on the 26th.

The effect of the heat and direct sunshine of the last ten or twelve days of June upon the crops was great and immediate. Wheat and barley changed from a sickly yellow to a deep green. The grass crops are very promising, and in the orchards there is every prospect of an abundant crop of apples, pears, and plums.

During this hot period thunderstorms were frequent and violent, and produced heavy falls of rain in a short time. At Stroud 1in. fell in an hour, on the 17th; More Rectory, 1·05in. in 1½ hours, on the 8th; Larden Hall, ·55 in 1 hour, on 8th; ·42 in 30 minutes, on 23rd; Stokesay, ·77 in 45 minutes, on 8th; Burton, ·24 in 15 minutes, on 26th; Weston-under-Lyziard, ·77 in 45 minutes on 29th; Tamworth, 1·61 in 3 hours, on 29th; Henley-in-Arden, 1·27 in 20 minutes, on 26th; Stuffynwood Hall, ·24 in 30 minutes, on 26th; Sedgebrook, 1·23 in 3 hours, on 26th; Northampton, 1·25 in 50 minutes, on 26th; Bishop's Castle, ·84 in 45 minutes, on 8th; Cheltenham, ·39 in 20 minutes, on 23rd. The importance to engineers and others of a knowledge of these heavy falls of short duration is obvious, as the sewers, watercourses, &c., are often totally inadequate to cope with such emergencies.

Natural History notes are few this month, but from Burton Mr. Tripp reports lime in flower on 6th, and wild rose on 10th.

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.	3·51	1·03	17	14			39·0	15
Cheltenham	R. Tyrer, Esq.	2·49	·47	2	15	85·8	26	42·0	6
Stroud	S. J. Coley, Esq.	3·75	·97	17	13	84·0	26	45·0	5 & 8
SHROPSHIRE.									
Haughton Hall, Shifnal	Rev. J. Brooke	2·57	·53	29	13	83·0	26 & 27	38·0	6
Whitchurch	A. B. George, Esq.	3·95	·93	8	13	85·0	27	42·0	5
Woolstaston	Rev. E. D. Carr	3·92	·70	8 & 11	14	84·5	26 & 27	43·0	1 & 14
Leaton Vicarage, Shrewsbury	Rev. E. V. Pigott	2·91	·73	8	14	88·0	26	35·0	6
More Rectory, Bishop's Castle	Rev. A. Male	3·49	1·05	8	18	84·0	26	37·0	6
Larden Hall, Much Wenlock	Miss F. R. Boughton	4·20	·91	29	15				
Bishop's Castle	E. Griffiths, Esq.	3·65	·84	8	16	86·0	25 & 26	40·0	6
Cardington	Rev. Wm. Elliot	4·18	·78	11	15				
Adderley Rectory	Rev. A. Corbet	3·63	·92	9	17				
Stokesay	Rev. J. D. La Touche	3·92	·80	8	17	86·1	26	41·2	15
HEREFORDSHIRE.									
Whitfield	W. Wheatley, Esq.	3·03	·48	10	17			36·0	15
Stoke Bliss	Rev. G. E. Alexander	2·12	·43	11	11	86·0	29	43·0	5
WORCESTERSHIRE.									
Orleton, Tenbury	T. H. Davis, Esq.	3·19	·49	11	16	86·0	26	38·0	6
West Malvern	A. H. Hartland, Esq.	2·39	·46	9	14	92·0	26	42·5	5
Pedmore	E. B. Marten, Esq.	2·65	·52	9 & 11	13	89·0	28	43·0	5
Stourbridge	Mr. J. Jeffries	2·89	·49	11	13	90·0	25 & 26	42·0	20
St. John's, Worcester	G. B. Wetherall, Esq.	1·73	·40	3	11	84·0	26 27 28	40·0	1
STAFFORDSHIRE.									
Thorganby Villa, Wolverhmtn	G. J. C. Broom, Esq.	3·85	·69	29	15				
Barlaston	W. Scott, Esq.	3·83	·77	12	15	86·1	26	34·0	5
Amblecote	Mr. J. Robins	2·53	·46	9	12				
Dudley	Mr. J. Fisher	3·39	·61	9	13	94·0	26	42·0	5
Sedgley	Mr. C. Beale	3·01	·49	9	13	83·0	26 & 27	44·0	5
Kinver	Mr. W H. Bolton	2·57	·54	9	12	87·0	26	39·0	5
Walsall	Mr. N. E. Best	3·55	1·21	29	15	85·0	27	44·0	5
Grammar School, Burton	C. U. Tripp, Esq.	3·14	·91	3	15				
Patshull Gardens	Mr. T. W. Dell	3·38	·71	4	10	91·0	26	35·0	6
Weston-under-Lyziard R'tory	Hon. and Rev. J. Bridgeman	3·51	1·12	29	14	92·0	25	38·0	6
Wrottesley	E. Simpson, Esq.	3·71	·56	3	13	87·0	27	41·5	15
Tamworth	W. Arnold, Esq.	4·33	1·61	29	16				
Tean Vicarage, near Cheadle	Rev. G. T. Ryves	3·75	·75	12	14			36·0	6
The Heath House, Cheadle	J. G. Philips, Esq.	3·67	·77	12	16	82·0	26 & 27	41·0	6
Alstonfield Vicarage	Rev. W. H. Purchas	3·94	·76	5	10	83·1	27 & 28	34·0	6
WARWICKSHIRE.									
Coundon, Coventry	Lieut.-Col. R. Caldicott	3·69	·90	29	16	85·0	26	47·0	1
Coventry	J. Gulson, Esq.	2·86	·66	9	12	81·0	26 & 27		
Bickenhill Vicarage	W. R. Capel, Esq.	3·83	·49	11	17	81·0			
St. Mary's College, Oscott	Rev. S. J Whitty	2·35	·51	29	16	84·0	26	40·9	6
Henley-in-Arden	T. H. G. Newton, Esq.	5·44	2·37	27	16	90·0	26	40·0	6
Rugby School	Rev. T. N. Hutchinson	3·15	·99	26	14	85·2	26	41·0	6
DERBYSHIRE.									
Buxton	E. J. Sykes, Esq.	4·15	1·15	4	16	80·4	26	36·0	2
Stoney Middleton	Rev. U. Smith	3·05	·75	4	11	83·0	27	30·0	5
Trent College	Rev. T. F. Fenn, M.A.	2·11	·50	8	9	89·0	25	39·0	1
Fernslope, Belper	J. G. Jackson, Esq.	2·81	·56	4	11	87·0	26 & 27	41·0	2
Matlock Bath	R. Chadwick, jun., Esq.	4·20	1·05	4	13	81·5	27	37·0	6
Linacre Reservoir, Ches'field	C. E. Jones, Esq.	3·03	·87	4	10				
Willesley Gardens, Cromford	J. Tissington, Esq.	4·16	·92	4	10				
Stuffynwood Hall	Mr. R. Rolfe	2·69	·81	4	12	88·0	26	39·0	1
Spondon	J. T. Barber, Esq.	3·37	1·09	26	11	94·0	26		
YORKSHIRE.									
Tickhill, Rotherham	B. J. Whitaker, Esq.	2·23	·74	5	13	90·0	28	35·0	2
NOTTINGHAMSHIRE.									
Hodsock Priory, Worksop	H. Mellish, Esq.	2·14	·68	4	11	86·0	27	35·2	2
Grove House, Mansfield	W. Tyrer, Esq.	2·40	·58	4	13	88·6	27	38·2	2
Tuxford	J. N. Dufty, Esq.	2·13	1·05	4		91·0	26	41·0	15
LEICESTERSHIRE.									
Loughborough	W. Berridge, Esq.	1·80	·39	4	10	87·0	26	40·3	1
Ashby Magna	Rev. E. Willes	2·29	·65	9	11	87·0	26	42·0	6 & 15
Market Harborough	S. W. Cox, Esq.	2·25	·70	9	16	83·0	26 & 27	38·0	1
Kibworth	T Macauley, Esq.	1·82	·39	2	11	88·0	19		
Town Museum, Leicester	W. J. Harrison, Esq.	1·70	·44	9	15	85·0	26 & 27	41·5	6
Belmont Villas, Leicester	H. Billson, Esq.	1·73	·46	9	14	87·8	27	41·8	6
Syston	J. Hames, jun., Esq.	1·91	·44	9	14	93·0	27	40·0	2 & 6
Waltham-le-Wold	E. Ball, Esq.	2·03	·48	4	12	86·0	26	46·0	1
Little Dalby Hall	G. Jones, Esq.	1·55	·31	2	11	98·0	26	46·0	2 & 15
Coston Rectory, Melton	Rev. A. M. Rendell	2·50	·48	4	14	83·5	26	32·2	2
Belvoir Castle	W. Ingram, Esq.	2·63	·70	5	13	88·0	27	39·0	15
Foxton Locks	Union Canal Company	1·96	·45	26	8				
NORTHAMPTONSHIRE.									
Towcester Brewery	J. Webb, Esq.	3·26	·69	2	15				
Castle Ashby	R. G. Scriven, Esq.	2·38	·50	3	13	86·0	26	41·0	11
Sedgebrooke	C. A. Markham, Esq.	3·31	1·23	26	14	95·0	27	32·6	15
Kettering	J. Wallis, Esq.	2·46	·58	29	13	84·0	27 & 28	43·0	2
Althorpe	W. F. Jakeman, Esq.	2·94	·61	17	13	85·0	26	38·0	1
Northampton	H. Terry, Esq.	3·84	1·40	26	15	87·0	26	38·0	16
RUTLAND.									
Burley-on-the-Hill	W. Temple, Esq.	1·82	·31	26	12	86·0	26	36·0	14
West Deyne, Uppingham	Rev. G. H. Mullins	2·36	·67	26	10	87·9	26	39·1	15
Northfields, Stamford	W. Hayes, Esq.	1·45	·32	9	7	85·0	26	40·0	1
Addington, Bucks	J. Mathison	2·19	·54	13	13	86·0	27	37·0	15
Radcliffe Observatory, Oxford	Mr. Lucas	1·92	·40	16	12	87·1	26	40·3	11
Spital Cemetery, Carlisle	T. Bell, Esq.	3·02	1·12	2	14	90·0	27	35·2	13
Ventnor Hospital	H. Sagar, Esq.	·76	·26	10	7	81·3	27	47·0	16
Altarnun Vicarage	Rev. G. Tripp	1·42	·89	11	15	88·0	27	38·0	1

Reviews.

Flowers: their Origin, Shapes, Perfumes, and Colours. By J. E. Taylor, Ph.D., F.L.S., F.G.S., &c., illustrated by thirty-two coloured figures, by Sowerby, and 161 woodcuts. London: Hardwicke and Bogue. Price 7s. 6d.

The very interesting book, the title of which is given above, is written by the well-known Editor of "Hardwicke's Science Gossip." It is intended chiefly for such as have the desire but lack time and opportunity to make themselves acquainted with the varied and suggestive results of modern botanical investigation, otherwise than second hand. Dr. Taylor has summarised the more important of these results, and done so in a manner which will please most botanists and impart valuable and novel ideas to many whose knowledge of the recent labours of Dr. Charles Darwin and others is but limited. The first chapter is devoted to a consideration of what the author calls the old and new philosophy of flowers. The former had for one of the principal articles of its belief that flowers and plants in general were created solely for the delight or use of man. The teachings of the latter put this consideration in a subordinate place, and indicate that all the qualities possessed by plants of every description, flowering and flowerless, but especially the former, are just those which are of essential importance to the plants themselves. "Thus," to quote our author—

"Most flowers require crossing, and the floral machinery of even our common British wild flowers is of the most unlooked for and complex description, usually designed to *prevent* self-fertilisation and encourage or ensure *crossing.* Among some of the chief of these devices may be mentioned the following:—Absolute barrenness when the pistil is fertilised by the pollen of the adjacent stamens; pistils ripening before the stamens, or stamens before the pistil; *dimorphism* and *trimorphism*, or flowers possessing pistils and stamens of two and three lengths, all intended for the special purpose of crossing; the existence of *monœcious* and *diœcious* flowers, or those in which we have staminate and pistillate flowers on the same plant, but with the pistils and stamens separated from one another, and those in which one plant bears staminate flowers only and the other pistillate flowers. Most of these contrivances are not of a nature to invite attention; and some of them have escaped the notice of botanists for years, or had been remarked without being understood. We can, therefore, readily understand why they should be passed over by those who are totally ignorant of botanical structures. And yet it is these very organs and their arrangement on which the perpetuity of the species depends. . . . . The colours and perfumes, and in many instances even the *shapes* of flowers, have reference *only* to the visits of insects. And in proportion to the brilliancy or size of the corolla, or the sweetness of the perfume, is the necessity of the plants possessing them to be crossed. On the other hand, inconspicuous flowers are either self-fertilised or only occasionally require to be crossed; whilst the largest number of flowers, such as the grasses, sedges, rushes, &c., have no corolla at all, and do not require insect aid to carry the pollen from plant to plant, so as to beneficially cross them. Modern botanists find it comparatively easy to group all plants into two great divisions—those crossed or fertilised by insects and those by the wind. The terms *entomophilous* and *anemophilous* are applied respectively to these two classes. . . . . To such an extreme is the division between wind and insect-fertilised flowers carried out, that the microscopist can, without much difficulty, assign even pollen-grains to one or the other of these groups. Thus, the pollen usually produced by entomophilous plants have their surfaces roughened over with minute points or other means of readily attaching them to the hairy bodies of insects. On the other hand, the pollen-grains of anemophilous plants are exceedingly light, usually round or lenticular, and expose as much surface as possible to the force of the wind which blows them about. . . Darwin has shown that in some instances the relationship between certain insects and certain plants has been so narrowed that if the insects were absent from any locality the plants necessarily would be absent also. . . . Such a special connection between one group of the animal and one of the vegetable world we affirm need not interfere with man's enjoyment of the presence of either. It may operate as a check to his self-conceit to feel that flowers have not been primarily intended for himself; but, if his be a well-regulated mind, the marvellous inter-relationship between insects and flowers which science has thus brought to light will throw an additional halo of poetic interest over these unconscious agents, which, acting through blind instincts, have made the world more beautiful for those who can admire it." (Pp. 13-21.)

The chapters which follow relate to "The Geological Antiquity of Flowers and Insects," "The Geographical Distribution of Flowers," "The Structure of Flowering Plants," "Relations between Flowers and their Physical Surroundings," "Relations between Flowers and the Wind," "The Colours of Flowers," "The External Shapes of Flowers," "The Internal Shapes of Flowers," "The Perfumes of Flowers," "Social Flowers," "Birds and Flowers," and "The Natural Defences of Flowering Plants." Exception will, we think, be taken to some of Dr. Taylor's statements, and it would, perhaps, have been prudent had he been a little less positive in places. The tone of the book will make it acceptable to many who would probably be deterred from considering the subjects dealt with if presented as they undoubtedly would be by many modern botanists. The wide range over which Dr. Taylor travels will be gathered from the titles of the chapters quoted above. In each he has managed to compress much interesting, and, for those for whom the book is primarily intended, a good deal of novel information. As a popular and well formulated statement of the results won by the laborious researches of some of our foremost biologists, this volume has an undoubted value which ought to ensure for it a large circulation. There are many woodcuts and some coloured illustrations, not a few of which will be found most useful in elucidating the text.

Practical Taxidermy: A Manual of Instruction to the Amateur in Collecting, Preserving, and Setting-up Natural History Specimens of all kinds. By Montagu Browne. London: "Bazaar" Office, 32, Wellington Street, Strand. Price 3s. 6d.

In this practical manual by Mr. Montagu Browne, Naturalist, Birmingham, the amateur taxidermist will find clear, concise, detailed instruction in "the art of preparing and preserving the skins of animals for cabinets, so as to represent their natural appearances."

The first chapter is of an exceedingly interesting character, giving in a complete form the history of the rise and progress of the "Skin Art," as Mr. Browne rather loosely translates it, and to correct which we have above given Dr. Ogilvie's definition of Taxidermy in full.

In the second chapter, which treats of trapping and decoying birds and animals, we should prefer that the author should substitute the word "beasts" for "animals" in the title, as he is liable to be told that he is not a believer in the animalism of birds; also, it would be better to alter the title to "decoying and trapping," as it is essential that the animal should be enticed to the trap, or decoyed into it before it may be trapped. The opening observations in this chapter do, indeed, constitute a golden rule, and ought to be engraved on every rifle and fowling piece in use. Then, perhaps, the hideous scenes at Hurlingham, and other pigeon-murdering places, would cease, and sports having a healthier moral tone take their place. Mr. Browne has rendered good service in this chapter; it is a pleasure to read the details of making and setting each form of snare or trap, for the descriptions are lucid, easily grasped, and well illustrated, points which place this chapter above the average of such technical works; indeed, the value of such descriptions as those of traps, &c., and the methods employed in skinning and stuffing, are such as must be heartily appreciated by any industrious amateur or even professional taxidermist.

The question of the number of tools employed must rest, of course, with the amateur himself, and may depend upon the means at his command, but although so few are here recommended, the reader must remember that the educated fingers of an intelligent taxidermist, who knows well the habits and living appearances of the creatures he works upon when dead, supply the place of a boxful of bird-stuffing implements, however beautiful or costly.

The most important part of the book lies in the chapter on preservative media, which contains some very useful formulæ, comprising all the more important soaps, pastes, powders, solutions, and washes. Some of these are formulæ arranged and tested by the experience of the author, and which have enabled him to get up a large amount of first-class work, some of which those who saw the fine collection of preserved specimens at the recent Conversazione of the Midland Naturalists' Union in the Town Hall, Birmingham, will remember and appreciate. In this chapter, Mr. Browne starts an argument which he terms "Common Sense *versus* Arsenic," which, let us hope, will prove of real value to the members of his craft, by breaking down the old, foolish, and dangerous practice of using arsenic in any form. There cannot be a doubt in the mind of any experienced person that the destroyers of animal skins, more especially Tinea, cannot face the powerful influence of light, and that a well-made cabinet, with plenty of light in its interior, will preserve properly cured and well-mounted specimens for a very long time, and this with or without arsenic. We call Mr. Browne's attention to the use of the word "meat" on page 57 and other parts of the book, and suggest that it is not so proper or useful as "flesh."

We quite concur in the idea that if a bird's head is to regain its proper appearances after being skinned so far as the eyes or root of the beak, the calvarium, or upper part of the skull, at least, should be retained undamaged. With regard to modelling the faces of animals, we should like to know whether the author has ever tried to fill up the hollows caused by the removal of the muscular and cellular tissues, with ordinary or even pipe clay, which is capable of such very nice finger and thumb manipulation after the skull has been replaced, as we find on page 79 that he advocates the use of peat and plaster of Paris, which latter is sure to absorb whatever moisture may remain in the skull, skin, or case, and ultimately crumble to pieces, so spoiling the specimens in which it has been employed. A better method, where the skin is of a very greasy nature, as in dogs, &c., is to mix plaster of Paris with sufficient boiled linseed oil to form a thick putty, which resists all damp, is capable of much finger manipulation, and dries as hard as a stone, besides being non-poisonous and possessing the requisite lightness which, in the ordinary lead putty are still desiderata.

With regard to plaster casts of fruit, &c., (pages 107 and 108,) a much neater and readier method of making the mould is to mix a sufficient quantity of bees' wax with rozin in a pipkin over a slow fire. It must be used whilst just lukewarm, by either dipping the fruit, say an apple, until it is sufficiently coated, or by painting the surface of the apple until sufficient adheres to form a good, strong coating. When cold, (dipping in cold water will readily make it so,) the whole can be cut through with a sharp knife, the halves of the fruit come out easily, and a perfect mould in two halves is thus obtained. Fasten the halves of the mould together with string, and smear a little of the warm material over the joint to hold it together, and cast your model in the usual way with liquid plaster of Paris. When set, place in a little warm water, when the mould easily strips off, leaving a model of the most perfect kind, and at a small expense, for the mould can be melted up and used over and over again.

The remainder of the book contains many ingenious suggestions, which the practical taxidermist, as well as the enterprising amateur, would do well to carry out. Altogether, we must congratulate ourselves and Mr. Browne on the effect his book is likely to have upon taxidermy in general. The rubbish which for many years we have endured at the hands of self-styled taxidermists will, we hope, vanish before a more enlightened and careful manipulation of those beautiful creatures whose lives are so often sacrificed to the vanity of the collector, the sportsman's bag, and the follies of fashion. We sincerely hope that Mr. Browne's efforts to bring first-class specimens of his art into the houses of town dwellers will have a beneficial and humanising influence, and that his book, which in this particular branch of literature has no rival, will be well and widely read.—Wright Wilson, F.L.S., &c.

Report of the Rugby School Natural History Society for 1877. Rugby: W. Billington. 1878.

This is a really interesting, well-written, well-printed, and capitally illustrated volume. It is, we think, the twelfth report of the Society, (this should be stated on the cover,) and is not behind any of its predecessors in the additions which it makes to the Natural History of the neighbourhood of Rugby, or in the evidence which it affords of the thorough and interesting manner in which Natural Science is taught in the great School with which the Society is connected. Of fifteen papers read during the year, nine are by present members of the School.

Of these we note one on "Continuous Edges," by H. Weisse, which is highly ingenious and interesting. Others on "Snakes," by R. C. Cordiner; "Local Names," by H. F. Wilson; and "Autumn Moths," by J. Lea, show good powers of observation. The Rev. T. N. Hutchinson contributes an article on "Corroded Limestone in Yorkshire," illustrated by two beautiful plates drawn on stone by himself. The same contributor has also given a graphical representation of the Meteorology of the year as a frontispiece, but to this the lithographer has altogether failed to do justice. An interesting note on "Beavers in Bute" is illustrated by a humorous papyrograph drawing of "a beaver family engaged in the production of one of their well-known beaver hats," in which we recognise the skilful hand which enriched the 1875 report with some capital drawings of owls. The reports of the section include exhaustive lists of Rugby fossils, and of insects, birds, and new plants noted during the year. The report concludes with an account of the new Temple Observatory, where Messrs. J. M. Wilson and G. M. Seabroke, assisted by Mr. Percy Smith, will, we hope, long continue the excellent work which they did under the old and cramped conditions. The Observatory, as is well known, contains the Rev. Mr. Dawes' ("eagle-eyed Dawes") magnificent 8¼in. refractor, Alvan Clarke's masterpiece, which was purchased (a great bargain) by Mr. Wilson, for 400 guineas, and presented by him to the school. Altogether the report shows a most satisfactory state of things, and goes far to explain the numerous distinctions won at the Universities in Natural Science by Rugby boys of late years. If Martin (see "Tom Brown") ever revisits his old school, his delight and satisfaction must, we should fancy, be unbounded.—W. J. Harrison.

The Birmingham Saturday Half Holiday Guide, with a Map. Third Edition for 1878. Birmingham: W. Walker. Price Sixpence.

We wish there was as useful a guide book to the pleasant and interesting places within easy reach of every large town as the one named above is to the districts to which it relates. The plan of the book is admirable. From Birmingham, as a starting point, the places within easy walking distance surrounding the town are first disposed of: next, more distant places are described, most, however, being such as may be easily reached by a railway ride. Then follow a series of most excellent and suggestive papers on the Natural History of the locality, mainly contributed by members of the Birmingham Natural History and Microscopical Society. These articles relate to Botany, Conchology, Entomology, Geology, and Ornithology, while one, which is particularly good, points out the objects easily found which can only be examined by means of the microscope. Boating, Bathing, Bicycling, Cricket, and Fishing, as suitable sports for half holidays, are next dealt with, and complete one of the cheapest, most useful, handy, and interesting books ever written for the encouragement of healthy out-door occupations. The inception and completion of this volume are due to Mr. Joseph Sturge, who has spared no pains to make it a thoroughly trustworthy guide to the holiday seeker. There is a good map (reduced from the ordnance map) of the country for more than twenty-five miles around Birmingham.

Correspondence.

Combined Work.—In reply to F. L. I hope to state, in our September number, my scheme for a combined examination of the Glacial Deposits of the Midland Counties, by the members of the Scientific Societies comprised in the Midland Union. In the meantime I shall be glad to receive suggestions from all who are interested in the subject.—W. J. Harrison.

The Magnophone, so called (page 187.)—It is to be hoped that this name will not be adopted, as it will add one more to the already sufficiently long list of incorrectly formed words. Magnophone is a hybrid, the first element being derived from the Latin, and the latter from the Greek language. If it is required to invent a word which shall mean "an instrument for increasing sound," it will be easy enough to do so. The word Megaphone has also been used; this is incorrect too; Megalophone is not liable to the same objection, and may be used if it can be accepted as expressing the required idea.—W. B. G.

Spurious Antiquities.—We have just had forwarded for inspection and to report thereon a number of leaden figures, vases, &c., some of which bear the date 1001, and others 1010. They are evidently of the same description as those which were "sown" during the construction of the Thames Embankment, some ten or fifteen years ago. A medal of *Claudius Cæsar* cast in brass, which accompanies them, is of rather better execution, but still is plainly enough a *modern antique*.—Leicester.

Pre-Glacial Man.—Walking through the Jermyn Street Geological Museum a few days ago I noted a remarkable addition to the case of stone implements. This is a palæolithic implement of yellowish flint, about three inches in length and of a type between ovate and pointed. It is still embedded in a reddish brick-earth. The accompanying label describes it as a "Palæolithic implement embedded in matrix of loam below the chalky boulder clay at Botany Bay Brickyard, Weeting, near Brandon." It was found by Mr. S. J. B. Skertchley, of the Geological Survey. As the chalky boulder clay of the eastern counties marks the height of the Glacial Period, it is evident that the finding of an implement undoubtedly wrought by human hands, *beneath* that boulder clay, is a satisfactory indication of the existence of man prior to or during the Glacial Period. We trust Mr. Skertchley will at no distant date make public the full details of his most interesting and important discovery.—W. J. H.

Cuckoo.—I do not know whether it has ever been noticed by your readers that the cuckoo is extremely active previous to rain. I have frequently noticed this during the spring, and could always reckon upon rain within two hours of his singing.—E. Griffiths, Bishop's Castle.

Cuckoo.—In answer to your correspondent, N., I beg to say I have many times heard the cuckoo give the note mentioned, but have always concluded that it did so when alarmed. The first two notes are sounded somewhat slowly and the next four *very* much more quickly.—Observer, Stroud.

Cuckoo.—The additional "Cucks" in the song of the cuckoo, mentioned by "N." in the last number of the "Midland Naturalist," are by no means uncommon, and may be heard most frequently when the bird is chasing another, or being itself chased; or sometimes—but more rarely—it appears to be uttered from very wantonness, a perfect volley of "Cuck-Cuck" being shouted out before the final "o-o."—Montagu Browne.

CUCKOO.—In answer to your correspondent "N.'s" enquiry, (p. 198,) I beg to say *it is quite common* for the cuckoo to repeat the first part of its note, or cry six or seven times in rapid succession just before its departure from our island; in fact, the cry "N." refers to is a sure indication of the bird being about to leave us. I cannot give a reason for it. It may, perhaps, be interesting to some to know that I have obtained a cuckoo's egg in the south of England as early as March 3rd, though the bird is seldom heard to utter "cuckoo" till about the 14th or 15th of April; and for some days after that the sound is exceedingly hoarse and indistinct.—J. R. THOMPSON, Tamworth.

REDPOLL.—In answer to Mr. Rothera, although it must be conceded that properly speaking the lesser redpoll, common redpole, lesser redpole linnet, pea linnet, which are some of the common names for *Linaria rufescens*, (Viell.,) is the bird we intend when speaking of the "redpoll," yet arguing from analogous cases the Act would, I think, be found to embrace *all* birds coming under the general term "redpoll," *i.e.*, the "common," "gray" or "brown" linnet, *Linaria cannabina*, (L.,) which is really a "greater" redpoll, the *L. rufescens* instanced above, and also the mealy redpoll, *L. canescens*, (Gld.)—MONTAGU BROWNE.

ORNITHOLOGICAL NOTES.—The time is coming when the song of the birds mostly ceases. We have still, however, some of the best of them, the blackcap and garden warbler. The blackbirds and thrushes are only too numerous, and, as usual, claim a large share of the fruit, which must be placed on the other side of their account against the quantities of worms and snails of which their regular meals are made. I have noticed that the song of the thrush is in many cases quite different in the summer months from what it is in early spring. Some of the birds seem to amuse themselves with a repetition of the syllables "Weetah, Weetah," several times, followed by a somewhat monotonous chirrup, which is often repeated, and becomes rather tiresome to listen to. I suppose these must be the young birds of the present season, whose musical powers are not fully developed. Their song is much less agreeable than that of the older and more experienced performers. We have a good many of the gold-crested wrens about us this year. They are the smallest of all the British birds, and are very active and pretty. The nest is generally woven into the leaves at the extremity of a pine or cedar branch. We have also a great number of magpies all round us. They are great thieves, and their depredations amongst our little chickens and ducklings have made them very unpopular with us. I expect the comparatively innocent hawks and owls (which are much more easily shot) often get credit for the crimes which are really due to the magpie. When the young birds are fledged their appetite is ravenous, and the parents find the young ducklings hatched under a hen, and with no mother to guard them, an easy prey. They have carried off about half a dozen of these little ones, besides chickens. I do not object to their taking a fair share of the thrush's eggs, a delicacy they are fond of in early spring, and we can spare them some young blackbirds and thrushes, the remains of which bear frequent witness against them, but when they are seen to fly away with the little ducks there is a reasonable outcry against them.—JOHN GULSON, Coventry. July 3rd.

SIDE-BLOWN EGGS.—Will any of your correspondents describe the method of blowing eggs with one side-hole only?—E. A. GREEN, Normanton Rectory. [The following extract from "Practical Taxidermy," by Mr. Montagu Browne, Naturalist, Birmingham, published at the *Bazaar Office*, London, will give the information our correspondent requires:—"Eggs, when procured, must have their contents removed. To do this they must first be drilled with little steel instruments called egg drills, which are made of various degrees of fineness, according to the size of the egg to be operated upon. Drills are to be procured from the various dealers, but can be made from steel wire softened in the fire and filed to a sharp three-cornered point—afterwards tempered to hardness—for the smaller eggs, or filed up for the larger eggs to the pattern of a 'counter-sink,' used for wood—indeed, the smallest-sized 'counter-sink' made, to be procured at any ironmonger's, will do very well for eggs the size of a hen's. To use these drills, rotate the point by 'twiddling' the drill between the finger and thumb, making only one hole, and that in the centre of the egg. When a nicely rounded hole is cut, the egg must be emptied by means of an 'egg-blower,' or blow-pipe; the point being introduced into the hole, the contents are blown out or sucked up into the bulb, which, when full, is emptied out at the other end. It sometimes happens that the egg is 'hard set.' The embryo must, in that case, be cut out with small curved scissors specially made. In all cases eggs should be thoroughly rinsed out with a solution of six grains of corrosive sublimate to an ounce of rectified spirits of wine. This may be sucked up into the bulb of the 'egg-blower,' and thence ejected into the egg, which is to be rotated, and what solution is left may then be sucked back and thrown away, or returned to the bottle. Great care must be taken, however, that the mixture does not pass the bulb and be drawn up into the mouth, as it is, of course, a deadly poison; the egg being placed (hole downwards) on blotting-paper, is to be left until dry."]

The Proposed Increase of the Subscription to the Midland Union of Natural History Societies.—I do not intend to discuss at present the question of this increase, but I desire to place on record an explanation personal to myself. As the Secretary of a Sub-committee appointed by the Birmingham Natural History Society, I conducted the negotiations which established the Union; and throughout these negotiations the principles laid down were those upon which the West Riding Union had been formed. The most important of these was one upon which I gave personal assurance to many of the Societies now in the Union that their pecuniary responsibility would be limited to one penny per member. Of the proposal made at the very first meeting of the Union to increase the levy to a shilling I knew nothing until, to my astonishment, it was made by the President of that Society on behalf of which I had acted. I therefore trust that any Societies of the Union who may see in this the appearance of a breach of faith on my part will understand that I am in no way responsible for it. I have expressed my sense of the false position in which I have been placed by resigning my seats on the Council of the Union, and on the Committee of the Birmingham Natural History Society.—Lawson Tait.

[The proposition to raise the subscription was fully discussed and adopted as a recommendation to the General Meeting at the Meeting of the Council which preceded the General Meeting, (as appears in the report,) as it had been found by the experience of the short time during which the Union had existed that the subscription fixed at the first meeting of the Council, on the assurance of Mr. Tait that it had been found to be sufficient by the West Riding Union, was utterly inadequate to carry on even the formal business of the Union, without taking into consideration the necessary expenses connected with the more important objects for which the Union was formed. Simultaneously with the above recommendation of the Council of the Midland Union, a circular was addressed by the West Riding Union to its members, (a copy of which was printed last month, at page 180,) stating it to be "perfectly obvious that the contributions paid by the affiliated Societies of one penny per member per annum are quite inadequate" for the objects of the Union. The proposal which Mr. Tait mentions was referred by the General Meeting to the different Societies to ascertain their opinions upon it, and surely the right of the Union to govern itself, and to make such alterations in its rules as may from time to time be found necessary, cannot be doubted. The subject is now under the consideration of the Societies, and will, as a matter of course, be decided according to the opinions of the majority.

Edward W. Badger, W. J. Harrison, Hon. Secs. to the Council.]

Gleanings.

Dr. Prescott Joule has been granted a Civil List Pension of £200 per annum.

Yorkshire College, Leeds.—The late Mr. Henry Brown, J.P., formerly of Bradford, has bequeathed to the College £5,000, for founding and maintaining scholarships.

A Natural History Museum is to be erected at Bolton. The foundation stone was laid early in July.

Diatomaceous Material.—*Hardwicke's Science Gossip* announces that Mr. Clark, the Secretary of the San Francisco Microscopical Society, is now enabled, by the kindness of the State Geological Survey, to offer return exchanges of the Pacific Coast diatomaceous deposits on receipt of any valuable microscopical material.

Science and Art Department.—Messrs. Chapman and Hall have just published for the Department, in one volume, a selection of the Free Evening Lectures, delivered in connection with the Scientific Apparatus Loan Collection, in 1876. Among these, as of local interest, we note Mr. Harrison's lecture "On the Study of Local Geology, with Illustrations from Leicestershire." There are also good papers by the Earl of Rosse, Professors Roscoe, Tyndall, Gladstone, Hull, Spottiswoode, &c.

Dipping Tube.—We desire to draw attention to a useful form of glass dipping tube, which can be obtained of Mr. Bolton, 17, Ann Street, Birmingham, for sixpence. It has a funnel top, on which some thin indiarubber is tied. There is a small hole in the side of the tube, which can be closed at will by one finger, when a slight touch of the stretched indiarubber cover of the funnel by another finger will, as may be desired, draw up or force out a column of water. The microscopist will find that under a dissecting microscope, with the help of this tube, he can readily pick out very minute and lively *Infusoria*, &c., for examination.

Excursion to the Bas Boulonnais.—The Geologists' Association has issued the programme of a week's visit (August 5—10) to the neighbourhood of Calais and Boulogne, there to inspect the eastern termination of our Wealden area, together with the Oolitic, Carboniferous, and Devonian rocks which crop out from beneath the former beds. The directors are M. E. Pellat, Dr. C. Barrois, and S. R. Pattison, Esq., and it needs little power of prevision to indicate a most pleasant and instructive week for those members who cross the Channel. England is evidently getting too small for our scientific societies !

A Roman Villa has recently been found during some excavations at Abinger, Surrey, on the property of Mr. T. H. Farrer. The remains at present disclosed consist of a portion of the atrium, or reception hall, with a pavement of small red tesseræ, more or less worn in parts, and now well secured from the weather by a thick thatch of straw placed carefully over it ; an apartment to the north-east of this, measuring 11ft. by 6ft., and divided from the adjoining ones by well-built walls of stone and brick, another room running eastward, of similar dimensions, and another below this, on the south side, of a square form measuring 11ft. 6in. by 11ft. Beyond, directly eastward, as well as southward, are indications of other chambers, but at present Mr. Farrer has not proceeded further in the excavations. Silver and bronze coins, red and white tesseræ, pottery, some pieces Samian, nails attached to portions of roof tiles, &c., have already been met with.

British Rainfall in 1877.—Mr. Symons' capital volume has been published since our last issue. It contains rainfall returns from about 2,000 stations in the British Islands, and is, as usual, an excellent example of the amazing perseverance and industry of the compiler. For the British Isles generally the year 1877 shows an excess of about twenty-seven per cent. *above* the average, the figures being as follows :—

	Depth in 1877.	Average.
England	46·22 in.	36·55 in.
Scotland	46·88 in.	37·32 in.
Ireland	43·14 in.	34·37 in.

The Collectanea Antiqua.—Mr. C. Roach Smith has just issued to his subscribers the first part of his seventh volume. It contains admirably illustrated papers on Roman Potters' Kilns discovered near Colchester ; Notes on some of the Antiquities of France ; Roman Leaden Seals, and British Oppida and Roman Castra. In the last-named paper the author points out how commonly the British or Celtic earthworks are confounded with Roman camps, and illustrates this by reference to the fortification at Lingfield Mark, in Surrey. The fine earthwork on Borough Hill, in Leicestershire, we consider to be certainly of British construction, and we trust to describe it, with some others in the same county, in a future number of the "Midland Naturalist."

Rhætic Fossils.—The beautiful star-fish, *Ophiolepis Damesii*, (Wright,) first found in England by Mr. Harrison, near Leicester, turned up some time afterwards at Garden Cliff, on the Severn. We now hear that the same radiate has been found by the Rev. P. B. Brodie, near Stratford-on-Avon, and by Mr. H. J. Elsee, near Rugby. Evidently it only wanted looking for.

South African Fossils.—To lovers of science it may not be uninteresting to know that a collection of fossil Saurians has just been shipped for England by Mr. Thomas Bain, who, at the request of Professor Owen, was allowed by the Government to undertake the work of collecting. It consists of 308 crania of the Dicynodon, Oudenodon, Lycosaurus, Galesaurus, and the Cynodracon, and some skulls apparently quite new to science, fossil wood, vegetable impressions, and a sample of Beaufort coal. Mr. Bain found the head of a Saurian in the matrix of the coal, within two feet of the seam, a fact, he considers, worthy of record, as it may give some clue to determine the age of our Cape coal period, about which there is much diversity of opinion at present.—*The Cape Argus.*

Roman Inscriptions.—In the Leicester Town Museum there is an interesting fragment of the beautiful red polished ware known as Samian, which the Romano-British settlers imported from Gaul, and which they prized so highly. It is a slightly curved piece, perhaps originally part of the rim of a bowl, and is about 3½in. long by 1¼in. broad. It is pierced for suspension round the neck, and on it is incised, in a bold, clear letter, VERECVNDA LYDIA, LVCIVS GLADIATOR. Evidently it was a present, a keepsake, from one Lucius, a gladiator, to Verecunda Lydia, his sweetheart. It was found in Bath Lane, Leicester, during the progress of the sewerage works in 1854, and is believed to be the only inscription extant from the hand of one whose stated occupation it was to brave the perils of the public arena.

Reports of Societies.

BIRMINGHAM AND MIDLAND INSTITUTE SCIENTIFIC SOCIETY. —June 10th. The members made an excursion to the Vale of Llangollen. Among the places visited were Crow Castle, Valle Crucis Abbey, Llantisilio, and the Berwyn Hills, from which they obtained a very fine view.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—GENERAL MEETING, July 2nd.—The following exhibits were made by Mr. Hughes, on behalf of Mrs. Randall:—*Echinocyamus pusillus*, the Green Pea Urchin, from Falmouth, and mounted specimens of *Spatangus purpureus*, showing the spines peculiar to that species; by Mr. J. Bagnall, a Stag Beetle, *(Lucanus cervus;)* by Mr. H. E. Forrest, a fine living specimen of *Spongilla fluviatilis*, from Sutton; *Argulus foliaceus*, the fish flea, taken from the dead body of a roach, at Windley Pool, Sutton; and a fine specimen of *Carchesium*, found in an aquarium; by Mr. Bolton, a young Newt, *Triton punctatus*, showing the circulation in the gills and pulsations of the heart; by Messrs. Caldwell and Butterfield, a large number of plants; by Mr. T. J. Slatter, a well-preserved specimen of a species of fern, from a band of marly clay, in the Waterstones and Lower Keuper Sandstones, near Redditch. The remaining meetings during the month were devoted to the exhibition of specimens contributed by various members. July 19th.—At 10 30 P.M. a party of twenty-eight of the members left Birmingham, *via* Midland Railway, for Arran, which they reached before noon the following day, where they remained till Saturday, July 27th. A steam yacht having been secured for the week, much active work in dredging was done, with what result will be reported in a future number.

BURTON-ON-TRENT NATURAL HISTORY AND ARCHÆOLOGICAL SOCIETY.—On July 10th, under the leadership of Dr. Perks, the members made an excursion to Wall (the Roman Etocetum) and neighbourhood. Reaching Walsall by rail they proceeded next in carriages to Barr Beacon, an isolated eminence, from which on a clear day a vast tract of country is visible. Sutton Park and the neighbouring town of Sutton Coldfield were afterwards visited. In the churchyard of the latter is the grave of Mary Ashford, who was supposed to have been murdered by Absalom Thornton in 1817. The accused on arraignment pleaded not guilty and offered the "Wager of Battle." There being no one to accept the challenge on behalf of the murdered girl, Thornton escaped. He emigrated to America, where he died in 1870. It was this case that brought about the repeal of the statute under which Thornton availed himself of the "Wager of Battle." Shenstone was next visited, where the party were met by Col. Bagnall. In the churchyard is an ancient dial shaft, now surmounted by a cross, on which the Rev. R. W. Essington, the present vicar, has caused the following inscription to be placed:—

> If o'er the dial glides a shade, redeem
> The time, for lo, it passes like a dream;
> But if 'tis all a blank, then mark the loss
> Of hours unblest by shadows from the Cross.

From Shenstone the party proceeded to Wall, which is believed to be the site of the Etocetum of the Romans. Col. Bagnall stated that some years since he made a series of excavations in the neighbourhood, and found a great quantity of bones of horses, swine, deer, and other animals, a large quantity of bronze, &c. Copper coins and fragments of glass had also been dug up, as well as large quantities of charcoal and Samian ware. It is said that where Wall Church now stands was originally the site of a temple of Minerva. Dr. Perks commented upon the fortifications of Wall, and, in referring to the Roman Vallum discovered and described by the Rev. S. Shaw, contended that it was highly probable that another Vallum had run in a south-easterly direction to the hill on which Shenstone Church now stands, and that the two would afford an imposing and extended barrier to any attack from the north-east. The excursionists proceeded to Lichfield, from whence they took train to Burton.—On July 20th the members, under the guidance of Mr. Thos. C. Martin, (hon. sec.,) went to Alrewas and Wichnor, where they were joined by members of the North Staffordshire Field Club.

EVESHAM FIELD NATURALISTS' CLUB.—The second excursion of the club took place on Saturday, June 29th, to Dovedale, near Blockley. There was a small attendance, and only botanical specimens were taken. They included the following:—*Listera nidus-avis*, *Paris quadrifolia*, *Spiræa filipendula*, *Vicia sylvatica*, *Campanula glomerata*, *Digitalis purpurea*, and *Aquilegia vulgaris*. A meeting of the club was held on Tuesday, July 2nd. The Chairman (Mr. A. H. Martin) exhibited eggs of the red-legged partridge found at North Littleton.

NOTTINGHAM LITERARY AND PHILOSOPHICAL SOCIETY. —NATURAL SCIENCE SECTION. — June 29th. An excursion was made to Stanton-by-Dale and West Hallam. The party visited an interesting cliff of calcareous Bunter conglomerate near the Stanton Gate Station, and the Millstone Grit and Bunter quarries were also seen. Near Dale the Kilburn coal seam is worked from the outcrop. This seam is 4ft. in thickness, and is the lowest seam worked in the Midland Coal-field. At Dale the ruins of the abbey and the picturesque little church were seen, and near Stanley a quarry in the Coal Measures sandstone. The Botanists of the party obtained a large number of interesting plants. A field near Stanton Gate is remarkable for the number of species it contains, *e.g.*, as many as five of the Vetches, including *tetrasperma*, being found within a very short distance. *Jasione* and *Genista tinctoria* are also very abundant. The *Orobanche*, which is said to grow near Dale, was not found.

OSWESTRY AND WELSHPOOL NATURALISTS' FIELD CLUB AND ARCHÆOLOGICAL SOCIETY.—THIRD EXCURSION. July 17.—The meeting-place was Wrexham. After a visit to the fine old church, the party took train to Cefn-y-bedd, whence their route lay up the beautiful Nantyfridd Valley, a narrow wooded dell, along which runs the line of the Great Cambrian Fault. Rocks of mountain limestone and millstone grit protrude here and there. At the upper end of the valley is a very pretty waterfall. Here the party left the valley, and proceeded over the hill to Minera, celebrated for its lead mines and lime works. Here a break met them, in which, after seeing the church, they returned to Wrexham. The day was lovely, though very hot. Among the plants found, we may mention *Corydalis claviculata*, *Hypericum Androsæmum* and *montanum*, *Geranium pratense* and *lucidum*, and a beautiful white variety of *G. Robertianum*, *Campanula latifolia*, *Cystopteris fragilis*, and *Polystichum angulare*.

PETERBOROUGH NATURAL HISTORY AND SCIENTIFIC SOCIETY. —On June 22nd, July 6th, and 20th, afternoon excursions were made in the neighbourhood of Peterborough; also evening excursions on June 25th and July 3rd. On the 8th, 17th, 24th, and 29th inst. evening botanical excursions took place, and were highly satisfactory.

WOOLHOPE NATURALISTS' FIELD CLUB.—On June 20th there was a large gathering of members at Ross for Symond's Yat and the Doward. After visiting the recently-erected church at Ross, the party proceeded to Symond's Yat, on the top of which the formal business of the Club was transacted. Mr. H. Southall pointed out and named the surrounding hills, &c. The members then took boat about a mile down the Wye to the Dripping Well, which was examined. Proceeding further down the river to the Old Fish House, they landed and visited King Arthur's and the other Caves. Little Doward Hill was then ascended, through the woods, to the Iron Tower. After passing through the Leys Park, the party proceeded in carriages from Crockford's Ash to Ross. After dinner, Mr. Southall read a most interesting paper on the Doward Caves, the botany of the district, &c., &c.

Notices to Correspondents.

We shall be glad to receive communications from the Members of Natural History Societies in any part of the kingdom.

All communications should reach us not later than the 18th of the current month, if desired for insertion in the next issue. We shall always be willing to insert communications relating to Exchange of Specimens.

For prices of advertisements address, the Midland Counties Herald Office, Birmingham.

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

ECONOMIC MYCOLOGY.*

BY J. GRIFFITH MORRIS, ESQ.,
PRESIDENT OF THE WOOLHOPE NATURALISTS' FIELD CLUB.

In the work of education during early life little is done to draw out and develop two of the principal faculties with which man is endowed—observation and manipulation. Habits of seeing quickly, observing accurately, and discriminating minutely are not acquired without learning to use the eyes. Nor are delicacy of touch with lightness, accuracy, and steadiness of manipulation without a similar education of the hands. Readiness and accuracy of investigation and observation are likely to be of more service to most men in everyday life than any amount of scholarship, whether classical or mathematical. Examining Boards are now doing much to enforce the study of science at schools, and the coming generation, not content with exclusively classical teaching, will go forth into the world better prepared to advance the material interests of mankind.

> This earth is beautiful indeed,
> And in itself appeals
> To eyes that have been taught to see
> The beauties it reveals.—*Montgomery.*

From the study of any branch of Natural History two sources of advantage are to be expected—a beneficial result on the mental and physical powers of the individual, and the practical utility of the knowledge gained. The student becomes a wiser and better man; he becomes elevated and refined, a love for the true and beautiful is created within him, and his enjoyments are increased in proportion.

Mycology is a subject with which the name of the Woolhope Club is especially connected; it well illustrates the truth of these remarks, and inasmuch as little progress can be made in its study without the aid of the microscope, additional educational advantages arise, for that instrument in itself demands the practice of patience, order, and observation, and developes the senses of sight and touch.

Mycology presents a wide and fertile field of research. The progress of recent science demonstrates more and more that the growth, reproduction, and life-history of minute funguses is of vast importance in the economy of nature. To their unseen causation are due most of those changes which affect organic life. Under their influence organic tissues alter their form of vitality.

What is called decay is in truth only a process to other forms of life, sometimes beneficial to man in the production of wholesome food, but more often injurious by causing disease and pestilence.

It is ten years since the Club commenced the study of Agarics, and that series of discussions and papers began which have since given so much renown to it. The subject was scarcely introduced when in the following year prizes for collections of funguses were for the first time given at South Kensington, and Dr. Bull took the chief prize for Herefordshire.

* Part of an Address read before the Woolhope Naturalists' Field Club, at the Annual Meeting, held at Hereford, on April 23rd, 1878.

In the autumn of 1868 the first Fungus Foray was made to Holme Lacey, under the superintendence of our staunch friends, Messrs. Lees and Worthington Smith. These forays have gradually grown in interest, increasing numbers join them, and an abundant supply of papers notifying new facts and discoveries is annually read.

Many of the most distinguished mycologists have done us the honour of attending them. The Club will be proud to mention the names of Berkeley, Broome, Cooke, Currey, Plowright, Phillips, Renny, Vize, Houghton, Percival, Cornu, De-Seynes, and several others who have again and again been present at our forays.

The active interest of our members in the study of funguses was at once excited by calling attention to the edible kinds. It was shown that a large amount of vegetable matter containing nitrogen, hitherto allowed to waste year after year, might be utilised as food. Experience has shown, however, that an idea so philanthropic is not in England practically feasible. Few species of Agaric are edible, more are tasteless or disagreeable, and some that are poisonous are unfortunately too common.

The comparative scarcity of uncultivated land in this country, and the uncertain and, as it were, capricious growth of Agarics, put quite out of the question any reliance on them as a source of food for the people, the more especially as other food is happily so abundant. It still remains, however, for the scientific epicure to distinguish and profit by them, as he assuredly may do, and gather from them a varied and delicious relish.

The study of Mycology deserves all the ardour with which it has been recently followed; to it we owe the knowledge of those destructive agents, the various kinds of moulds, smuts, rusts, &c., that are called blight. The term blight is too indefinite. It is indiscriminately applied to funguses, to insects, and to diseases caused in the young and tender parts of plants by sudden alterations in the temperature or the amount of moisture in the atmosphere. Most living plants and animals are at times more or less infested with funguses, which are nourished at their expense, very often to the eventual destruction of both. Some of these parasites attack man himself, as shown by the production of various kinds of ringworm and thrush. The belief is growing that diphtheria, cholera, low fevers, and other such complaints, may be caused by microscopic funguses. It is an unhappy fact that these parasitical pests take up a residence on those vegetables that are the most useful to man, viz., those which produce starch. Of these the cereals are the most important. Rust and mildew attack the leaves, stem, and bracts, while ergot, smut, and bunt attack the organs of fructification of barley, wheat, rye, oats, maize, rice, and other cereals.

The corn rust and mildew are the same species of *Puccinia* in different stages of growth. It may be found on almost every grass in every part of the world; but it seems to have a preference for wheat. General attention appears to have been directed to it for the first time in 1804, when Bauer made drawings for George III. The wheat of that year contained only 604 parts of starch and gluten in 1,000 parts, instead of the 995 parts of the nutritious matter which it ought to have contained. In 1806 the quantity was absolutely reduced to 203 parts. In 1810-11-12, when wheat was at its highest price during the war, corn rust was so prevalent and severe, the foliage of the plants so eaten up with it, and in consequence the grain so small and shrivelled, that, much as it was wanted, it was not considered worth while to thrash it out. It has been noticed that severe attacks of corn rust have more than once been coincident with the appearance of cattle plague. The last time that the cattle plague was prevalent in this country the clothes of people walking through corn fields became orange coloured from the dusty spores falling on them.

Smut is individually a very minute fungus, and yet of all the corn parasites it most readily attracts attention. It is a species of *Ustilago* that attacks the anthers and ovaries of wheat, barley, oats, maize, and rice, plants whose fertility and well-doing are of the utmost importance. It appears as a white viscid fluid, which dries up into a sooty, pulverulent mass. A German some years since attempted to prove that this powder was simply a collection of diseased cells, and therefore not a fungus, but he was easily refuted, for he was shown in the microscope the germinating spores.

Bunt *(Tilletia caries)* is a concealed foe, its residence is in the growing seed, and it is not till the farmer takes his sample after thrashing that he detects the presence of this pest (the little bunch of pappus at the upper end of the seed is not white, as it ought to be, but dark and dusty.) On careful search he then finds some distorted grains containing a fœtid powder, which under a microscope is seen to consist of brown reticulate spores. Of course the presence of much of this fungus would be detected in the flour by its colour and smell, but the millers get rid of the affected grains by rolling and blowing. This fungus has not been destructive for some years.

In northern and cold countries where the soil is poor, rye is almost the only cereal grown. This grain is peculiarly liable to the attack of a fungus called Ergot. It is often present in such large quantity that when ground up and eaten a train of peculiar symptoms is produced, called ergotism, and instances are mentioned in which the continued use of the diseased grain has caused death. The same fungus grows on some of our pasture grasses, and often occasions great mischief to cattle.

In some parts of France the peasantry do not object to eat mouldy bread, and in most instances with impunity; but the species of mould varies, and alarming effects have sometimes followed. These, together with experiments performed on animals, prove that bread in a state of mouldiness will cause death. M. Barrul, the French analyst, who reported to his Government on these cases, advises "that as most people are unable to distinguish the species of mould, the use of all bread in such a condition should be avoided."

Next in importance to corn as a starch producing vegetable is the potato. Many funguses attack it. The *Peronospora infestans*, that is so very destructive, is one of the white moulds. The mycelium of this fungus is able to penetrate every part of the plant, discolouring and corroding the green parts, and causing loss of vitality and decay in the tuber. Partial observations of several mycologists had revealed much of its life history and mode of growth during the summer, but it was left for an honorary member of the Woolhope Club to discover how it survived the winter. It has long been known that some funguses, like insects, go through several stages or metamorphoses. The final and perfect stage is easily recognised in most insects, because that is the only one that has the power of reproduction; but among funguses every stage is able to propagate itself in some way; thus in summer the potato blight throws off from the free ends of its mycelial threads two kinds of short-lived spores, which, if they fall on the leaf of a potato, germinate and quickly reproduce themselves, killing their victim and perishing with it.

Our friend Mr. Worthington Smith had the good fortune, while investigating the natural history of this fungus, to discover another kind of spore, called a resting spore, because it hybernates in or on the ground. He watched its mode of formation in the autumn and its growth the following spring, and thus was enabled to prove that this spore was the long sought for means by which *Peronospora infestans* continues its existence from year to year.

This spore is to be found in the tissues of the decaying plant. It is formed by a process of conjugation not uncommon among funguses. By degrees it acquires a hard protecting coat, and, with the dying plant, falls to the ground, where it remains to take its chance during the winter. On the return of warmth, the hard coat bursts, mycelial threads exude, and extend in search of a foster mother. If they do not meet with a potato plant in growth, they speedily exhaust themselves, and die; but if unfortunately successful, they pierce the cuticle, and the work of destruction commences.

Through want of thought and custom, much is done that favours the existence and propagation of this pest—diseased haulm and tubers are left on the surface of the ground when the crop is taken up, and are afterwards dug in to serve as manure. If this happens in a garden or rented potato ground, and the same crop is put in a second year, a vigorous crop of *Peronospora* is the result, and the cottager scarcely gets his seed back. The potato blight is also extensively propagated in another way. It most houses it is usual to throw away diseased tubers along with parings and other rubbish into dust heaps, which are in due course carted away and used as manure. It is probable that storing potatos in the same buildings or floor year after year, favours the spread of the disease.

Mr. Worthington Smith's discovery teaches that every part of an infected plant should be burnt; it is the simplest way of effectually destroying the fungus; and also, that under no circumstances should potatos be planted for two consecutive years in the same ground.

Parasitical fungi, not content with damaging corn and potatos, are also very injurious to garden produce; cabbages, beans, peas, celery, and onions, each of them cherish and foster some unbidden visitor; fruit trees, as pears, plums, peaches, filberts, and walnuts furnish a residence for some unwelcome intruder.

Flowering plants, grown for their beauty, are much injured, and sometimes killed, by parasitical funguses; witness the rose trees and hollyhocks. Two years out of three hopyards are rendered unproductive by attacks of an *Erysiphe.*

Timber trees do not suffer much while in growth, yet it is curious to number the varieties of fungus found on them. M. Wessendorf says that "seventy-four attack the lime, of which eleven reside on the leaf; 114 the spruce fir, and no less than 200 the oak;" among the latter are reckoned those funguses whose ravages in timber-built ships have occasioned a loss in fourteen years estimated at twenty millions, and which in church and domestic architecture produce great annoyance and expense by causing dry rot. *Merulius lacrymans*, *Polyporus hybridus*, and a *Thelephora* are the funguses which prey on sound timber; their mycelium creeps between the cells, and decomposes the lignin and cellulose; the *Merulius* has a rusty-coloured irregular stemless pileus, from whose gills a liquid constantly exudes.

If the useful plants of other countries are examined, we find in the south of Europe olives, oranges, and onions damaged by a fungus that envelopes their leaves in a covering of soot; in the Atlantic isles and France the *Oïdium Tuckeri* destroys the grape vine. This fungus first appeared in an English hothouse, and thence has spread in all directions. Our friend, M. Cornu, told us last October that another fungus had lately appeared on the vine at Narbonne, causing a disease called Anthracnose. In some parts of Italy the cultivation of the silkworm has been suspended because it is attacked and destroyed wholesale by a species of mould somewhat resembling that which kills flies in the autumn, and leaves them adhering to the glass in our windows, surrounded by a cloud of white spores. In America the maize is often much injured by a smut that causes large and curious distortions of the grain and cobs. The plant which of all others is the most important for clothing purposes—the cotton plant—has two formidable enemies. One attacks the leaves, the other the pods.

Some manufactures are much impeded by the growth of moulds. Bleaching cannot be carried on in the fields on account of moulds growing and causing unsightly and irremovable blotches on the fabric. The preparation of gelatine, maccaroni, lime juice, and wines requires precautions to be taken to prevent access of air containing spores of funguses. It would not be difficult to extend the list of noxious funguses, but enough has been said to show that man's person, food, clothing, building materials, and occupations are all injured by divers species of fungus. In proportion to the amount of injury they cause, they become important. It must be desirable, therefore, that their structure, habits, and life-history should be carefully studied, so that advantage may be taken of every opportunity of lessening or preventing their injurious effects.

The chemical process of nutrition in funguses is not the same as in other vegetables. Funguses do not convert inorganic matter into organic compounds. They possess a vital force capable of overcoming the natural play of chemical affinities, and they live by appropriating the constituents of the compounds they are thus enabled to decompose. Fermentation is nothing more than the manifestation of this process of decomposition. Such fermentations as are not produced by the immediate action of living cells are called indirect. They are caused by the intervention of nitrogenous soluble matters elaborated by living cells. These soluble ferments are often stored up till circumstances require their alterative action. It would seem that most organic substances are subject to fermentative changes, often occasioned by a special ferment plant. There are other ferment plants besides those that are recognised as funguses. Sugar undergoes several direct fermentations—the alcoholic, lactic, vinous, and butyric. Alcohol by fermentation becomes acetic acid; albuminous matters and urea are transformed into ammonia by processes of fermentation.

It will be interesting to sanitarians to know that there is reason for believing that the conversion of ammonia into nitric acid is caused by the presence of a fungus; this process has been called nitrification. It goes on constantly in soil that is saturated with decomposing animal matter. The saltpetre of commerce is for the most part imported from India, and is obtained by washing it out of the soil. Nitrification has long been known and carried on artificially. Pasteur suggested that it might be a fermentative change, and some recent experiments show that he was probably correct. MM. Muntz and Schliessing passed sewage water through a porous medium; for eight days there was no change in the amount of ammonia, but after that time ammonia disappeared and nitric acid took its place. This experiment is only explicable by supposing that germs of a ferment plant were present and took time to mature. This notion was confirmed by another experiment, which proved that the presence of antiseptic vapours suspended the action.

Among fermentations the alcoholic takes the first rank; it is the most familiar and the most easily studied. There has been considerable difference of opinion as to the nature of the plant which causes this fermentation. Most English authorities have considered till lately that it was a modified growth of a common mould called *Penicillium.* German mycologists make it into a genus belonging to the class *Torulæ* among funguses. They call the genus *Saccharomyces*, and include within it several species.

Common yeast is *Saccharomyces cerevisiæ;* the composition bakers use has very small cells and is called *S. minor*. The yeast that grows on malt liquor when left to spontaneous fermentation, as is the practice in Belgium, is *S. apiculatus*. Other species appear on musts of wines, and juices of stone fruit. The species that is so important in this district, because it effects the transformation of apple juice into cider, appears under the microscope to be identical with that which is found on malt liquor, viz., *S. apiculatus*. Pasteur has proved by a simple experiment that germs or spores of *Saccharomyces* exist on the surface of grapes. He introduced boiled grape juice into a series of thirty flasks ; of these ten were immediately sealed up ; into a second ten he dropped a minute quantity of liquid prepared by washing the surface of some ripe untouched grapes ; into the third ten he passed some of the same liquid boiled. In forty-eight hours the first ten were unaltered, the second ten were in full fermentation and filled with flakes of mycelium, the third ten were unaffected. There is reason for believing that all saccharine fruits have on their surface spores which remain quiescent till a concurrence of circumstances brings them into contact with the enclosed juices, then subaqueous growth commences accompanied by the decomposition of the sugar. So long as the subaqueous growth continues propagation of the fungus takes place by budding, but as soon as the sugar is exhausted the fungus comes to the surface and forms spores. *Saccharomyces cerevisiæ*, or common yeast, is seen under the microscope to consist of a multitude of granular cells, diffused through a turbid liquid called yeast water. The cells are about 1-3,000 of an inch in diameter, and, like all other vegetable cells in their simplest stage, consist of a speck of jelly called protoplasm, enclosed in a non-nitrogenous envelope. Yeast is composed principally of albuminous and amylaceous matter, but it contains a large proportion of phosphates of potash and magnesia. The remarkable feature in its composition is its richness in nitrogen. Funguses contain more nitrogen than any other class of plants. The *Chantarelle* contains 3·62 per cent., *Boletus edulis* 4·25, *Lactarius deliciosus* 4·60, mushroom, 7·26, and yeast 10, so that it closely approaches animal matter. These Agarics have been selected for comparison because they have been often set before us at our Fungus Foray dinners. Knowing the chemical composition of yeast, we should expect the medium in which it flourishes to contain the nitrogenous and mineral matters which it requires. It has been proved by experiment that yeast will not exert its peculiar action on sugar unless these matters are present in solution.

We all know that if yeast be added to a liquor at a suitable temperature in which malt or some saccharine fruit has been digested, certain occurrences will ensue. The liquor will shortly become turbid, effervescence will take place from the escape of free carbonic acid, the sweetness will disappear, alcohol will become evident to the taste and smell, and a large increase will take place in the bulk of the fungus.

There are several varieties of sugar much alike in their chemical composition and properties. The two principal are saccharose and glucose. Yeast acts differently on each, so that it will be well to trace back their relation to, and formation from, starch. Starch, chemically, is nothing more than carbon, combined with the elements that compose water in the proportion of six to five. It appears to be the first product of that decomposition of carbonic acid and assimilation of the carbon, which, under the influence of the sun's rays, is continually going on in growing plants. Starch is the basis from which most other vegetable secretions are formed. It is either used up at once by the plant that secretes it, or it may be laid by for future use ; sometimes in the tuber as in the potato, in the seed as in corn, or in pith as sago. Saccharose, the sugar of commerce, or cane sugar, is made up, like starch, of carbon and water; but the proportions differ. Instead of six to five, in saccharose it is twelve to eleven. This sugar is found in the maple and beet; whenever found it is intended as a store for the future use of the plant at the time when a great and sudden demand is made for the purposes of reproduction. Glucose is the sugar met with in the grape and other fruits; it contains a little more water than saccharose and is more soluble. It is necessary that stored-up starch and saccharose should be altered into glucose before they are used by the plant. This alteration is always prepared for by the laying up of nitrogenous matter in close approximation with the stored material. When the food is wanted, the nitrogenous matter acts as indirect ferment, and causes the starch or saccharose, whichever it may be, to take up an additional quantity of water and become glucose. Thus the starch stored up in the barleycorn is altered into glucose when heat and moisture bring the nitrogenous matter called diastase (which has been laid up under the cuticle) in contact with it. This process takes place in seeds when they germinate, and is taken advantage of by the maltster. For the same reason the tuber of the potato becomes sweet and transparent from the alteration of its sugar into glucose when growth begins. Again, when sugar cane and beet blossom a large supply of nutriment is suddenly wanted; the stored-up saccharose is then digested; that is, altered into glucose, and is carried away in the sap to the reproductive organs, to be there reconverted into starch, and stored up again in the seed. Parsnips and some other sweet roots that do not blossom the first year, lay up glucose itself, which is held in reserve till the next summer, then seed is formed and the root loses its sweetness and collapses.

If yeast be placed in water containing air or oxygen, the oxygen gradually disappears and is replaced by carbonic acid; a process exactly similar to the respiration of fishes, continuing day and night, but proportionately more active. The yeast would die when the oxygen was absorbed, but if glucose be then added, the fungus will abstract from it the oxygen required, and set free carbonic acid and alcohol. Pasteur, who has given great attention to the life-history of ferments, has concluded, after many experiments, that a continued supply of oxygen and the combustion it causes are necessary sources of energy for the development of vitality in ferment plants. As soon as the cells of yeast have exhausted the glucose in contact with them they have a tendency to come to the surface and take on their aerial growth, which is simply the formation of spores. Under favourable circumstances some of the cells at the surface may be observed under the microscope to form an additional internal membrane, which, becoming septose, divides the protoplasm into three or four parts; each of these parts becomes spherical, opaque, and is ultimately detached as a spore. The nutrition of yeast in one particular resembles that of the higher orders of plants, for it is supplied with a soluble nitrogenous ferment which enables it to alter saccharose. This nitrogenous matter may be separated by washing the cells in water, every time they are washed some of it is dissolved out, it is always acid, and if neutralised becomes again acid, directly that it comes in contact with saccharose the latter is forced to take up an additional atom of water and thus become glucose. The multiplication of the cells of yeast by budding is a process that may be easily watched under the microscope. If the temperature is kept between 75 and 90 degrees, one or more cells may be seen to arise in succession, or even at the same time, from a parent cell, and form themselves into short irregular chains. The vitality of yeast is dormant below 50, and is destroyed, as we should expect, at 140 degrees, for at that temperature nitrogenous matter begins to coagulate. The growth of yeast is checked if the solution of sugar is too dense, or if the quantity of alcohol is too large. Attempts have frequently been made by physiologists to account for these phenomena, but how and why carbonic acid and alcohol are substituted for sugar is still a mystery, and, like other mysteries connected with vitality, is likely so to remain. It has been ascertained that the weight of the alcohol and carbonic acid is nearly equal to the weight of the sugar which has disappeared. The slight difference is caused by the formation of other compounds that only appear in minute quantities. Some think that the glucose and other materials that form the food of the yeast plant penetrate the cell by osmose, and there, after undergoing transformation, are assimilated and converted into growing cells and tissues, while at the same time disassimilation is proceeding, the worn-out tissues are changed into alcohol and carbonic acid, and are eliminated as excrementitious matter. This may be called the intra-cellular theory. Pasteur is of opinion that the vital action of the cell causes decomposition of the glucose, and that a portion of its oxygen penetrates the cell membrane and takes part in the process of assimilation, while the other constituents of the glucose are left outside free to arrange themselves into carbonic acid and alcohol. This is the extra-cellular theory. Which is correct? It remains for some one, perhaps a Woolhopian, to determine.

In this agricultural and woodland county there is abundant opportunity for the study, not only of the parasitic funguses, but of most others, and as our Field Club was constituted for the purpose of observing and recording all facts connected with the Natural History of the district, it is to be hoped that some of our members will forthwith set up their microscopes and become students themselves. The facts observed at the time may often appear isolated and of little consequence, but subsequently by combination and further discovery they may become of the greatest value. Minute scientific research always precedes the application of science to industry, and, though little acknowledged, is at the present day performing a very important part in intellectual and industrial advancement, and will ere long effect great and unexpected changes.

The British Association.—The highly successful Dublin Meeting was brought to a close on August 21st, under the presidency of Mr. William Spottiswoode, M.A., F.R.S., LL.D., D.C.L., &c. The total sale of tickets was 2,578. Next year's meeting will be held at Sheffield, commencing August 6th.

A SCHEME FOR THE EXAMINATION OF THE GLACIAL DEPOSITS OF THE MIDLAND COUNTIES OF ENGLAND.

BY WM. JEROME HARRISON, F.G.S.,
CURATOR OF THE TOWN MUSEUM, LEICESTER.

One of the great advantages which it was hoped would result from the formation of the Midland Union of Scientific Societies, was the opportunity which it would offer to distant workers to become acquainted with one another, with a view to combined work upon the many scientific problems which our district offers to us for solution.

At the Annual Meeting of the Union, at Birmingham, on May 28th, I ventured to suggest the Glacial Deposits of the Midlands as a subject peculiarly fitted for our joint efforts, and as this idea was favourably received both at the time and since, I now venture to offer a few suggestions as to the way in which we should begin work.

I.—The Workers.—No Society can plead an absence of material on which to work. The stratified rocks which constitute what we term the solid geology of our country run in tolerably definite bands, but the glacial drift is scattered irregularly all over the face of the country, and is with us everywhere. Each Society then should appoint one of its members who should act as secretary or record keeper for the particular study we propose to attempt. The other members who are willing to aid actively in the task should give in their names to him, and he should summon meetings of such members at frequent intervals.

A chief duty of the record secretary would be to keep a large observation book, in which to enter all notes and discoveries. If this book contained plenty of guards such members as preferred it might write out the results of their own work, which could then be pasted in the book.

As it would be absolutely necessary to gain personal experience, it would probably be easy to arrange for joint meetings of all who take an active interest in this work in the various districts in turn. The typical deposits of the east and west coasts and of Scotland would also be visited and examined.

II.—The Work.—In the first place it would be necessary for each worker, or at all events each Society, to obtain the Ordnance Maps, both plain and geologically coloured, of their neighbourhood.

Upon the plain maps they should distinguish by dots and numbers the precise position of every gravel pit, brick pit, &c., where the surface deposits are well exposed. Each of these sections should then be visited in turn and carefully examined. Each should be measured, and a plan and section—no matter how rough, if fairly accurate—drawn to scale ; if a water-colour sketch could be made of the principal face so much the better. In as many cases as possible an idea of the height of each point above the sea level should be obtained either by aneroid, levelling, or computation. The dip, if any, of the layers must be noted, false-bedding looked out for, and especially in the clayey deposits any indications of *bedding* remarked. Specimens from each point must be collected. If in wooden boxes about 6in. by 4in. an average specimen of each deposit could be secured, it would be of service in comparing with other localities. The stones must be carefully examined for striations, and so also the rock surfaces below when exposed. If 100 stones are collected at random from any pit they should then be sorted according to their composition, and the proportions stated. Specimens of every variety must of course be secured for reference. Fossils must be carefully looked for. So far as I know, not one shell has yet turned up in the drift deposits of the midlands proper. Entire and large shells must not be hoped for, the smallest fragments will be acceptable, and the sand must be washed and examined microscopically for foraminifera, &c.

The large boulders will almost force themselves upon our attention. Good specimens of each measuring not less than 4in. by 3in. must be obtained, and every possible fact recorded about them. Much information may often be got from rustics and dwellers in the neighbourhood generally, and the ideas so elicited are often of the most racy description.

When an examination of the principal open sections has been completed in this way we shall be beginning to obtain some familiarity with our task, and must endeavour to connect our observations so as to make complete maps of the surface deposits, to connect, that is to say, the various exposures so as to show what deposits are present under grass-covered fields or wheat crops as well as in the gravel pits and brick pits which we can so easily examine. This is a point, however, which we can consider further on, only remembering in the meantime to make as many notes about water-supply and well sections as we can. It will be necessary to endeavour to identify the rocks of which boulders are composed so as to determine the direction in which the ice-sheet has travelled. For this purpose typical collections of Welsh rocks, of those of the Lake district, and of Charnwood Forest will be most useful. I shall be glad to forward to any one who is in want of them for this purpose a small collection of typical Charnwood specimens, and doubtless dwellers near other regions of hard and old rocks would also help in this way.

In a separate note book enter *at the time* as many particulars as possible; omit nothing however insignificant, and let each point be visited more than once, and by different workers if possible. It will be found useful to have a small number book, containing sheets of numbers, say from 1 to 1,000, gummed and perforated. When a specimen of a boulder, &c., is obtained, let a number be at once gummed on it, whilst in the note book the same number is written down with full description of locality. I have found this the best of many plans.

The apparatus required in addition to a map is not much. A geological hammer with a square head and belt with flap to carry it in; a small compass, a little acid bottle to test for carbonate of lime, a good satchel or stout gamekeeper's bag, a clinometer, a pocket lens; all these are useful, but I have known a working man with a coal-peck do excellent work. It is a great thing to walk much, to get a thorough geographical idea of the tract of country you are about to examine. Suppose at the meeting of your "committee on the drift deposits" you with a friend have undertaken the examination of a district including, say ten square miles. Then the best thing to do is to learn this little region thoroughly, to master the course of every brook and streamlet, the position of every house and hedgerow. The number of new facts that are sure to turn up will surprise you.

A complete list of what has already been written upon the drift would more than fill one number of this magazine. "The Great Ice Age," by Mr. Jas. Geikie, (2nd edition, 24s., Daldy, Isbister, and Co.,) is an excellent book. Mr. Searles V. Wood, jun., is another high authority on the subject, to whom I am personally indebted for much kind advice. Unfortunately Mr. Wood's papers are chiefly in the "Journal of the Geological Society" or in the "Geological Magazine," but it may safely be said that no one has done more remarkable and original work in connection with the glacial deposits (chiefly of the eastern counties) than Mr. Wood. In "Geological Survey Memoirs," lately published by Mr. de Rance ("Superficial Geology of S.-W. Lancashire," 17s.) and by Mr. S. B. J. Skertchley (the "Fen-Land," 40s.) we get, of course, most reliable and interesting information, but the price of these works is to individuals almost prohibitory. Such works, however, may well be added to the libraries of all our societies. I will endeavour to review these two books in our next (October) number. In H. B. Woodward's "Geology of England and Wales" (Longmans, 14s.) there is also a good and full *resumé*.

No very special training is needed on the part of those who are willing to lend a helping hand. For instance, we want to know how far the chalky boulder clay of the eastern counties extends to the west and south, and also the relations to it of certain beds of flinty gravel and sand. Now everybody knows the appearance of a lump of chalk and a piece of flint, and we ought to be able to fix the westward extension of these beds to a certainty. I have never seen the clay full of bits of chalk in size from a pin's head upwards, at any point west of Charnwood Forest, but then I have not enjoyed many opportunities of examining the drift of Staffordshire, Warwickshire, &c. The flinty gravel appears to stretch further west, but what is its limit in this direction? Again, in the midland district we hold the key to the correlation of the deposits of the east and west coasts. It is now thought that the glacial deposits of Lancashire and Cheshire are of a later date than the "mid-glacial sands" and chalky clays of the east coast. We must endeavour to track each set of deposits as far inland as possible, and observe their relative behaviour.

With this branch of geological study is bound up the question of the origin of man. If in the Victoria Cave, near Settle, clear evidence is obtainable of pre-glacial or inter-glacial man, why should not other evidence of his presence in the centre and north of England be found?

Then in each midland county if some half-dozen workers will but band themselves together for the prosecution of this study, I see no reason why valuable results should not be attained at an early date, and the exhibition of specimens, illustrative of the glacial deposits of the Midlands, might be made a special feature of the Annual Meeting of the Union at Leicester, in 1879.

If any scheme of the kind hinted at above can be set on foot, I would suggest that the various record keepers meet at given centres, say at first monthly. They should appoint one of their number as a general secretary or reporter, and notices of the work done should appear from time to time in the pages of the "Midland Naturalist."

Finally the three questions upon which it seems necessary to fix our attention are :—

(1) Is it a right and useful thing that the scientific societies of the Midlands, having entered into a union with each other "for the promotion of the study of Natural History, and to provide opportunities for personal intercourse among their members," should place before them definite objects of scientific study for combined work?

(2) If so, is the study of the Glacial Drift a suitable object?

(3) And is the plan of work proposed in this paper calculated to yield satisfactory results?

NOTES ON MELICERTA RINGENS.

BY F. A. BEDWELL, M.A., F.R.M.S.

There is, perhaps, no animal that has been more observed and less studied than *Melicerta ringens*. To sit looking for hours at her beautiful tower in the hope of seeing her lobes appear is tantalising work; but it is really on our capacity for this patient waiting that our success in the study depends. Unless you examine Melicerta with at least a one-fourth, I know of no method of illumination which will bring out her details, while any power above two-thirds necessitates your confining her in a space so small that the lobes feel the glass sides of your minute tank the moment they come out, and then they shrink at once from the contact. Dr. Hudson, of Manilla Hall, Clifton, showed me, as long ago as 1860, how to manage such objects, and I have followed his plan ever since, and know no better. The specimen is laid in an *annulus* of thin microscopic glass, (the thinner the better because you can always double them.) the diameter of the outer circle is about $\frac{7}{8}$ths of an inch, that of the inner circle about $\frac{5}{8}$ths. You glue this ring to the ordinary glass slide, and when a piece of thin glass is laid over it you have a minute tank, which you can fill with water at pleasure by a dipping tube as the water evaporates.

It is most important that students should know what a field this and cognate rotifers offer for study, and that the subject is very far from being exhausted. The question of the male alone is nearly untouched, and, with high powers at command, it ought to be a very productive and interesting subject. I was so fortunate as to see what I believe was the male of Melicerta in last November. I was examining a very fine female specimen, which was freely out and briskly engaged, when from the tube there emerged a small free swimming rotifer. In point of size it was not quite as long as one of the larger lobes of the female; the tube of the female in length would make about six of it. It was very active, and it bent its body into most graceful and rapidly changing curves; its ciliary disk was totally unlike that of the female, its tail also was wholly unlike the female's, for while the female has a sucker foot to fix on to a weed, this specimen had a forked tail, of which it made constant use, opening the forks like pincers to nip the objects to which it attached itself. Its first action alone was enough to beget the idea of its gender. It began to woo and caress the lobes of the female in the most active and elegant manner; it seemed almost as if it was nibbling the main wreath of cilia of the female.*

Now, to any one accustomed to watch Melicerta, it must be always a matter of astonishment to see such a timid, nervous rotifer allow another to touch the cilia with impunity, but in this instance the female never flinched in any way, but accepted the attentions of the little visitor with perfect composure, and continued to feed as if quite undisturbed by its presence. The free rotifer almost immediately afterwards sailed away, and I soon lost it, though not before I had seen enough of it to conclude that had I met with it as a stranger, and not known whence it came, I should have at once set it down for one of the numerous members of the family Hydatineæ. I regret to say here that I have never contrived to attain to a knowledge of names—at least in the rotifer world—and I have always estimated an object above its name, and a fact above a new object. The desire of being godfather to a new animal is apt to lead us into fruitless paths, while the love of facts about old ones never does.

Knowing Melicerta so well, I was quite sure she would not have permitted such liberties as I had witnessed without good cause. The mere circumstance of a rotifer making its appearance from her tube was unusual, and a rotifer with a forked tail doubly so. The ordinary female egg leaves the tube in a footless and very imperfectly developed condition, while Melicerta is not an animal to allow strange rotifers to visit its tube without resentment. The time of year struck me also as special, for I had never examined Melicerta so late in the year before. Throughout last December and January, I obtained specimens from Mr. Bolton, and broke the tubes up to examine their contents, and I was so fortunate as to find ten more of the same free swimming rotifer in about fifty tubes, and under circumstances which leave little doubt in my mind as to its nature and sex. I

* The portrait of the supposed male of *Melicerta tyro*, given by Dr. Hudson (M. M. J., vol. xiv., p. 225,) is very like the male here described.

during the coming winter students who have access to them will break up with a couple of fine needles some tubes of Melicerta, they will find that a very few will contain a living female rotifer. She may have some eggs with her in the tube, but more probably she will have none. If the tube contains no female rotifer, then it will probably, in about one out of five instances, be found to contain either eggs or developed males, or perhaps both. In the very first tube I opened the female had gone, devoured by her offspring perhaps, but there were four of these free swimming rotifers. They were very lethargic, and seemed startled by my rude intrusion. One or two of them were like eggs struggling into life. I found them in every stage short of real activity, and in one or two specimens I found them incompletely developed and associated with ordinary female eggs, a fact which showed that the developed specimens were not visitors to the tubes, but were bred and born there. The way to recognise a male egg in *M. ringens* is to look for the mastax. The fact that the male has a mastax leads me to think that for a time it is in a state of growth, and that the spermatic secretions are not ripe until it has left the parent some hours, or perhaps days. It is possible that then the mastax and stomach may dwindle into insignificance, while the other organs increase in importance. The difficulty of following particular individuals will make it by no means easy to learn its whole life history. The mastax is developed very early, while the egg is in the womb of the mother. In examining some slides of dissections of the mastax of *M. ringens*, presented to me by the Rev. Lord Sydney Godolphin Osborne, and lately exhibited at the Royal Microscopical Society on the reading of a recent paper there, I found that on one slide there were six eggs, and that one of these exhibited a mastax in a forward state of development, and I believe it is a male egg. That the male should have a mastax at all is singular, as usually these males are mere spermatic bags, without mouth or stomach, very active and lively, but apparently requiring no food at all. But the mastax of the male Melicerta is very easily recognised; it differs from that of the female in being much more angular; it is shaped something like a W inverted; it is a very busy organ, and even protrudes at times from the disc itself. The facts above stated support the view that the tube of Melicerta is not only a protection to the animal when living, but harbours the eggs when the animal dies; while they also lead me to think that the time to seek the male is the end and beginning of the year.

With respect to the act of coition, that must be no doubt usually concealed by the tube, but we recognise what a delicate sense of touch these rotifers must possess, when we reflect that they are able to recognise the salutation of the suitable male, and that they permit it to have access to the tube. The remarkable disproportion, again, in the size of the male rotifers deserves attention; large male rotifers would be quite useless as they simply could not enter the tube. We see, too, that the absence of stomach and mastax in some, and the diminution of the size of these organs in others, leave room for an increased supply of the more important secretions. What Melicerta, for instance, requires as essentials in her male is a size which shall be in inverse proportion to his capacity, and that is precisely the kind of male with which she is supplied. How she has obtained such a male, or, conversely, how such a male has obtained such a female, are important but insufficiently noticed elements in that great question of the day, which fills all our thoughts.

The whole subject of these apparently and so-called degraded males is here open before us, and it offers a wide field for observation and reflection; and the very first reflection that occurs to us is this, that, *a priori*, we have no more right to talk of degraded males than we have to talk of exalted females. What we actually see before us is a male exactly suited to the wants of the female, and able to provide her with the only secretion in the world which will enable her to continue the race, and *vice versa*. The terrible nuptials of the Queen Bee, the dying sufferings of the selected husband, the frightful slaughter of the rejected males, is a story that gives rise to some painful thoughts—thoughts which the rotifer world and its mouthless males at first sight seem sadly to confirm. For if it be true that "degradation" can bring males to such a pass, why then we see what a future may possibly be in store for other animals—for animals which are now endowed with higher powers. The bees, the ants, and the rotifers are not the only animals among whose ranks the main body of females surpass, or have a tendency to surpass, in self-restraint, intelligence, and industry, the main body of the males, and if there be any substance in the suggestion that degradation is a part of evolution, and that evolution is the principle by which "life changes" and "life progress" are conducted, why, then, a hideous future may be in store for some of the more highly-organised races; when appetite becomes the ruling force, it is developed at the expense of intelligence, and the male must inevitably degrade, and must either drag the female with him, and so obliterate both, or sink below her in intellectual capacity.

But here I must confess myself altogether a heretic, and for my own part I believe that, so far as the question before us goes, neither degradation nor evolution had anything to do with the present state of the bee or the rotifer world. I am of the mind of Falconbridge as to his parentage. "Evolution could do well," but it could not get a suitable male for a female without the aid of an outer independent and far higher principle than that which is involved in the word development. To me the male rotifer is what it is, that is to say, a diminutive spermatic bag, simply because it was of the utmost importance to the race that the male should have one object in life, and only one, and that it should not waste time in seeking and devouring food in an hour when the continuance of the race requires that it should be engaged otherwise. The "replenishment" of the earth, the multiplication of stock, runs like a marvellous thread of exquisite and infinitely varied contrivance through the whole series of living beings, and the microscope greatly intensifies the marvel. The difficulties which lie in the way of treating, without offence, this subject of male and female has made it popularly a neglected topic, and thus the world at large has missed the strongest argument which, to my mind, there is against the theory of development. As a complete creative, productive agency, I altogether disbelieve in evolution—as a separator of species, as a destroyer of thousands of forms that cannot all live, and so as a probable selector of what shall survive out of the million possible products of God's higher creative, productive laws, whatever those laws are, I accept and believe in the theory which is known by this name, but no further can I trust or follow those who trust and follow it, and amongst other reasons because *Melicerta ringens* and its suitable male will not allow me to do so.

NATURALIST FIELD CLUB EXCURSIONS.

BY THE REV. J. D. LA TOUCHE, B.A.,
PRESIDENT OF THE CARADOC FIELD CLUB.

Field Clubs are now in full work. Long days, sunny weather, nature clothed in bright and varied hues, all combine to call forth those whose souls are stirred with any higher aims than to follow the mill round of daily work and add to their daily store; all invite us to come forth from desk and study, from workshop and counter, to explore the marvels which a good Creator has prepared to instruct and cheer and elevate our souls. It may, therefore, be not unsuitable at such a time to consider a few of the objects which we place before us in our excursions, with a view to rendering them more useful for their professed purpose. And first, I would remark that Field Clubs are apt to err in two opposite directions in either proposing too much for themselves or too little. With the model before them of the British Association and other great societies, of which the members are the primates and leaders in scientific research, they are, especially on starting, inclined to fancy that they can in some way emulate the proceedings of these learned bodies. Accordingly the work they cut out is often on too extensive and ambitious a scale, and in a short time breaks down. I have been present at the inaugural meetings of such societies when the elaborate rules and bye-laws adopted contemplated a scale of operations which it was manifestly impossible could ever be attained. And this soaring ambition, the not unnatural ambition of early youth, is very apt in more mature years to relapse into the opposite extreme, when serious effort is virtually abandoned, and the so called Naturalist excursion becomes a mere pic-nic, pleasant and useful enough in its way, but having little relation to the objects for which the club was started. Nor should it be overlooked that this *dilettante* kind of work brings science into contempt, and not unfrequently have kind critics suggested a comparison between the proceedings of the Field Club and those of the immortal Pickwick and his friends.

If these societies are to attain what their members would desire, if they are to add anything to the stores of science, their aim must be more modest, practical, and definite. First, with respect to the work cut out for the excursions. It is not often that this can be of the thorough and laborious nature which individuals or very small parties can undertake.

The leaves of the stone book cannot be turned over by the geologist to any good purpose in a few moments. The trunks of old trees, swamps, and brakes are not likely to yield up their treasures to the botanist on a cursory glance. Time and diligent research and scrutiny are essential to secure these prizes. But time generally fails where a large party has to be guided from point to point. The most that can be expected on such occasions is to obtain a more comprehensive view of the surface of a district, and sometimes to listen to an exposition of its features from those who are well acquainted with it.

Secondly, a vigorous effort should be made for the production of original papers. Field Club meetings are favourable opportunities for those members who have devoted themselves to any branch of science to make known the results of their researches. There are few bodies of men among whom some are not to be found who are quite competent to do this, and one of the most valuable functions of the society is to elicit any local information which they may be able to supply.

Thirdly, the formation of local museums, or the addition to those which already exist in the neighbourhood, may well occupy the attention of our members. Of course some districts are much more favoured in this respect than others. But the very existence of a field club implies that of objects worth observing and collecting, and nature may truly be said to be inexhaustible in supplying them.

Lastly, I would suggest the importance of each club taking up some definite line as an object for its energies and researches. The example in this respect of the most distinguished and successful of the clubs in the West of England may be studied with advantage. While prosecuting a variety of the ordinary subjects usually proposed by such bodies, the Woolhope Club for several years made it their chief aim to record and describe the trees of Herefordshire; and in their transactions—an extensive and very interesting series of volumes—many photographs and interesting papers have appeared descriptive of those which are remarkable for their size, age, or history. Here was a subject in which everyone could take part, and though at first sight it might appear of but limited range and not very important, yet it was soon evident that it led to observations of great and varied interest; for everyone who has entered on almost any investigation with ardour and perseverance must have remarked that, as he goes on, many unexpected paths branch out into allied subjects, each of them supplying abundant material for further research. In this case the mere attempt to record the height, the girth, and other conditions of remarkable trees led to observations on their botanical varieties, to the comparative hardness and durability of timber, to many historical facts connected with them, and, in some instances, the progress of geological events has been indicated by noting the change in the course of a river proved by the existence of some old tree that once grew on its banks, but from which it has now far receded. The Woolhope Club has since made the study of the fungi, especially with reference to their usefulness as articles of food, their chief pursuit; and their annual Fungus Forays, and exhibitions and dinners at which the products of the chase are served for experimentation on the palates and digestion of their enterprising but adventurous members, are well known not only in England, but throughout Europe. They have lately added to these the description of varieties of apples and pears, and will doubtless attain the same success in this branch of study as has attended their efforts in others.

A subject which might with much advantage be taken up by any club, and which is within the reach of any one of ordinary observation, is that which goes by the name of Teratology, or a record of abnormal growths in plants and animals. The appearance of such unusual forms has been made much use of by our great physiologists to solve some of the most interesting problems in the science of development and generation. When intelligently correlated with other facts, they often supply links now lost, and explain the use of organs and the connection between the successive races of creatures which have from time to time existed in the world. To read these phenomena rightly, to put together the disjointed members of the puzzle, is indeed within the power of but few, as it is perhaps one of the highest functions of which the human mind is capable; but the more humble task of recording them is one which anybody might undertake, and would seem to be a very appropriate and feasible object for the members of clubs to propose to themselves; in doing so they might hope to materially promote the cause for which they exist, since there can be no doubt that large numbers of facts of this kind, which if known to a Darwin or a Huxley would be made of the greatest use, are lost to science from the want of observation and of record. As a guide to this branch of research, a volume on Teratology, by Dr. Masters, published by the Ray Society, has been highly recommended.

METEOROLOGY OF THE MIDLANDS.

THE WEATHER OF JULY, 1878.

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

The rainfall of July presents several interesting features. It is generally below the average, and greatly so in the few places which escaped the severe thunderstorm of the 24th. The return from Cromford of one rainy day only in July was so extraordinary that I wrote specially to Mr. Tissington, who replies, "I beg to say that my return for July is quite correct. I heard of rain falling within a few miles of here, but unfortunately it did not reach us." The dry period, which commenced on June 18th, lasted till the 24th of July. Up to the 17th of the latter month the weather was warm, but the sky cloudy, with a prevalence of north-westerly winds. From the 17th to the 22nd the heat was intense, the thermometer rising daily to above 80°. On the 23rd the temperature fell suddenly, and the next day a succession of thunderstorms visited almost every point in the Midlands, producing the maximum and only important rainfall of the month: in the neighbourhood of Coventry, nearly 2½ inches fell in as many hours. At Coston Rectory, the lightning in this storm was noted as being very vivid, and of a remarkable rosy hue. Afterwards fine weather, but with a lower temperature, prevailed to the end of the month.

STATION.	OBSERVER.	RAINFALL. Total for M.	Greatest fall in 24 hours.		No. of rainy d.	TEMPERATURE. Greatest ht.		Great'st cold	
		In.	In.	Date.		Deg	Date.	Deg	Date
GLOUCESTERSHIRE.									
Cainscross, Stroud	W. B. Baker, Esq.	1·85	1.23	24	9	110·	20 & 21	44·0	22
Cheltenham	R. Tyrer, Esq.	2·06	1·61	24	7	84 8	19	39·5	30
Stroud	S. J. Coley, Esq.	1·92	1 11	24	8	81·0	19	49·0	27 29 30
SHROPSHIRE.									
Haughton Hall, Shifnal	Rev. J. Brooke	1·30	1·07	24	7	79·0	20 & 21	45·0	4
Whitchurch	A. B. George, Esq.	1·0[illegible]	·60	23	5	80·0	19	54·0	24
Woolstaston	Rev. E. D. Carr............	·90	·70	24	5	84·0	20 & 21	46·0	14
Leaton Vicarage, Shrewsbury	Rev. E. V. Pigott	2 02	1.64	24	9	85·0	20	41·0	9
More Rectory, Bishop's Castle	Rev. A. Male	1·31	.91	24	8	85·0	20	40·0	28
Larden Hall, Much Wenlock..	Miss F. R. Boughton	·96	·63	24	6				
Bishop's Castle	E. Griffiths, Esq.	1·10	·65	24	8	88·0	21	43·0	4
Cardington	Rev. Wm. Elliot	1·05	·79	24	5				
Adderley Rectory............	Rev. A. Corbet	1·08	·49	24	10				
Stokesay	Rev. J. D. La Touche......	2·05	1·26	24	5	86·5	21	41·7	31
HEREFORDSHIRE.									
Whitfield	W. Wheatley, Esq.	·81	·26	24	10			39·0	4
Stoke Bliss	Rev. G. E. Alexander	1·34	·82	24	5	82·0	20	47·0	13
WORCESTERSHIRE.									
Orleton, Tenbury............	T. H. Davis, Esq.	2·16	1·47	24	8	85·7	17	41·2	4
West Malvern	A. H. Hartland, Esq.	2·26							
Pedmore	E. B. Marten, Esq.	·29	·10	25	6	90·0	21	47·0	3 4 12
Stourbridge..................	Mr. J. Jeffries..............	·46	·20	22	6	86·0	16	42·0	12 31
St. John's, Worcester	G. B. Wetherall, Esq.	1·82	1·43	24	6	84·0	22 23 24	39·0	
STAFFORDSHIRE.									
Thorganby Villa, Wolverhmtn	G. J. C. Broom, Esq.	·58	·29	24	6				
Amblecote	Mr. J. Robins..............	·26	·09	22	6				
Dudley	Mr. J. Fisher	·50	·15	25	9	94·0	21	46·0	3
Sedgley......................	Mr. C. Beale	·41	·13	7	9	85·0	21	42·0	3
Kinver	Mr. W H. Bolton..........	·45	·17	22	5				
Walsall	Mr. N. E. Best	·67	·32	24	8	87·0	19	48·0	3 12 31
Patshull Gardens	Mr. T. W. Dell	1·72	1·40	25	3	89·0	21	41·0	13 & 31
Weston-under-Lyziard R'tory	Hon. and Rev. J. Bridgeman	1·10	·67	24	9	93·0	21	43·0	4 & 31
Wrottesley	E. Simpson, Esq.	·61	·38	24	6	86·0	22	46·3	4
Tamworth	W. Arnold, Esq.............	1·25	·48	25	10				
Tean Vicarage, near Cheadle	Rev. G. T. Ryves	2·09	1·14	24	8	81·5	19	42·0	13
Heath House, Cheadle	J. G. Philips, Esq...........	1·76	·98	24	9	82·0	21	47·0	4 13 28 31
Alstonfield Vicarage	Rev. W. H. Purchas	·62	·25	24	8	83·4	21	40·6	13
WARWICKSHIRE.									
Coundon, Coventry	Lieut.-Col. R. Caldicott	2·90	2·43	24	9	84·0	19	50·0	3 & 12
Coventry	J. Gulson, Esq.	2·81	2·36	24	7	79·0	20 & 21		
Bickenhill Vicarage..........	Jos. Ward, Esq..............	1·18	·42	24	6	85·0	31	48·5	31
St. Mary's College, Oscott....	Rev. S. J Whitty	·66	·26	24	5	83·2	21	47·1	13
Henley-in-Arden	T. H. G. Newton, Esq......	.99	·50	25	10	88·0	19	46·0	24 28 29 30
Rugby School	Rev. T. N. Hutchinson	1·00	·68	24	7	84·4	21	44·2	4
DERBYSHIRE.									
Buxton	E. J. Sykes, Esq.	1·76	1·12	24	11	79·9	21	40·4	13
Stoney Middleton............	Rev. U. Smith	1·26	·39	24	8	83·0	20	35·0	13
Fernslope, Belper............	J. O. Jackson, Esq.	·52	·33	24	8	86·0	20	44·0	4
Matlock Bath	R. Chadwick, jun., Esq.....	·57	·45	24	4	79·0	21	41·5	4
Linacre Reservoir, Ches'field	C. E. Jones, Esq.	·61	·23	24	8				
Brampton S. Thomas	Rev. J. M. Mello	·67	·30	24	7	83·2	20 & 21	42·[illegible]	13
Willesley Gardens, Cromford..	J. Tissington, Esq.	·17			1				
Stuffynwood Hall............	Mr. R. Rolfe................	1·50	·94	27	8	89·0	19	43·[illegible]	3
Spondon	J. T. Barber, Esq...........	·88	·51	24	9	80·0	19 20 21		
YORKSHIRE.									
Tickhill, Rotherham	B. J. Whitaker, Esq.	1·46	.84	28	9	87·0	21	42·[illegible]	4
NOTTINGHAMSHIRE.									
Hodsock Priory, Worksop ..	H. Mellish, Esq.	1·06	·67	27	8	84·2	18	40·[illegible]	4
Grove House, Mansfield	W. Tyrer, Esq.	1·08	·40	27	9	83·2	19	41·[illegible]	4
Tuxford	J. N. Dufty, Esq............	·98	·40	27		90·0	20	46·0	12
Highfield House, Nottingham	E. J. Lowe, Esq., F.R.S.....	2·60	2·21	24		91·0	19	41·4	4
Park Hill, Nottingham	H. F. Johnson, Esq.	1·54	1·05	24	6	83·6	21	49·0	3 & 12
LEICESTERSHIRE.									
Loughborough	W. Berridge, Esq..........	1·47	·89	24	8	88·5	21	41·2	4
Ashby Magna................	Rev. E. Willes	1·02	·52	24	7	83·0	19	46·0	13
Market Harborough	S. W. Cox, Esq.............	·97			4	81·0	19 & 20	39·0	3
Kibworth	T Macauley, Esq.	1·45							
Town Museum, Leicester	W. J. Harrison, Esq.	2·04	1·21	24	8	84·0	21	42·9	4
Belmont Villas, Leicester....	H. Billson, Esq.	2·02	1·25	24	7	86·5	20	45·8	13
Syston	J. Hames, jun., Esq.	2·05	1·22	24	10	.95·0	22	42·4	4
Waltham-le-Wold............	E. Ball, Esq.	1·21	·94	24	7	84·0	20	41·0	1
Little Dalby Hall............	G. Jones, Esq.	1·59	·81	24	9	94·0	19	41·0	4 & 13
Coston Rectory, Melton......	Rev. A. M. Rendell	1·43	1·11	24	8	81·8	21	35·1	4
Belvoir Castle	W. Ingram, Esq.	1.39	·75	24	8	87·0	22	38·0	4
Foxton Locks................	Union Canal Company	·84	·38	22	5				
NORTHAMPTONSHIRE.									
Towcester Brewery..........	J. Webb, Esq...............	0·83	·60	24	6				
Castle Ashby	R. G. Scriven, Esq.	·73	·42	22	6	84·0	19	42·0	4
Sedgebrooke	C. A. Markham, Esq.	·59	·19	24	8	88·0	21	38·0	4
Kettering....................	J. Wallis, Esq.	1·25	·46	27	7	82·0	22	48·0	4
Althorpe	W. F. Jakeman, Esq.	·62	·35	24	4	84·0	20	41·0	3
Northampton................	H. Terry, Esq.	·45	·19	22	6	85·0	19	47·0	3
RUTLAND.									
Burley-on-the-Hill	W. Temple, Esq.	1·75	·45	25	7	85·0	18	45·0	3
West Deyne, Uppingham	Rev. G. H. Mullins	1·26	·62	24	7	88·8	19	44·3	4
Northfields, Stamford	W. Hayes, Esq.	1·06	·90	24	5	82·0	20	47·0	13
Radcliffe Observatory, Oxford	Mr. H. E. Bellamy	1·13	·66	24	7	84·3	19	46·7	3
Spital Cemetery, Carlisle	T. Bell, Esq.	·94	·27	5	11	82·4	21	40·0	12
Altarnun Vicarage	Rev. G. Tripp..............	1·59	·40	27	14	86·0	20	44·0	1 29 31

The barometer, with the exception of one drop accompanying the thunderstorm alluded to above, was uniformly high and steady, and there were no strong winds. Many reports speak of the excellent hay harvest, which was secured in good condition. The corn, too, improved greatly. Oats were cut at Waltham in the last week of the month, and barley near Nottingham on the 23rd.

Of direct solar heat, measured by a thermometer with blackened bulb, in a vacuum, we had at Spondon, 158° on the 20th, and 153° on the 21st, 144·8° at Cheltenham on the 20th, 144° at Leicester on the 20th, 138·2° at Loughbro' on the 20th, and 133° at Buxton, also on the 20th. Thick night mists with heavy dew are reported from Rotherham, during the middle part of the month, "owing, doubtless, to the drought of nearly five weeks."

Correspondence.

Where are the Butterflies ?—May I ask our Entomological friends what has become of the "Diurnal Lepidoptera" this year? I have scarcely seen a butterfly here, not even a white one. Were they destroyed by the wet May, and has their absence been noted in other counties?—Umbrella Net, Leicester, August 18th.

Cristatella Mucedo.—On the 15th of August, for the first time this year, I found the rare and beautiful Polyzoa, *Cristatella mucedo*, near Birmingham. On that day I found only three specimens, although searching for over two hours; but on the 22nd I found them in great abundance, and full of their elegant statoblasts or winter eggs. I am preparing a reduced copy of Professor Allman's drawing of this object, from his admirable Monograph on the Fresh-water Polyzoa, which I hope to send out to my correspondents, together with the living objects if they should survive long enough.—Thomas Bolton, 17, Ann Street, Birmingham, August 24th, 1878.

Snipe Breeding.—As instances of the snipe breeding in this district are, I suppose, rare, it may interest some of your readers to know that about a month or five weeks ago I saw in this neighbourhood a nest of the full snipe with four eggs in it. My friend who pointed it out to me was fortunate enough to see the bird on her nest. This I did not do. She has since hatched out her young safely. Soon after seeing the nest I flushed a snipe on some hill ground, about a mile from the first-named locality. Whether this was the male bird feeding, or whether it betokened another breeding couple of course I cannot say.—Wm. Elliot, Cardington Vicarage, Church Stretton, Aug. 9th, 1878.

The Cuckoo, &c.—The double note of the cuckoo is not uncommon, but the same cuckoo does not change from the single to the double note. The bird which says cuck-cuck-oo never says cuck-oo. There was a cuckoo with a double call which came here regularly for several years, and from the first day of its arrival to the day of its departure it always used the double call. In this neighbourhood there is now a great scarcity of cuckoos, and this has been the case for several years. It seems desirable to record the alterations in the number of animals, birds, &c., from year to year. There is a great increase in the number of moles, rats, wood pigeons, toads, frogs, and field mice, and a great falling-off in the number of landrails, cuckoos, dragon flies, wasps, and grass-hoppers. An epidemic has killed many field mice and fowls in this neighbourhood.—E. J. Lowe, Nottingham.

Cuckoo.—Your correspondents, in answer to "N.'s" enquiry in the July number of "The Midland Naturalist," regarding the note of the cuckoo, concur in stating that the frequent repetition of the first part of its note is very common. Such is my own observation; but is not Mr. J. R. Thompson mistaken in saying that this only occurs just before the bird is about to leave us, as I have frequently noticed the circumstance soon after the cuckoo's arrival in May? At the former-named period, however, its note is often very hoarse and peculiar, much like the sound produced by the trumpeter pigeon. The question of the cuckoo's incubation is a more important and interesting one. It is, I fancy, quite unique in the habit of depositing its egg in the nest of another bird, and this invariably an insectivorous one—usually a wagtail or a hedge-sparrow. It is sometimes asked how can this be managed, where the nest, as often happens, is in such a position as to make it impossible for the cuckoo to go in and lay its egg like any other bird? I am assured that the egg is first laid and then conveyed to its destination in the cuckoo's mouth or throat. An accident, which lately occurred near here, seems to confirm this explanation of the difficulty. A cuckoo flew against a plate-glass window and fell stunned by the blow. It was taken up and a little water sprinkled on it to revive it, when it was seen to vomit an egg, apparently from its throat. It then soon recovered, and was set at liberty. A few days later a cuckoo, possibly the same bird, was observed clinging to a mass of jasmine close to the same spot, and an egg was deposited in a water-wagtail's nest, situated within the bush. A young cuckoo was soon afterwards hatched and reared there by the wagtails, and was an object of much interest to the inmates of the house during its growth and after it had left the nest, being, apparently, tended with the greatest solicitude by its foster parents. Can any of your readers supply further information on this subject?—Arthur S. Male, More Rectory.

An Apple Tree in my garden, bearing fruit, has this week put out blossoms on one branch, a thing I never observed at so late a date before. Wm. Elliot, Cardington Vicarage, Church Stretton, Aug. 9th, 1878.

Mirage, seen by Capt. A. E. Lawson Lowe, (from the camp of the North Durham Militia, at Redcar.)—Capt. Lowe writes:—"This mirage occurred on July 19th, 1878, on an intensely hot day, (the temperature said to be 96° in the shade,) a little before six in the afternoon. Looking towards Hartlepool, (about six miles off,) the distance being particularly clear, every object in the town was distinctly visible. About a quarter of an hour later a slight haze seemed to rise along the sea line, stretching quite across in front of Hartlepool, and when next I looked the whole town was reflected upside down in the sky. Every object was exactly reproduced in a reverse position up to a certain height, where the mirage was cut off by a clearly defined line, above which was the blue sky. Exactly in front of Redcar, out at sea, the ships were not reversed, but appeared distorted, their masts and sails being carried up, as it were, to twice their actual height. More to the right the ships appeared reversed in the same manner as was the town of Hartlepool; and at the extreme right, besides the reversed ships, each vessel had a shadowy representation of itself at a little distance to the right. The phenomenon lasted about ten minutes. Several of the officers were out fishing at the time, about a mile and a half from shore, and although they noticed the line of haze, the mirage was not visible from where they were."

Agave Americana (the American Aloe.)—Two of these rarely flowering plants have this year bloomed in the conservatory at Sudbourne Hall, Wickham Market, Suffolk, the seat of Sir Richard Wallace. The plants are about 24ft. high, with branches very short and thickly set together at the top of the stem, farther apart lower down, and not opposite one another; the flower-branches do not grow near the leaves, but are quite 3ft. above them. There were thirty-two branches, and taking each truss to average eighty blossoms, there were about 2,700 flowers on one plant. The flower buds look a pale greenish white, tipped with bright yellow; the flower lasts from three to four days. The scent is most disagreeable; an immense quantity of honey drops from the flower. The thickness of each leaf next the stem is from 6in. to 8in.; the width of leaf at the base is over a foot; length about 6ft. The leaves are dark green, with stripes of yellow round the edge. These plants are said to have been in the conservatory nearly eighty years. As soon as the flowers expand, the leaves begin to droop, and the plants gradually die away. The dry stem of a plant, that flowered about eight years since, is preserved in two pieces in the conservatory; and although nearly 27ft. long, can be easily carried about by a lady or child, being as light as a piece of cork.—R. M. S.

Geology of Shropshire.—Dr. Callaway having referred, in "The Midland Naturalist" for August, (p. 206,) to some criticisms of mine on his paper in the "Quarterly Journal of the Geological Society" for November, 1877, I may be allowed to say that these were founded on a misapprehension of his words as reported in the discussion on his paper. I find him saying there that "the shales are one homogeneous formation marked throughout by the same fossils, the younger types occurring in the same beds with the older forms, and mixed indiscriminately with them. In the lower part of the upper series also, there are no signs of transition into an older fauna, the species being common Caradoc forms." At a recent excursion of the Caradoc Field Club to Pedwardine, Dr. Callaway explained that he here referred to two distinct strata, in the lower of which Tremadoc forms are found without intermixture with those of Caradoc age.—J. D. La Touche, Stokesay, Craven Arms, Aug. 6th, 1878.

Gleanings.

The Reindeer in the Midlands.—An antler of the Reindeer *(Cervus tarandus)* has lately been found in the gravels of the Soar, near Leicester. The perfect portion is 2½ft. long, and 5in. in circumference at the beam. It is now in the Leicester Museum, which possesses another antler, and also a fine tusk of the Mammoth from the same deposits. These large bones seem always to occur at or near the base of the river-gravel, (here 10ft. to 17ft. thick,) resting upon the Keuper Red Marls.

Pond Life Collector's "Condensing" Bottle.—Mr. T. Bolton, of 17, Ann Street, Birmingham, has showed us a good form of "condensing" bottle, (price 3s.,) which collectors of pond life will find a most convenient addition to their apparatus. The water as taken from a pond is poured through a long-necked funnel into a bottle, of which the exit pipe is terminated inside by a wire cage covered with fine muslin. By help of this apparatus the living animalcules in a considerable quantity of water can be rapidly condensed into a small bulk, and so conveniently carried home.

Rev. W. B. Clarke, born 1798, (Suffolk,) died 1878 (Sydney, N.S.W.) Mr. Clarke was the "Father of Australian Geology." He went out in 1839, and was among the first, if not the first, to recognise the existence of gold in the Australian Continent. He was also the discoverer of diamonds and of tin there. An idea of his work may be gained from the fact that he is said to have officially reported on no less than 108,000 square miles of territory.

Entomology.—A good list of books on Entomology, now on sale, has just been issued by Mr. W. Wesley, 28, Essex Street, Strand, London, W.C.

W. C. Hewitson, born 1806, (Newcastle-on-Tyne,) died 1878. Of this deceased Naturalist an interesting memoir appears in the *Entomologist* for July. He was famous for the exquisite delineation and careful colouring of his illustrations of British Oology and of the Diurnal Lepidoptera. He has left his magnificent collections to the nation, but his library, with £3,000, to the Natural History Society of his native town.

The Geological Survey.—The new catalogue of the Survey publications has been lately issued, and may be obtained from any of the agents—as Longmans, Paternoster Row; Stanford, of 55, Charing Cross, &c. Many works are reported as "out of print," such as "Jukes on the South Staffordshire Coalfield," "Ramsay's North Wales," &c. Surely, some efforts should be made to bring these up to date. Among new works marked "nearly ready" we note "Skertchley on the Manufacture of Gun-Flints," &c., (which, we expect, will prove most interesting to all who are engaged in the study of pre-historic man,) and a big book by Prof. Green and his colleagues on the "Geology of the Yorkshire Coal-field." It will be interesting to note the price at which the latter will be sold, after the experience we have had lately.

Deep Well-boring at Holkham Hall, Norfolk.—We are indebted to Mr. W. Whitaker, F.G.S., for the details of this successful undertaking.

		Feet.
	Gravel	20
	Chalk with flints	519
	Chalk without flints	116
	Red marl ("red chalk")	8
	Blue gault	10
Neocomian, 70ft.	Hard sandstone	½
	Sandstone	14½
	Green sand	8
	Sand ?	39
	Soft carstone	3
	Hard carstone	5

An abundant supply of water was obtained, 540 gallons per minute having been pumped. Holkham Hall is thirteen miles east of Hunstanton, where the red chalk crops out in the well-known cliff, but at the latter point the gault is absent.

Reports of Societies.

BURTON-UPON-TRENT NATURAL HISTORY & ARCHÆOLOGICAL SOCIETY.—The members made an excursion to Wichnor and Alrewas, on Saturday, July 20th, under the leadership of Mr. T. C. Martin, hon. sec. At Alrewas Church they were joined by a number of members of the North Staffordshire Naturalists' Field Club. The church, a very interesting building, was fully described by Mr. A. Scrivener. The register contains entries as early as 1547. Wichnor Hall, the seat of Colonel Levett, was next visited, where luncheon had been hospitably prepared for the visitors. Wichnor Hall was an object of great interest from its historical associations, the curious nature of its tenure, and the many rare objects of various kinds carefully preserved in it. After passing through the Park the Church was visited. Cordial votes of thanks were given by the two societies to Colonel and Lady Jane Levett for their hospitality and kind reception.

CARADOC FIELD CLUB.—The second Field Meeting was held at Brampton Brian, July 18th. A paper was read at Coxwall Knoll, by the Rev. C. Burrough, supplementary to one read last year at the Gaer Ditches, maintaining the claim of that locality to be considered the scene of Caractacus's last battle. The President read a paper at Brampton Brian Castle, containing extracts from the letters of Lady Brilliana Harley, who was besieged there. Subsequently Dr. Callaway gave an address at Pedwardine on the place of the beds exposed there in the system which his recent investigations have been elucidating. The members dined together at the Craven Arms Hotel.

DUDLEY AND MIDLAND GEOLOGICAL AND SCIENTIFIC SOCIETY AND FIELD CLUB.—The fourth field meeting for the year was held at Rugby, on Thursday, July 18th. Excellent arrangements were made by Mr. Hutchinson, Mr. Wilson, Mr. Oldham, and others, of the Rugby School. With the help of various vehicles a long round was accomplished on the borders of the Lias district. After visiting two clay-pits showing good typical sections of the Lower Lias clay overlaid by quartzose and flinty drift, the surface of the clay being in wave-like undulations, sometimes folded over like a crested breaker, the magnificent sections were examined in the Victoria Hydraulic Lime and Cement Works, where great interest was excited by finding some Saurian bones near a fine head which had been removed a few days previously. After gathering numerous fossils and getting a hasty view of the cement-making process, the way was taken through Holbrook Park to Holbrook Grange, the residence of C. M. Caldecott, Esq., who had kindly arranged on the lawn many fine specimens of bones found in the neighbourhood, some of which are figured in Dr. Buckland's "Reliquiæ Diluvianæ." Many other interesting curiosities were also seen, including flexible sandstone and rare agates, some of which were presented for the society's museum at Dudley. After passing the remains of old Boughton Hall, King's Newnham Lime Works and a weak chalybeate bath were visited, and good specimens of the upper part of the White Lias were secured, with marks of boring insects as evidence that they once formed the surface. This surface is now covered with Lower Lias *Planorbis* shale, and this again by red glacial clay, the reasons for the irregular junction of these causing some discussion. After a peep at Newbold-on-Avon Church, a walk through the churchyard led to the Newbold Lime Works, where a very fine section of contorted Lower Lias limestone and shales was seen. Returning to Rugby a welcome luncheon was found set out in the Town Hall for greater commodiousness. Dr. Fraser, the President, thanked those to whom the Society were so much indebted for the day's programme, and then, by permission of Dr. Jex-Blake, the School was visited, where, besides the class rooms, chapel, and houses, and the magnificent close which always has an interest all its own on a half-holiday afternoon, special interest was taken in the Museum and the model of the neighbourhood in course of construction, and a good collection of fossils and other objects, and also in the baths and gymnasium, but particularly in the observatory, where members lingered over the valuable instruments used for some of the more abstruse investigations in Astronomy. Equally good arrangements had been made for an afternoon ramble in the opposite direction of Hillmorton, where some more clay-pits, and especially a clay-pit and sand-pit near together with a probable fault running between them in a singular manner were to be seen, also a cutting for widening the railway, by the "Steam Navvy," in a glacial re-formation of Lias; and the Church standing on a sort of island in the midst of deep peat. All these were most attractive objects, but want of time prevented the ramble, although it has since been done by some of the members. The Chester field day and visit to Salt Mines at Northwich promises much interest, and the help of many local residents has been promised. It has, however, been found necessary to postpone it from September 10th and 11th to September 17th and 18th.

EVESHAM FIELD NATURALISTS' CLUB.—An excursion of the Club took place on Wednesday, August 14th, to Buckland, near Broadway. The following botanical specimens were taken during the afternoon:—*Epipactis palustris*, *Vitia sylvatica*, *Campanula trachelium*, *Polystichum aculeatum*, *Aspidium Filix-fœmina*, and *Scolopendrium vulgare*.

NORTHAMPTON NATURAL HISTORY SOCIETY.—The June excursion to Rothwell, Rushton, and Lamport proved a very enjoyable one. The party first visited the gardens and grounds of Rushton House, in which is situated the Triangular Lodge where the conspirators met to concoct the Gunpowder Plot. The wilderness used to be the habitat of the fly orchis, but this was searched for in vain. Rothwell Church and Market House were then visited, the *miserere* seats in the former being very curious. After a pleasant drive through the Harrington Valley and Orton to Foxhall, near which occurs the almost sole piece of bogland left in Northants, the botanical section eagerly searched over this ground, which yielded among other plants, *Pinguicula vulgaris*, *Eriophorum angustifolium*, *Carex pulicaris*,* *C. stellulata*,* *C. flava*,* *C. fulva*,* *Carduus pratensis*, *Pedicularis palustris*, *Pimpinella magna*, *Gymnadenia conopsea*, *Orchis latifolia*, *Ophioglossum vulgatum*, *Molinia cærulea*,* *Triodia decumbens*,* *Valeriana dioica*, and a very rare plant, *Blysmus compressus*.* In the hedgerows, nearer Mosely Wood, *Rosa tomentosa*, *R. micrantha*, and *R. Doniana* occur. Rejoining the photographic section at Foxhall the party proceeded to Lamport, noticing on the way *Festuca myurus*. At Lamport the grounds of Sir Charles Isham afforded some pleasant rambles, the rockeries being covered with some interesting Alpine plants. The rectory pond is said by Rev. J. M. Berkeley to yield *Acorus calamus*. [Plants marked thus * are not included in "Topographical Botany."]

OSWESTRY AND WELSHPOOL NATURALISTS' FIELD CLUB AND ARCHÆOLOGICAL SOCIETY.—Fourth Excursion, August 12th.—The Club met at Lydham Heath Station, and proceeded to Linley Hall, the residence of Jasper More, Esq., which is approached by a fine double avenue of oaks, a mile long. At the top of the avenue is the site of a Roman villa. The park is very beautiful, and there is another fine avenue of beeches two miles in length; the old archery practice ground of the Norman soldiers, called The Butts, was also visited. It consists of two large mounds, eighty yards apart. The party then went on to the Stiperstones, the second highest hill in Shropshire, 1,759ft. high. Some of the party visited a quarry on the Shelve Hill, and found specimens of *Dictyonema sociale*, and a species of Graptolite, and also of Bellerophon. Amongst the plants found were *Campanula patula*, *Artemisia absinthium*, and *Vaccinium vitis-idæa*.

SEVERN VALLEY NATURALISTS' FIELD CLUB.—On August 6th, forty-five members and friends visited Ellesmere. The Great Western train landed them at Whittington Station, whence, inspecting *en route* the picturesque ruins of Whittington Castle, they drove to Ellesmere. Here they walked to the Bowling Green on the site of the old Castle mound, and thence along the side of Ellesmere, then to Oteley Park, where, by kind permission of the owner, S. K. Mainwaring, Esq., they were able to enjoy a walk through the lovely gardens and grounds. After luncheon under the trees in the park, the walk was resumed by Newton Mere and Kettle Mere to Colemere, Blackmere being also seen on the way to Whitemere. This part of the day's proceedings was interfered with by heavy thunder rain, which, however, ceased when Whitemere was reached, and a fine drive was enjoyed to Rednal Station. The explorations of the botanists were cut short by the weather, but the Rev. W. A. Leighton directed attention to a singular phenomenon which occurs in Ellesmere at this season, and was then taking place. It is locally called the "breaking up of the water," which resembles the turbid state of boiling wort. "The innumerable minute bodies in motion causing this appearance, are (said Mr. Leighton) composed each of a central agglomeration of spherical cellules, from each of which cylindrical filaments radiate in every direction. These filaments are broader near the central globule, and are attenuated gradually towards their apices, and are divided into short uniform cells, separated by distinct septa or joints, the cells being filled with chlorophyll of a glaucous or verdigris green colour. The mode in which this minute plant reproduces itself has not been observed, but it is not improbable that some sort of conjugation takes place as in the conjugate confervæ, when the chlorophyll of two adjacent cells is united into a third or new cell, which forms the winter spore. These winter spores are doubtless the central spherical cells above mentioned, which sink to the bottom of the lake and remain there dormant till August, when they rise to the surface, and germination takes place by throwing out the radiating filaments which eventually again produce the sporangia which sink as before mentioned. This little alga is well figured in English Botany, tab. 1378, under name of *Conferva echinulata* from specimens sent in 1804 from a lake in Anglesea. Its proper systematic place is in Roth's genus *Rivularia*." At Colemere and Whitemere Mr. Leighton also pointed out the singular green "Moor Balls," which are found in abundance at the bottom of these lakes, and in Alpine lakes, in North Wales, and in other counties. "They consist of an articulated Conferva, (said Mr. Leighton,) which, by the action of being rolled about the bottom of the lake by winds and currents of water, forms rounded agglomerations, varying in size from a walnut to a cricket-ball." Mr. Leighton also observed on the stonework and steps of the terraces at Oteley, large masses of dense black stains, some of which he scraped off, and on microscopic examination at home, found it to be a collemaceous lichen, termed *Synalissa picina*, Nyl., which has never before been detected in Great Britain.

SHROPSHIRE ARCHÆOLOGICAL AND NATURAL HISTORY SOCIETY.—The members had a very pleasant summer excursion on July 8th. The first point of interest visited was Tong Church, the Hon. and Rev. J. R. Orlando Bridgeman acting as conductor to the party. It contains some interesting monuments, chief among which is an alabaster one to the memory (it is supposed) of Sir Richard Vernon and his lady, and another to the memory of Sir Thomas Stanley, on which are the lines commencing "Not monumental stone preserves our fame." Donington was next visited. The church there is now being restored. The Rector, the Rev. H. G. De Bunsen, received and guided the party through the church, in which there is an ancient window supposed to represent "Our Lord and His Mother," in the *fleur de lys* costume of A.D. 1280-1300. The party proceeded to "Whiteladies," now a ruin, but once a flourishing convent of Cistercian nuns. It contains some interesting monuments. Boscobel House next occupied the attention of the party. Here it was that Charles II. found shelter after the battle of Worcester in 1651. Much interest was, as usual, centred in the "Royal Oak" tree, in which the King is said to have hid himself while Cromwell's troopers were in search of him. Whether the present safely-guarded tree is the one which afforded a hiding-place to the royal fugitive is matter of controversy. Mr. De Bunsen quoted the Rev. G. Plaxton, Vicar of Donington, 1690-1703, who in his day spoke of "the poor remains of the Royal Oak" being fenced in; Blount, Evelyn, and other authorities, who all spoke of the way in which the original oak had been robbed by relic-hunters, &c. On the other hand, Mr. De Bunsen read a letter from the Earl of Bradford, in which his lordship discarded the usual stories of the owl flying out of the tree, and of a pillow being placed in its branches on which the King reclined; as also he did the equally—as his lordship thought—untrustworthy accounts of the destruction of the tree. In his lordship's family it had been handed down from father to son that the tree was the same as that up which the King, suddenly disturbed when out with the Penderels, hastily climbed; which was described as a growing oak. Nine years after, when the Restoration came, the tree was well known, and when the coppice was thinned it was preserved. From father to son amongst the tenantry it had been known, and his lordship, who had known the tree for fifty years, was strongly of opinion that the tree itself bore evidence of being of the necessary age, and not a sapling from the original tree. The lower branches had, doubtless, been cut away, but not to the extent described. An article appeared in the *Gardeners' Chronicle*, September, 1866, in which the writer holds that the opinion that the tree is a "seedling" is absurd. He goes in for the great age of the existing tree as enthusiastically as Lord Bradford does. He measured the tree to be 11ft. in circumference, but does not say at what height from the ground; and as "18ft. to the crown, and, perhaps, 20ft. more to the top." The Rev. J. Brooke, in 1857, measured it, at 4ft. from the ground, to be 11ft. 4in. in girth; and, with the assistance of an experienced timber merchant, who carefully compared it with other trees, came to the conclusion that it was not then more than 150 years old. Amongst other authorities who had written about the tree, Mr. De Bunsen quoted Dr. Charlett, of Oxford, who saw it in 1702, and who described it as "the trunk of the Royal Oak now enclosed within a round wall;" on which Mr. Dale (who was appointed curate of Donington in 1811,) writing in 1845, remarked "*truncus*, a stump, stock, or body of a tree." Dr. Stukeley (1713) was also quoted as describing the tree enclosed within a wall, and "almost cut away by travellers," and as having by its side a "thriving young plant from one of its acorns." The Rev. W. A. Leighton said he remembered when a boy his aunt, who lived at Brewood, showing him a bit of touchwood, which had formed part of the original tree, and he had no doubt whatever the tree they were looking at was the sapling mentioned by Dr. Stukeley. Mr. De Bunsen said he had heard of old people who remembered two trees enclosed, and it had been suggested that the wrong one had been shown to relic-hunters so as to preserve the original tree. The party drove back to Shifnal through Weston Park, by permission of Lord Bradford, instead of along the ordinary road.

TAMWORTH NATURAL HISTORY, GEOLOGICAL, AND ANTIQUARIAN SOCIETY.—July 8th.—Monthly Meeting.—Mr. E. D. Hamel exhibited the Microphone and described the several novel inventions recently brought before the public by Prof. Bell, Eddison, and others. A number of experiments were made with the Microphones, and a most successful evening brought to a close by the usual vote of thanks. On the 19th July an excursion was made to Rugby and Bilton, in which a goodly number of members accompanied the President. The party visited the Schools, (by kind permission of Dr. Jex-Blake,) and afterwards inspected the valuable Archæological collection belonging to M. H. Bloxham, Esq. Conveyances then took the members to Bilton, and both the Church and Hall there afforded much interest. The party reached home again at nine o'clock P.M., after spending a very enjoyable afternoon. August 12th.—General Meeting.—A friendly competition had been entered into between two lady members of the Society as to which could produce the greatest variety of wild flowers growing on the banks of the Rivers Tame and Anker. Eighty-one specimens, carefully labelled, were shown as collected on the Anker, and thirty-three from the Tame. The President afterwards read a paper entitled "Primitive Man," in which he dwelt on the evidence afforded in the Stone and Bronze ages, as showing the existence of man at that time.

WOOLHOPE NATURALISTS' FIELD CLUB.—July 18th was what is courteously designated "The Ladies' Day," and, as is customary, a goodly attendance of ladies recognised the courtesy. The Forest of Dean was the scene fixed for the excursion. Much of the once forest is now bare of trees, but that portion which the Society visited on this occasion is still occupied by worthy arboreal representatives of an earlier state. The Botanists were on this occasion fully to the front, and many interesting finds were secured for their vasculums. Among the most noticeable we may mention *Anagallis tenella*, *Scutellaria minor*, *Pedicularis sylvatica*, *Hydrocotyle vulgaris*, *Hypericum elodes*, *H. humifusum*, and *H. pulchrum*, but the great find was *Campanula hederacea*. A large beech tree, which at five feet from the ground gave a girth of 16ft., attracted deserved attention. Others gave 12ft. 4in. and 14ft. 2in. One, just fallen, gave a girth of 14ft. 6in.; and as the saw had cut its way smoothly through, its age was ascertained, with tolerable accuracy, by counting the annular rings, (123 in number.) which were a little shaky in the centre and at the margin—for which, making due allowances, twenty were added to the plainly visible ones—to be no less than 143 years. The largest beech in the forest measured, at five feet from the ground, 17ft. 4in. in circumference, and its height was estimated at from 90ft. to 100ft. The "High Beeches" are still loftier, and two of them are very grand; but the most imposing only gave a circumference of 16ft. The holly trees about the "Speech House" (an inn so called) are noticeable, some of them being very aged. A few funguses were obtained. Dinner was served in the Verderer's Room at the "Speech House," after which the veteran, Mr. E. Lees, F.L.S., gave utterance to valuable though modestly called "Cursory Notes on the Forest of Dean and some of the Objects Within it," the appreciation of which was, on the motion of Dr. Bull, evidenced by a unanimous vote of thanks for present and past favours to the Club. The company having adjourned to the beautiful terrace on the western front of the inn, Capt. Mayne Reid gave a most pleasing account of the "Chinampas or Floating Gardens of Mexico," which was acknowledged by a cordial vote of thanks. This Field Day was a pleasant and memorable one.

ERASMUS DARWIN.

In the published address of the President of the British Association, at the meeting for 1874, we read that the late Sir Benjamin Brodie had often called his (Professor Tyndall's) attention to the fact that at the end of the last century the philosopher and poet, Erasmus Darwin, who may be especially claimed by the Midlands as their own, was the forerunner of those biologists of the present epoch who have wrought so great a change in vital dynamics. How far this is true may be worth enquiring into, as well as profitable, and we shall probably come to the same conclusion as Sir Benjamin, but at the same time be far from believing that the doctrine of Natural Selection, or the Survival of the Fittest, and the Origin of Species by such simple means, is not the offspring of the thought of our own days. The older philosopher was, indeed, the precursor of the illustrious biologists of our present times, as he was the progenitor of the greatest of them; but it will be seen that in some cases the old and modern theories are just the antitheses of each other. Still it remains a subject of interest to observe philosophers of the last and present centuries, with such relationship, pursuing the investigation of the same identical subjects, whether we attribute the circumstance to the hereditary transmission of the same tastes, a subject well dwelt upon in the writings of both, or simply to the force of precept and example.

Till the year 1781 Erasmus Darwin, M.D., F.R.S., (though he had been previously a short time stationed at Nottingham,) was in practice at Lichfield, but he afterwards resided in Derby. To judge from the "Zoonomia," and from what his literary friend, Miss Seward, tells us, his practice must have been pretty extensive. Indeed, he was an example showing that the life of even a rural disciple of Esculapius, from the natural tendency of his art and of scientific pursuits to mutual diffusion, need not, nay, should not be alienated from the latter; and such an alluring tendency of science towards medicine is happy, for the *liaison* is not always profitable in the vulgar sense. Dr. Johnson, the lexicographer, was in the "sere and yellow leaf" when Dr. Darwin left Lichfield. They had met, but what was the sentence of the Colossus upon the "Botanic Garden," published about three years before Johnson's death, we are not in a position to say. There was no deficiency of other society in and around the little city, such as Darwin estimated, and such as could estimate him—Watt, Boulton, Edgeworth, Day, Wedgwood, Brindley, Dr. Small, (of Birmingham,) and others. No doubt it was at Lichfield, where, taking advantage of some natural capabilities presented by a parcel of land which he had purchased, he had formed a little botanical paradise, that he composed his poems. He was instrumental, too, with Sir B. Boothbey and Mr. Jackson in publishing there part of the works of Linnæus.*

It has been observed that Darwin was entitled to be called "the poet of art and science," but "whose taste for philosophy, perhaps, in some measure, spoiled the poet, whilst his powers of imagination were

* A Miss Jackson, of the same city, published a botanical volume, with numerous drawings of plants, which are far from contemptible. 1840: Longmans and Co.

almost incompatible with the cool investigations of science." For the last, however, he himself apologises, by observing that theorising, when our knowledge is imperfect, is not without use; neither is the theoretic distribution of natural objects, as it developes some of their analogies. His poetry few read now, though it is often distinguished by great taste and elegance of description; in fact, it is the very *embarras de richesses* which is its fault. Though scientific thoughts or pleasing natural objects, sparsely introduced, become giants in poetry in the hands of a Tennyson or a Browning, yet too prodigally used they are worse than ineffective.

Darwin's poems are annotated by copious remarks which display learning, research, and many of them original views to which we have already alluded. His prophecies of future scientific triumphs have often been noticed as marvellous, and they certainly are remarkable, as, for instance, of steamships and railways; but then he ventured upon other predictions—as of subaqueous and controllable aerial locomotion, and many other things which at present are not likely to come to pass. His medical and physiological work, "Zoonomia," 1793-6, contains much that was new at the date of its publication, much that has been developed in our age—for instance, in medicine the recommendation of ovariotomy, and more explicitly of lithotrity; but, at the same time, it displays much of the fanciful and some little of the absurd, though on the whole entitled to a more frequent study. His later poem, entitled "The Temple of Nature, or Origin of Society," unnoticed in some of the biographies, was, we think, published only a few months before his death, in 1802, and has, like the "Botanic Garden," copious philosophical notes.

Taking his works generally, the "Botanic Garden," the "Temple of Nature," "Phytologia," and the "Zoonomia," for we do not think it necessary to specify the particular work, volume, or page, we shall find that, though Erasmus Darwin considers the earth to be still in its juvenile stage (!) he insists upon a vast antiquity, millions of years, for it; and observes, in accordance with our present geological ideas, that those parts of it which contain the highest mountains are often the newest raised, because they have not existed long enough to be worn down by external agents; he also teaches that there has been a constant development and differentiation going on in the world, even in the sidereal system; as of stars out of nebulæ, quoting the authority of Sir W. Herschel on this subject. He studied the formation of coral-rocks, and of limestone and chalk, by organic agencies. He observes that inland seas, such as the Mediterranean, would soon become freshwater lakes by a slight change of level, as the rivers flowing through them would wash out the salt. He is a friend to the doctrine of heterogenesis, and argues for it at length in the notes to the "Temple of Nature," as well as elsewhere—

> Hence without parent by spontaneous birth,
> Rise the first specks of animated earth.

He further argues for a formation by apposition, and against the *emboitement* of germs, and supposes all organic beings to have originated in simple plasm, and, when continued through generation, by filaments and molecules or organic particles, derived from every region of the parent (pangenesis.)

He believes it to be shown by the existence of rudimentary or useless parts, such as the nipples of male animals, or the useless toes of swine, that animals have undergone changes—that monsters prove the same thing, but that in some cases monstrosities may be progressive rather than retrogressive, and aim at something to come. Species are not permanent, but may be transmuted—the tendency being an increasing perfection. Animals are first aquatic, then amphibious, and finally aerial; and this is more or less seen in embryology. With respect to the Origin of Species in plants, he quotes Linnæus's opinion that at first there were only as many species as there are true natural orders. He discusses the theory of man's quadrumanous descent.

He gives due influence to a Struggle for Existence as regards the extinction and modification or improvement of animals. With respect to Sexual Selection, he observes "the final cause of this contention amongst the males seems to be that the strongest and most active animal should propagate the species, which should hence become improved." He lays stress on the effect of the natural or artificial cultivation of animals, hence the changes brought about in the horse, dog, sheep, rabbit, and pigeon. He also attributes an influence towards the gradual production of species to the *nisus* to obtain food and ensure security. This last is rather Lamarckian than Darwinian, and it may perhaps be seen that even in respect to the effects of cultivation and sexual selection we have not lucidly expressed the salient point of the modern hypothesis—the certain but gradual effect in the production of species of slight, favourable variation, when developed by Natural Selection, rendered sufficiently efficient by length of time and unlimited numbers of the individuals. The elder philosopher does not tell us that the changes are so inevitable and undirected. He saw in the colouration of birds and their eggs, in the habits of insects, and in the modes of vegetable fertilisation, &c., as well as in physical nature in general, signs of design or extraneous intelligence. Nature, he says, is subject "to immutable laws impressed on matter by the Great Cause of Causes, Parent of Parents, *Ens Entium*." He is more generally correct in attributing some modification of species to climate and season, than to hybridity, which appears to have, on the whole, the reverse effect.

He seems to have taken an interest in the modes of fertilisation of flowers, but was thoroughly ignorant of the participation of insects in that act. The corolla for him was a thing of beauty, and also for the respiration of the sexual organs; the nectar nourished the seeds, and was curiously guarded from the injurious depredation of insects, a superabundance of it only being, in a few instances, as in *Cacalia suaveolens*, acceded to them. He noticed the curious mechanism of the flowers of the broom, but did not discover that this mechanism is generally brought into play by the visits of bees. He gives curious examples of contrivances to effect ordinary fertilisation, mentions the ripening of different sets of anthers at different times, and the different length of sets of stamens in the same species, in *Lythrum* and *Lychnis* for instance; as well as the great appetency of the stigma in some flowers, as *Collinsonia*, for foreign pollen, which he calls *vegetable* *adultery*: he saw the injurious effect of breeding by buds alone, and instances disease of the potato as such a result; yet on most of these points he has been left far behind by the observations of his gifted and laborious descendant. He explains the similitude of the flowers of *Ophrys apifera* to the bee, as designed to keep off the insect, the latter supposing that the flower is already appropriated. He was the first to point out the many close analogies of the animal and vegetable kingdoms. He studied climbing-plants, bulbs, and buds, and the effects of grafts on the stock; and he alludes to the admixture of parts of two kinds of fruit in one. He notices the irritability of the leaves and their glandular hairs in the *Drosera*, though not from his own observation, and attributes such actions very strangely to vegetable sensation, ideas, and volition.

He considers instinct to be but an imperfect reason—a gradation to mind; that the race of bees is older than man, because the intelligence of the hive bee is unchangeable and arrived at perfection; that the singing of birds is more like artificial language than a natural expression of passion, as the young bird only learns its song from its parent, or from its own kind. Man has attained his pre-eminence principally by reason of his *touch* and developed powers of *volition*, as dwelt upon in our times by Herbert Spencer and Dr. Carpenter. In "Zoonomia" we have an interesting dissertation on Instinct, of seventy-nine pages, rich in fact. (Ed. 3rd, 8vo., 1801, vol. 1, sec. 16.)

He, more or less probably, endeavours to account for the origin of some of our facial or bodily expressions. He supposes that infants acquire the smile from the pleasure of relaxing the facial muscles after the action of suckling, and associates other pleasant feelings, as the sense of beauty, with the remembrance of the fount of infantile enjoyment. His remarks on hereditary acquirements are numerous and worthy of regard. He considers the acquired or inherited love of drink to be the frequent cause of the extinction of families, and of more than half of our chronical diseases; and even in his time, when the poorer classes could less afford to spend money in the pernicious stuff, as the curse of Christendom: like Prometheus, we take fire in our bosom, and sometimes suffer his punishment, even literally as respects the seat of injury. Darwin combated the gout in his own person at the age of forty by totally renouncing fermented drinks, and continued quite free from it till his death, though he was a gourmand in fruit and non-spirituous drinks of several sorts. From the hereditary tendency to disease arises his observation that "it is hazardous to marry an heiress."

We think that upon the whole we have now traced in the philosopher of the eighteenth many of the germs of thought which have been developed in the present century. But with respect to these more modern doctrines we say little in this article. Few have been more interested in Mr. Darwin's writings than ourselves, but it is not in us to say how far his theory is adequate to the requirements, or whether some *primum mobile*, which the vitalists would supply, is wanting—some doctrine of life as antecedent to, yet wonderfully influenced by, the simple operation of Natural Selection.

All men have not the same cast of mind. What may appear essential to one may seem impertinent to the question to another. Erasmus Darwin, though in his day branded with the name of atheist, and consigned to the infernal shades in the pages of the "Methodists' Magazine," &c., was eminently the reverse, and must be ranked with the teleologists; he certainly was not without the mistakes which are sometimes attributed to the school. Had he lived now he might have appeared in another phase; but whether so or not, we believe that he would have been a bright luminary in biology; that he would have been a popular poet may not be so certain.

KEMPLEY CHURCH, GLOUCESTERSHIRE.*

BY J. HENRY MIDDLETON, ESQ.

The Church at Kempley, in Gloucestershire, consists of a Norman nave and chancel, built probably at the end of the eleventh century: their sizes are roughly—nave, 34 feet by 19 feet; chancel, 18 feet by 14 feet, internal measurement. All the walls of this early part remain, with the west and south doors, the narrow chancel arch, and four of the original windows. In the fifteenth and sixteenth centuries a western tower was added, a wooden porch built on to the south door, and two perpendicular two-light windows were inserted in the nave, probably in the place of older Norman ones.

The dedication of this church is not quite certain, but tradition ascribes it to the Blessed Virgin, and this view is supported by the legend on one of the bells, which is *Dilige Virgo Pia quos congrego Virgo Maria.* Another bell has the following legend:—*Jesu campanam tibi semper protege sanam.* Both these bells date from the reign of Edward III.

The chancel, where the best preserved paintings remain, is covered by a plain, circular barrel vault, built in rubble. This vault has nearly been the destruction of the chancel, by spreading and so pushing out the walls, which were without buttresses, as is usual in Norman work. It has, however, been lately shored up and made secure from outside. Such vaults as these are common in military and monastic buildings of the eleventh and twelfth centuries; but, except the White Chapel in the Tower of London, I do not remember another English instance of a church being so roofed.

The chancel arch, as well as the vault, is much injured and distorted by settlement, and a crack along the crown of the latter has seriously injured the paintings.

The whole wall surface of the chancel, in addition to the soffit of the vault, has been richly decorated with painting, and most of it still remains in a remarkably perfect condition, considering its great age. The comparative freshness of the colouring is owing to the whole surface having been thoroughly covered with repeated coats of whitewash, and

* Read before the Woolhope Naturalists' Field Club, on May 28th, 1878, on the occasion of their visit to Kempley Church.

thus preserved from the effects of light, and other sources of injury. This covering of whitewash we removed bit by bit with the greatest caution and deliberation in the winter of 1872, when the existence of these long forgotten paintings first came to light.*

The paintings are executed on a single coat of stucco laid on the rubble wall, which is so rough and uneven inside that it cannot ever have been intended to be left bare; and I think there can be but little doubt that both the stucco and the pictures are contemporary with the building itself, *i.e.*, somewhere near the year 1100 A.D.

With regard to the technical process by which these paintings were executed, I am convinced that they are not true Frescoes: that is, that they were not painted on the wet stucco with purely earthy pigments and a lime medium: one reason being that the colour is little more than superficial, and has not sunk into and become incorporated with the stucco, as is the case with true Fresco. Another is the absence of "Fresco edges" as they are called, that is, the scarcely perceptible line that separates the patch of stucco laid one day from that of the next day; for, as it was necessary that the colours should be applied to perfectly wet and unset stucco, it was of course needful that no more should be applied to the wall than the artist could cover with one day's work, or in some cases even less. This being the case, then, that the paintings were executed on the finished and dry surface of the plaster, there remains no doubt that they are in some form of tempera, probably with a medium of egg and vinegar, or perhaps simply size. This latter process is sometimes wrongly called Fresco, even by the Italians themselves, who distinguish it by calling it "*Fresco secco*," and the true Fresco, "*Fresco buono;*" but it is better to use the word in its true meaning as implying painting on wet or "fresh" plaster.

In the centre of the vault is a figure of Christ in Majesty, more than life size, seated upon a rainbow, and enclosed in a frame or glory; a cruciform nimbus surrounds his head, and resting on the left knee is a book or tablet, with the letters IHC XPC, for *Iēsous Christos*. The feet are towards the east, and below them, just outside the frame, is a large circle much injured by the crack in the vault. This circle represents the earth made Our Lord's footstool. On each side of this globe is the figure of a seraph, nimbed, with six wings, and bearing a scroll. On either side of the figure of Christ the symbols of the Evangelists are represented—the bull and the eagle on the south side, and the lion on the north side, all holding books. The fourth beast is very indistinct, and is too much injured to be made out. Over the head of Christ are painted the sun and moon—the sun being a yellow roundel surrounded with white rays, and the moon a blue crescent with a small circle inside it. At the sides of these great lights are the

* The discovery of the paintings was brought about through the thorough examination of the walling previous to the proposed restoration of the church, which Earl Beauchamp, the patron of the living, had determined to commence. Mr. Middleton, the Architect engaged for that purpose, on discovering the existence of the paintings, strongly advised that the restoration should not be gone on with, but that the church should be shored up, the whitewash carefully removed, and the surface of the stucco covered with a solution of water glass to preserve the colouring.—Eds. M. N.

seven candlesticks, four on the north and three on the south side; they are blue with white knops and have long tapering candles. Next come two more seraphs, holding books in one hand and small flags or lances with pennons in the other. Beyond these, and close to the chancel arch, we find, on the south side, St. Peter, nimbed, with a key in his right hand and a book in his left. On the north side a figure of the Blessed Virgin, carrying a book; she seems to have no nimbus, but her head is covered with a veil or hood, surmounted by a sort of mural crown.

All these figures are painted on a red field covering the top of the vault. This red field or broad band is bounded by a white stripe on each side, and is stopped at the east and west ends by bands of an interlaced pattern, which are carried all round the vault and walls against the end walls. The side walls of the chancel are each divided into two unequal parts by windows near the east end.

The northern window is very perfect. The inner and outer arches have bands of colour, and the splay of the jambs and arch is covered with a chess-board pattern in squares of red, blue, and white.

The southern window is much injured, but there remains above it, as above the other, a painted canopy of walls and towers. To the west of the windows the wall space is covered on each side by six large arch-headed niches, in which are seated figures of the twelve Apostles. They are all nimbed, and hold books. St. Peter, who occupies the eastern-most niche on the north side, is distinguished by a large key, which he holds under his left arm. The others have no distinguishing symbol. They are not arranged in pairs, as is so often the case, but are all looking up towards the central figure of Christ. Below the feet of the Apostles there is an ornamental band or frieze, looking something like a rude inscription, but all painting below it is lost, if it ever existed.

Eastward of the two side windows are a pair of niches, rather wider than those occupied by the Apostles. In each is a figure without nimbus, and holding a staff in each hand, one resting on the shoulder and the other used as a support, suggesting the idea that these figures represent pilgrims. Both wear long tunics, with mantles fastened on the shoulder; and the southern one has a hat of the usual pilgrim form.

The east end has one window with round arched head, concentric with the vault. Below it is a band of interlaced pattern, like that at the ends of the vault. Over this window are three roundels, each containing a half-length figure of a nimbed angel with a scroll, and on each side there has been a large arched niche. The northern one has been completely destroyed by a mural monument which was fixed there, but in the other niche is a very perfect figure of a bishop. He is habited in mass vestments, the right hand is raised in benediction and the left holds a pastoral staff. The chasuble is dark blue or purple, lined with yellow; it is short in front and long behind, as we find in other examples of the same date. There is a broad white orphrey down the front, with a diaper pattern embroidered on it. The dalmatic is white, and reaches to the feet, so that the alb and stole are not visible. The maniple is blue, and very narrow, with expanding ends of white, with a fringe on each, as on the stole of St. Thomas of Canterbury at Sens. It is worn on the wrist, instead of being held in the hand, as was the more ancient custom, thus showing that this painting is not much earlier than the year 1100 A.D., as the change seems to have taken place in the latter half of the eleventh century. In early times the maniple was simply a napkin, and was used for wiping the priest's hands at the celebration of the mass. The mitre is pale red, not white as it generally is, and of the earliest form, exactly resembling those shown in Byzantine MSS. of the eighth to the tenth centuries; it seems to be worn over a sort of veil, which hangs down behind. At the feet of the bishop, on his right side, is a sort of cup or vase, probably intended for a chalice. On the left is a yellow roundel enclosing a blue cross, which may be a dedication cross; or again, this object may represent a paten.

The coloured decoration is carried over the chancel arch, which is in two plain square orders. The outer order is ornamented with a pattern of interlacing zig-zags, the inner one has ten yellow roundels bordered with red.

Considerable damage has been done to the side walls by two priest's doors, which have been broken through the wall, and by the insertion of a rude arch-headed recess, which was either an aumbry or an Easter sepulchre.

The only painting in the nave which appears to be contemporaneous with those in the chancel is the large one over the chancel arch, representing Christ in Majesty, and the Last Judgment. It is much damaged, and the upper part of it is still concealed by the modern ceiling. The figure of Christ, however, and of Archangels blowing trumpets, are still to be distinguished.

The other paintings are probably not earlier than the fifteenth and sixteenth centuries. On the jamb of the small Norman window, in the north wall, there are figures of St. Michael and a female saint. Between it and the next window there is a curious sort of wheel, enclosing ten circles, the meaning of which is not easy to make out.

On one of the jambs of the southern perpendicular window there is the figure of an Archbishop, and the wall west of it has a number of coarse paintings, which are of a still later date. Paintings like these later ones are far from rare in English churches; but I believe we might search in vain for another instance of paintings like those in the chancel and over the chancel arch, of a date so early as the beginning of the twelfth century, and with their unity of motive and completeness of design. The nearest to these in date are, I believe, the paintings on the chancel walls of Chaldon Church, in Surrey, representing the *Scala humanæ salvationis*, but they are, at least, half a century later than the examples before us.

It will be worth our while to compare a very interesting passage in Durandus' "Ratio Divinorum Officiorum," I., iii., 7—12, which, omitting the twenty-four elders, might almost be a description of these paintings. The great work of Durandus was perhaps better known and more widely circulated than that of any other author of the early middle ages, and there can be but little doubt that whoever executed these paintings was well acquainted with the following passage :—

"Sometimes Christ is depicted as Moses and Aaron, Nadab and Abihu, saw Him, namely on a hill, and under his feet as it were a work of sapphire, and a serene sky. And since, as St. Luke says, 'There they shall see the Son of Man coming in a cloud, with power and great glory and majesty,' therefore sometimes Angels are painted surrounding Him, who ever serve and wait on Him, and they are depicted with six wings, according to the words of Esaias, 'The seraphim were standing near Him, the one had six wings and the other six wings, and with twain they covered his face, with twain his feet, and with twain they did fly.' Angels are also depicted as in the flower of youth, for they never grow old. Sometimes also the Archangel Michael is painted near them, treading the dragon under his feet, according to the words of St. John in the Apocalypse, 'There was war in Heaven, Michael fought with the dragon,' which war denotes a division between the angels, the establishment of the good, the ruin of the wicked, or in the visible church the persecution of the faithful. Sometimes also there are painted round about him the twenty-four elders, according to the visions of the same John, in white robes, and crowns of gold. Sometimes also are included in the paintings the living creatures according to the vision of Ezechiel, and the same John : 'On the right hand the likeness of a man, and that of a lion, and the likeness of an ox on the left, and that of an eagle over all the four.' These are the four Evangelists, wherefore they are painted with books at their feet. . . . Sometimes also there are painted round about, or rather underneath, the Apostles, having long hair like Nazarites. . . . . . Moreover the Divine Majesty is sometimes painted with a closed book in His hands, because no one was found worthy to open that book, except the Lion of the Tribe of Judah. And sometimes He is painted with an open book, so that everyone may read in it, because He is the Light of the World, and the Way, the Truth, and the Life, and the Book of Life."

CONOCHILUS VOLVOX.

The pond near Redditch which for nearly two years yielded a constant and abundant supply of this interesting and beautiful Rotifer, has for the last month or so, on each visit in search of it, been "drawn blank." It is a curious fact that the "sticks" discovered by the Rev. Lord S. G. Osborne, congregated near the centre of many of the colonies from this pond, and called by his Lordship, (*vide* letter to the *English Mechanic* of 1st March, 1878,) "rooks' nests," were for several months in the spring and early summer, when the containing Rotifers were abundant, rarely to be found either floating in the water, in the sediment, or attached to submerged plants. But now that the Conochili have disappeared the sticks are plentiful, both floating freely and entangled in the brown flocculent matter (which by the way is full of interesting microscopic organisms) with which the water plants are at the present time coated.

There cannot be the least doubt that these "sticks" are Diatoms, though Mr. Hy. Davis, (by whom an interesting article on *C. volvox* was written and published in the "Monthly Microscopical Journal" for July, 1876,) once entertained, I understand, the opinion that they are Desmids, possibly belonging to the genus *Docidium*. This can scarcely be so, as the bodies divide longitudinally, as do Diatoms, and not transversely, after the manner of Docidium and other allied Desmids. They do not (at any rate the form commonly found) belong to the genus *Navicula*, as Lord Osborne originally supposed, as they lack the characteristic "median longitudinal line and nodules;" and his lordship's observation that only one form is found in each colony, and that the size of all the sticks in each is the same, the size varying with the dimensions of the colony, does not accord with my own. In one instance I found a decided Pinnularia, if not *P. viridula* a form excessively like it—one specimen only amongst a number of the common kind. The Diatoms, either owing to the jelly of the Rotifers not being a favourable medium for displaying the markings, or to the fact that the latter are worn away in some mysterious manner, are most difficult to resolve. Those which are free in the water are by no means easy, and though "high powers" have been brought to bear upon them, it is by no means clear which they are. I believe them to belong to the genus *Synedra*, closely allied to, if not identical with, *S. fasciculata*.

It is just possible that the plane spot at the centre of the valves may have been mistaken for the line of transverse division. At first sight it appears inexplicable that other bodies than acicular-shaped Diatoms are rarely, if ever, found in these erratic jelly-masses; but when we take into consideration that the jelly expands as the funnel-shaped creatures emerge, and becomes compressed when they are retracted, it is obvious the quasi tubes in which the animals live are always "too tight a fit" to allow freedom of entry for comers of every class, and it is simply owing to "Natural Selection," (if it is lawful to adopt the expression,) and the needle-pointed shape and hard and unyielding substance of the intruders, that they are able to gain a footing at the threshold. The sudden retreat of the irritated hostess draws, perhaps, one of them in a little way, the closely-pressing jelly retains it while its hostess cautiously passes outwards. Another sudden jerk draws the unwelcome visitor farther in, then another jerk and another, till the unbidden and perhaps unwilling guest reaches the middle of the globe and finds himself merely one "stick" in a "rook's nest."

The "Productive Pond," as Mr. Bolton styled it, now its stock of *C. volvox* is exhausted, has a rich store of the exquisite Polyzoa, *Plumatella repens*, growing unattached, twining in and out among the rootlets of *Lemna minor*. This condition is more favourable for observation than when the polypidom adheres to a large plant such as *Potamogeton natans*, upon which I usually find it hereabouts, as it is readily seen with transmitted light and without obstruction.—S. S. R.

MOSS HABITATS.

BY JAMES E. BAGNALL.

The habitats or natural homes of mosses are very varied. In fact mosses may be found everywhere in country districts, so that banks, trees, woods, fields, heath lands, walls, marshes, bogs, and other watery places all have their several mossy inhabitants. Though in many instances mosses show some degree of preference for particular habitats, no positive line of demarcation can be drawn with regard to the habitats of some species. *Ceratodon*, for example, seems to be at home in every locality, whilst others, such as the *Sphagnums* and many of the *Orthotrichums*, &c., are truly selective with regard to their haunts. Hence, I can only indicate the most likely mosses to be found in particular habitats. In many instances the same plants may be found flourishing in equal abundance in a variety of habitats. I have already mentioned *Ceratodon purpureus*, as a moss to be found everywhere. It is abundant on heathy waysides and on old walls, thatched roofs, and even on trees it is no less plentiful.

Banks, whether sandy, marly, or calcareous, are the favourite haunts of many mosses, and if we examine a damp sandy bank between February and April we shall be almost sure to find the dark green silky masses of *Dicranella heteromalla*, easily known by its terminal fruitstalk, which is pale in colour and is abruptly bent back just below the capsule. The leaves will be found to be very narrow and all curved in one direction, and the capsule surmounted by a lid having a longish beak,* [Plate IV., fig. 13 *a*,] the peristome or fringe [Fig. 12 *b*] consists of sixteen teeth, each of which is split half way down.

In like places we shall also find *Weissia controversa*, which has straighter leaves, with the margins rolled over towards the upper surface, erect oval capsules, lid with a long straight beak, and a fringe of sixteen rudimentary teeth ; when dry the leaves will be found to be much twisted. Smaller tufts of the apple moss, *Bartramia pomiformis*, may also be found, and may be known even when barren by its glaucous green foliage. The capsules of this moss are apple shaped, and surmounted by a slightly convex lid. The fruit ripens in early summer.

Hypnum prælongum will be frequently seen fruiting about November, but very often barren. In the barren state it may be known by its long trailing feathery stems, which, however, vary very much in habit. When in fruit it will be known by its long roughened fruit stalks, (which are lateral as in all Hypnums,) [Fig. 5 *a*,] curved capsules, and lid with a long curved beak, [Fig. 13 *a*,] the fringe is in two rows, an outer one formed of sixteen teeth, and an inner paler membranous one, divided into sixteen tooth-like processes. *Hypnum rutabulum*, another of the feather mosses, is more robust, has heart-shaped leaves, roughened fruit-stalk, and a shorter conical lid. *Hypnum velutinum* is much smaller, and has narrower lance-shaped leaves, and is more velvety looking ; whilst *Hypnum confertum*, which is constantly associated with the above,

*All the references in this article are to Plate IV., facing page 193.

has a *smooth* fruit-stalk, and lid with a longish curved beak. Many other mosses will also usually be found in like habitats.

Marly and clayey banks will yield such mosses as *Fissidens bryoides*, a very beautiful little moss, known by its flattened foliage, with leaves on opposite sides of the stem, looking very fern-like, fruit-stalk arising from the top of the stem and surmounted by an erect reddish capsule, with a cone-shaped lid, and a fringe of sixteen bifid teeth. The fruit of this moss ripens from October to the end of the year. A larger species, *Fissidens taxifolius*, will frequently occur with this, but the fruit-stalk arises from the base of the stem, the capsule is somewhat curved, and has a longish beak; fruit ripe in November. A species similar to *F. bryoides* is also frequent in Warwickshire, this is readily distinguished from it by the capsule, which is curved to one side. This is *Fissidens incurvus*. This species ripens its fruit about February or March.

Another moss, frequent on banks such as I have described, is *Tortula unguiculata*. It may be known by its somewhat tongue-shaped leaves, terminated by a small mucro or point, and having the margin recurved, or turned towards the lower surface; the fringe of the peristome consists of thirty-two spirally twisted teeth. It fruits from December to April. A close ally, *Tortula fallax*, not unfrequent, has leaves tapering from the base, a more curved capsule, and fringe also twisted. Another frequenter of marly banks is the minute *Dicranella varia*, which occurs in patches of a reddish green colour. It has narrowly lance-shaped nearly erect leaves. The capsule is small and slightly inclined to one side, and the conical lid has a very short beak; the fringe consists of sixteen deeply divided teeth. It fruits about November.

Tortula aloides and *T. ambigua* frequently occur together on marly and clayey banks. They are very closely alike, and can only be separated by careful examination of minute details, but may be known from other species occurring in like habitats by the short stem, dark green somewhat fleshy leaves, with the margins very much incurved. The capsule is cylindrical and erect in *ambigua*, and slightly inclined in *aloides*. The fringe is only slightly twisted.

On calcareous banks, such mosses as *Pottia cavifolia* may be sometimes found; this is a small species, having large concave leaves, often terminated by a whitish hair-like point. If the leaves be examined with a lens, some peculiar membranous processes will be seen attached to the veins of the upper surface. The capsule is egg-shaped, and the mouth has no fringe, or is naked, and the lid has a short inclined beak. *Pottia truncata* frequent on all sorts of banks, has a wide-mouthed capsule, and narrower leaves than the last-named variety, with no membranous processes on the upper surface. *Pottia lanceolata* is larger, and has a fringe of sixteen slightly perforated teeth. The leaves are spreading, somewhat oval-oblong in shape, and are terminated by a small green point. *P. cavifolia* ripens its fruit in February, *P. truncata* about November, and *P. lanceolata* about May on sandy banks. Many other species may be found, *Pogonatum aloides* and *P. nanum*, and (in elevated or sub-alpine districts) *P. urnigerum*, *Dicranella crispa*, *Mnium stellare*, *Bryum annotinum*, *Hypnum sylvaticum*, *Phascum subulatum*, &c., while on clayey or calcareous banks, such mosses as *Hypnum molluscum*, *H. Swartzii*, *H. lutescens*, *Weissia mucronata*, *Phascum patens*, &c., will often be met with.

[TO BE CONTINUED.]

RAIN-WASH.

Not long ago I was walking over Middleton Moor in Derbyshire, an elevated exposed tract of land lying a mile or two north-east of Dovedale. The most elevated points of the Moor—Arbor Low, Lean Low, &c.—rise from 1,200 to 1,300 feet above the sea, and lie near its margins, whilst the centre is depressed. After walking over the limestone rock, barely covered with short grass, which constitutes the greater part of the district, I found in a hollow near a farm house a considerable spread of a light red loamy deposit, which had evidently been largely dug, probably to spread over and improve the neighbouring land. It appeared to be from six to twelve or more feet in thickness, and contained no stones or fragments of foreign rocks. I had little more than a passing glance at this red clay, but it struck me that it was an interesting instance of the chemical action of rain water on the typical rock of this district—the Carboniferous or Mountain Limestone.

The Carboniferous Limestone contains about ninety per cent. of carbonate of lime, and, in addition, some silicate of alumina, silica, oxide of iron, &c. Now, the rain water in falling through the atmosphere dissolves out of the latter a little carbonic acid gas, and this combines with the carbonate of lime, forming a bi-carbonate, which is soluble in water, and which is consequently carried off in solution by the latter, thus causing the "hardness" of the water of limestone regions. The other ingredients of the limestone, however, are left behind. Slowly and gradually do they descend the hill sides. On the very hill-tops the bare rock peeps forth, but the slopes are covered with a few inches of *debris*, over and through which the rain water courses, gradually abstracting the soluble part, the carbonate of lime, and mechanically "moving on" the other ingredients, until they arrive at the lowest point. I noted that all the slopes of a given inclination had a terraced or step-like appearance, the lines running regularly, as if ruled at intervals of a few feet. If it be a valley through which a river runs, the insoluble substances on reaching the bottom are then carried off by the stream, whose waters they make muddy and turbid ; but on the limestone moors most of the water percolates through the rock, or disappears down swallow-holes, leaving the residue in the surface hollows. Here it accumulates. Most of it is clay, but there is some sand, and the whole is tinged red by the oxide of iron, which, by exposure to the air and water has been raised, if it were not previously in that condition, to the state of the hydrated peroxide. If we could measure the cubical contents of such a deposit, and also by analysis determine accurately the composition of the rock from which it was derived, we might obtain some interesting results as to the amount of denudation of the district in recent times. We might, perhaps, also obtain some idea of the *rate* of denudation, and the *time* which it had taken to form such deposits. In connection with this, the average rainfall might be made to yield results in aid. In the south of England the clay-with-flints, which covers part of the chalk downs has had a similar origin* to our Derbyshire rain-wash; the red cave-earth of limestone caverns (Kent's Cave for example) is a similar residue. All the soil of our fields, of course, is in large measure due to the disintegrating and chemical action of rain, but I should prefer to retain the term rain-wash, geologically, for any residuum which is wholly due to its action. I should be glad to hear from any correspondents whether they have observed any instances of deposits similar to that noted above, and under what conditions. I believe there are some thick clay beds at the foot of the Weaver Hills, which have been mistaken for boulder clay, but are really nothing but rain-wash, but these I have not yet examined; will anyone describe them for us?

W. J. H.

* Might not the well-known bed of red clay in Tideswell Dale have had a similar origin.

THE PROPAGATION OF *MELICERTA RINGENS* IN AN AQUARIUM.

No one I feel sure can look at *Melicerta ringens* under the microscope without being moved by feelings of the greatest admiration, and at the same time of regret that such beautiful creatures are to be found only in few places. I confess such were my own feelings after having examined some fine specimens kindly sent to me by Mr. Thomas Bolton, of Birmingham, in February last; and I thought if *Melicerta ringens* could be successfully maintained in an aquarium that it would afford an excellent opportunity for the study of the life history of those beautiful creatures. I therefore determined to make the attempt, and am pleased to say my success has been greater than I anticipated. I did not succeed with my first trial, but in the following month Mr. Bolton sent me some remarkably fine specimens. With these I set to work again, and in proof of my success, there is now in a beaker before me two pieces of Myriophyllum, one four inches long, to which are attached 200 specimens, and on another piece, three inches long, there are 150 specimens of *Melicerta ringens*. Indeed, I am sure there are altogether over 1,000 specimens in my aquarium.

Perhaps a description of my arrangements would be acceptable to many who may desire to have this interesting object always at hand. I feel certain these arrangements will prove as successful in the hands of others as they have in mine, and a knowledge of them will, perhaps, induce many to enter into the study of *Melicerta ringens*, as suggested by Mr. F. A. Bedwell in his admirable notes on this subject in the last number of the "Midland Naturalist." I now proceed to describe the plan I have followed, and to point out the conditions which my experience indicates are especially favourable to the propagation of this interesting Rotifer.

The room in which my aquaria are kept is lighted by one window which looks due east; against the south side of the room there is a sideboard, the nearest end of which is three feet from the window. On the sideboard are two aquaria, one holding 1½ gallons and the other four gallons. The smallest is placed four feet from the window, and the largest, which has been most successful, is placed seven feet from the window. The temperature has ranged from 41° to 68° F.

The bottom of the large tank is covered with a shallow layer of the finest river sand well washed. A little rockery consisting of quartz, limestone, and fluorspar crystals, is arranged at the end. The plants consist of one *Vallisneria spiralis*, three water violets, *(Hottonia palustris,)* and three water milfoils *(Myriophyllum spicatum.)* The last named plants are arranged as much as possible along and under the surface of the water.

The Melicerta is particularly fond of Myriophyllum and duck weed *(Lemna minor.)* There are also in the tank two smooth newts, *(Lissotriton punctatus,)* and of Mollusca there are six *Planorbis corneus*, three *Sphærium corneum*, (to be safe put in no Limnea,) and plenty of Daphnia and Cyclops. The water is very clear and sweet.

On the 4th September Mr. Bolton sent me a tube containing two specimens of the beautiful grouped Rotifer, *Lacinularia socialis*, which I put at once into my aquarium, and now there are five more groups.

My aquarium is now a source of the greatest pleasure to myself and friends. I will not name all the wonderful forms to be met with; but the following list of some of my treasures will, perhaps, be interesting: *Melicerta ringens*, *Floscularia cornuta*, *Limnias ceratophylli*, *Pterodina patina*, *Rotifer vulgaris*, *Stentor Mülleri*, *Epistylis*, *Vorticella*, *Cothurnia imberbis*, *Actinosphærium Eichornii*, and *Actinophrys sol*. If these observations should be the means of inducing others to enter heartily into the study of *Melicerta ringens* and other rotifera my object in writing will be accomplished. WILLIAM SHIPPERBOTTOM, Bolton.

METEOROLOGY OF THE MIDLANDS.

THE WEATHER OF AUGUST, 1878.

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

A wet month indeed, the rain mostly falling during thunderstorms, of which those on the 4th, 6th, 16th, 24th, and 30th may be specially noted. The storm of the 6th was accompanied in North Leicestershire by hail, which did much damage. At Dalby Hall some of the "lumps of ice" measured one inch in diameter; at Belvoir Castle they were "the size of filberts." At Matlock Bath 2½ inches of rain fell during this storm in "less than two hours." From Nottingham, Mr. Lowe writes: "The monthly fall here (8·76in.) was the largest for the past thirty-nine years." Mr. Davis, of Tenbury, states that the "rainfall for the month (7·81 in.) was excessive, and has only been exceeded twice in the last forty-eight years; in July, 1834, 9·23 inches of rain were registered, and in November, 1852, 8·22 inches."

Temperature was very uniform and about the average, although there was little sunshine. The crops suffered much from standing in the fields, and were not half secured at the end of the month. The barometer ruled rather low. Fogs prevailed on the 25th and 26th.

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.	4·40	1·70	23	18	85·0	14	42·0	18
Cheltenham	R. Tyrer, Esq.	5·29	1·18	10	20	74·6	10	48·0	11
Stroud	S. J. Coley, Esq.	4·09	1·23	22	18	74·0	6, 7, 9	50 0	10
SHROPSHIRE.									
Haughton Hall, Shifnal	Rev. J. Brooke	5 12	·74	5	20	75·0	9	46·0	1
Whitchurch	A. B. George, Esq.	4·98	·86	13	17				
Woolstaston	Rev. E. D. Carr............	6·05	1·17	22	24	74·0	10	47·0	17 & 18
Leaton Vicarage, Shrewsbury	Rev. E. V. Pigott	5·15	·95	22	20	74·9	5	43·9	1
More Rectory, Bishop's Castle	Rev. A. Male	4·86	·90	22	21	72·0	6	43·0	1
Bishop's Castle	E. Griffiths, Esq.	6·26	1·28	22	20	74·0	1 & 2	46·0	9 & 26
Cardington	Rev. Wm. Elliot	5·40	1·1[illegible]	22	20				
Adderley Rectory............	Rev. A. Corbet	5·05	·71	30	24				
Stokesay	Rev. J. D. La Touche......	5·60	1·06	22	19	72·8	26	43·5	1
HEREFORDSHIRE.									
Whitfield	W. Wheatley, Esq.	7·46	1·42	4	22			40·0	17
Stoke Bliss	Rev. G. E. Alexander	8·12	1·94	22	20	75·0	13	48·0	16
WORCESTERSHIRE.									
Orleton, Tenbury............	T. H. Davis, Esq.	7·81	1·98	3	22	75·0	8 & 11	41·5	8
West Malvern	A. H. Hartland, Esq.	4·68	1·4[illegible]	22		75·0	9	46·0	16
Pedmore	E. B. Marten, Esq.	6·97	1 09	22	19	77·0	8	48·0	1
Stourbridge..................	Mr. J. Jeffries..............	6·72	1·01	22	21	78·0	7, 9, 19	46·0	8
STAFFORDSHIRE.									
Thorganby Villa, Wolverhmtn	G. J. C. Broom, Esq.	6·46	·93	22	22				
Barlaston....................	W. Scott, Esq..............	6·50	·82	24	25	76·0	2	40 8	21
Amblecote	Mr. J. Robins..............	7·31	·93	22	20				
Dudley	Mr. J. Fisher	7·52	·94	6 & 22	21	80·0	9 & 18	44·0	16
Sedgley......................	Mr. C. Beale	7·32	1·17	22	22	71·0	2 & 9	47·0	16
Kinver	Rev. W. H. Bolton	6·33	·85	27	23	77·0	9	48 0	16
Walsall......................	Mr. N. E. Best	7·63	1·28	22	21	78·0	1	48·0	16
Grammar School, Burton....	C. U. Tripp, Esq.	4·37	·66	14	22	80 0	7	44 0	30
Patshull Gardens	Mr. T. W. Dell	6·61	·85	23	1[illegible]	82·0	26	42·0	1
Weston-under-Lyziard R'tory	Hon. and Rev. J. Bridgeman	5·97	·88	13	22	77·0	6 & 9	44·0	1
Wrottesley	E. Simpson, Esq.	6·4[illegible]	·86	22	22	74 5	10	46·6	1
Tamworth	W. Arnold, Esq..............	6·03	1·09	3	22				
Tean Vicarage, near Cheadle	Rev. G. T. Ryves	7·03	·85	13	25	74·0	5	42·0	1
Heath House, Cheadle	J. G. Philips, Esq............	7·91	1·21	6	25	71·0	2, 5, 6	43 0	17
Alstonfield Vicarage	Rev. W. H. Purchas	5·74	·56	6	21	74·6	26	41·0	2
WARWICKSHIRE.									
Coundon, Coventry	Lieut.-Col. R. Caldicott	6·19	·95	4	21	76·0	6	51·0	16
Coventry	J. Gulson, Esq.	5·57	·84	4	21	72·0	11 & 12	48·0	1
Bickenhill Vicarage..........	Rev. W. R. Capel............	6·66	·87	6	24	81·0	31	50·0	31
St. Mary's College, Oscott....	Rev. S. J. Whitty	6·29	1·05	22	19	74·7	18	46·2	1 & 9
Henley-in-Arden	T. H. G. Newton, Esq......	6 24	1 17	4	19	78·0	9	46·0	31
DERBYSHIRE.									
Buxton	E. J. Sykes, Esq.	6·77	1·15	13	23	69·5	2	42·0	17
Stoney Middleton............	Rev. U. Smith	6·92	1·09	13	22	70 0	2 & 26	42·0	21 & 28
Fernslope, Belper............	J. G. Jackson, Esq.	7·2[illegible]	1·51	6	24	73·0	5 & 9	47·0	1
Matlock Bath	R. Chadwick, jun., Esq.....	9·27	3 12	6	22	70·0	26	46·0	1
Linacre Reservoir, Ches'field	C. E. Jones, Esq.	6·41	1·13	23	22				
Willesley Gardens, Cromford.	J. Tissington, Esq.	8·82	2·47	7	15				
Stuffynwood Hall............	Mr. R. Rolfe................	7 04	1·09	23	24	71·0	1 & 2	46·0	1 & 21
Spondon	J. T. Barber, Esq..........	6·75	·91	13	24	71·0		50·0	
YORKSHIRE.									
Tickhill, Rotherham	B. J. Whitaker, Esq.	4·95	·75	7	19	76·0	28	41·0	22
NOTTINGHAMSHIRE.									
Hodsock Priory, Worksop ..	H. Mellish, Esq.	4·70	·87	6	21	74·4	26	42·2	1
Grove House, Mansfield	W. Tyrer, Esq.	8·27	1·30	23	24	72·8	9 & 26	43·9	1
Tuxford	J. N. Dufty, Esq............	7·00	1·05	23		84·0	4	46·0	19
Highfield House, Nottingham	E. J. Lowe, Esq., F.R.S.....	8·76	2·52	6	22	78·9	9	43·9	1
LEICESTERSHIRE.									
Loughborough	W. Berridge, Esq..........	4·53	·65	22	19	77·5	6	45·7	1
Ashby Magna................	Rev. E. Willes	4·15	·81	3	21	75·[illegible]	3	46·0	1
Market Harborough	S. W. Cox, Esq.	5·66	·90	22	21	77·0	21	45·0	20
Kibworth....................	T. Macaulay, Esq.	5·30	1·04	3	21				
Town Museum, Leicester	W. J. Harrison, Esq.	6·76	1·78	3	21	74·8	5	46·1	1
Belmont Villas, Leicester....	H. Billson, Esq.	6·72							
Syston	J. Hames, jun., Esq.	5·85	1·63	3	26	81·0	2	45·0	1
Waltham-le-Wold............	E. Ball, Esq.	5·74	·92	24	21	73·0	6	49·0	19
Little Dalby Hall............	G. Jones, Esq.	6·75	1·35	3	20	81·0	9 & 26	40·0	1
Coston Rectory, Melton......	Rev. A. M. Rendell	5·48	·86	22	20	73·8	5	[illegible]8·7	1
Belvoir Castle	W. Ingram, Esq.	5·09	·76	14	21	75·0	8 & 9	40·0	1
NORTHAMPTONSHIRE.									
Towcester Brewery..........	J. Webb, Esq................	1·16	·64	13 & 22	18				
Castle Ashby	R. G. Scriven, Esq.	4 77	·70	22	18	76·0	6 & 9	45·0	21
Pitsford	C. A. Markham, Esq.	4·31	·89	13	20	89·0	8	42 0	1
Kettering....................	J. Wallis, Esq.	4 73	1·19	3	19	75·0	7	51·0	21
Althorpe	W. F. Jakeman, Esq.	4·80	·91	3	18	76·0	5	46·0	25
Northampton................	H. Terry, Esq.	4·41	·94	21	18	77·0	5, 6, 9		
RUTLAND.									
Burley-on-the-Hill	W. Temple, Esq.	7·33	3·03	4	18	70 0	5	45·0	21
West Deyne, Uppingham	Rev. G. H. Mullins	[illegible]·31	1·20	3	20	78·2	26	45·4	21
Northfields, Stamford	W. Hayes, Esq.	6·03	1·72	3	20	76·0	6	49·0	30
Radcliffe Observatory, Oxford	Mr. H. W. Bellamy	5·12	·98	4	19	75·7	10	49·8	16
Spital Cemetery, Carlisle	T. Bell, Esq.	4·09	·60	3	23	79·0	1	44·3	15
Ventnor Hospital............	H. Sagar, Esq.	5·72	1·15	10	21	70·0	8	55·0	2
Altarnun Vicarage	Rev. G. Tripp..............	6·93	1 06	13	22	79.0	7 & 8	43·0	4

At Bishop's Castle the swallows were noted to be gathering for departure on the 19th, but many still remained on September 2nd.

At Alstonfield a great body of swifts *(Hirundo apus)* retired about the 10th. Hybernated specimen of the Painted Lady butterfly was seen on Derbyshire side on the 15th, and of Red Admiral on the 20th. The glow-worm was noted shining in the moist evenings after days of heavy rain. From Shifnal the Rev. J. Brooke writes—"Few butterflies, scarcely even white ones; and only one or two Red Admirals, Peacocks, and Tortoiseshells; not one Clouded Yellow, although we had such a strange influx of this species in August, 1877. Swifts gone by the 10th."

Reviews.

Proceedings of the Birmingham Philosophical Society. First Session, 1876-77. Vol. I, No. 1. Birmingham: Martin Billing.

We have already announced (p. 141) the issue of the first part of the Proceedings of the Birmingham Philosophical Society. We now proceed to give some account of the contents, and in doing so warmly congratulate the Society on the good work its members have already done. We trust this publication may prove to be the commencement of a long series of valuable contributions to local scientific literature. Of eighty-two pages of "Proceedings" seventy-five are covered by three papers.

The first of these is by the Rev. H. W. Watson, of Berkswell, and is on "The Kinetic Theory of Gases." Mr. Watson calls attention to the endeavours which have been made "to form a plausible theory of the constitution of a gas." He states, first of all, the theory in accordance with which the elasticity of a gas is the result of the mutual influence of the ultimate atoms of the gas upon one another. These atoms, it was supposed, mutually repelled one another, and the combined repulsion produced the outward thrust or pressure against the envelope of the gas. Mr. Watson points out how it can be demonstrated mathematically that such supposed mutual repulsion of the particles of a gas fails to account for the pressure which manifests itself. He then enters upon an explanation of the theory associated with the title of his paper. According to this, the varying states of elasticity of gas imprisoned within any flexible and expansible envelope, or in any cylindrical chamber fitted with an air-tight movable piston, are due, not to the mutual repulsion of the gas particles, but to the varying energy with which they all vibrate across their points of mean position. The pressure upon the containing envelope always varies with the temperature of the gas; and as heat is now looked upon as a manifestation of energy of vibration. the adoption of "the kinetic theory of gases" is but consistent with the reception already accorded to the corresponding theory as to the nature of heat. Mr. Watson, however, very candidly shows that the kinetic theory, in one respect, fails to account for experimental results.

Mr. G. Hookham, M.A., of Sutton Coldfield, contributes a thoughtful paper on "The Study of Science as an Instrument of Higher Education." By "higher education" Mr. Hookham means the education which should be begun when the mind has been disciplined at school or college by a course of formal study. Habits of thought once gained, the aim of each mind should be to assimilate to itself truth as to the constitution of the universe. This can only be done effectually by individual devotion to some special science. It should, of course, be remembered that every such science has relations with the whole domain on which enquiries can be prosecuted. Results attained by others in other departments may be known; but mere accumulation of knowledge of results is not "higher education." This can only be secured by the mind coming into contact with the realities of the universe. And what is higher education for the individual mind helps on also the general enrichment of humanity in knowledge. This is, Mr. Hookham thinks, especially exemplified in the beneficial influence which the German Universities, in which the studies are wholly real, are exercising upon the world.

The paper on "The Place of Archæology in Science," by Mr. James Kenward, F.S.A., of Harborne, is a most readable one. In a very broad sense, Mr. Kenward remarks, all sciences which concern themselves with the operations of nature, or with the thoughts, words, and deeds of man, in past times, may be looked upon as parts of a grand Archæology—the Archæology of the universe and of man. But his concern is with Archæology "as limited to human monuments and human relics; as a study and a summary of the remains—written, graven, sculptured, painted, built up, formed and finished in any mode—which appeal to us from palace and pyramid, and temple, and cave, and cairn; from book, and manuscript, and oral tradition." Besides being in itself of interest to all for whom the past of human history is a "divine drama," Archæology is a valuable auxiliary to all other sciences. The progress of none of them can be estimated without an appeal to it. Mr. Kenward's attractively written sketch of the development of Archæology ought to be widely read.

H. N. Grimley.

The Superficial Geology of the Country adjoining the Coasts of South-West Lancashire. By C. E. De Rance, F.G.S. London: Longmans and Co. 8vo., 17s.

This Geological Survey Memoir describes in detail the surface deposits of the low plains lying between the estuaries of the Mersey and the Ribble, and also in a more general way the same beds as far to the north as Morecambe Bay, southwards to the Dee, and eastwards to Blackburn, Bolton, and Manchester.

It contains 139 pages, including a few simple woodcuts, is bound in a paper cover, and is issued by Her Majesty's Stationery Office at the modest price of seventeen shillings, a fact which must be equally aggravating to the officers of the Geological Survey and to the public.

The author commences by describing the physical geography of the district—a plain but little above the sea, and sloping down to it, with lines of sand hills or dunes running along the coast. The solid geology of the country is composed of Triassic strata, but these are hardly ever visible, being covered over with beds of glacial drift, often as much as 150 feet in thickness. Of these the lowest deposit seen Mr. De Rance calls the *Till.* It is a dark leaden-coloured clay, occurring at elevations of 200 feet and upwards only. It contains angular blocks of local origin, but no shells, and seems to have been formed by a sheet of land-ice. Upon it rests the *Lower Boulder Clay*, of reddish-brown colour, with many stones and boulders of lake-district rocks. It is finely exposed in the cliffs north of Blackpool. It is often stratified, and the stones, though striated, are partly rounded. Hence it would seem to tell us of a period of submergence when ice drifting from the north and east dropped its stony cargo in a shallow sea. Shells are not uncommon.

The *Middle Drift Sand and Gravel* marks a mild period, when the glacial cold had decreased. It is sometimes as much as 70 feet thick, but is often absent. The molluscan remains show a mingling of northern and southern forms. It is commonly false bedded.

The *Upper Boulder Clay* is sometimes 100 feet thick. It is of a dull red tint, weathering on the surfaces or joints which may be exposed to the air, to a bluish-white. Large boulders are rare, but glaciated stones and shell fragments are common. Mr. De Rance believes that it was deposited under similar conditions to those of the Lower Boulder Clay, viz., from ice-floes in a shallow sea.

Thus the same triple division of the Drift is observable here as obtains on the east coast of England. The two, however, were not contemporaneous; and it is a pity that the same names should have been applied in each case to the different sub-divisions. Mr. S. V. Wood, jun., has shown the great probability that the Lancashire Drift is of later date than that of East Anglia. Is it possible that the east and west played a game of see-saw—the east coast first undergoing depression, while land-ice scoured out Lancashire? The Geologists of the Midland Counties must endeavour to aid in the solution of this problem, by tracking the deposits as far inland as possible.

In the latter part of his work Mr. De Rance treats at length of the Post-glacial deposits, especially peat; of the economic uses of the various deposits; the water supply; the deposition of shingle and sand forming the dunes; the action of tidal currents on the Lancashire coast; and various other interesting points. One valuable feature of the work is that abstracts are given of almost all the papers that have been written by previous authors on the subject. In an appendix (revised by Mr. Etheridge) the occurrence of the various shells which have hitherto been found in the glacial deposits of Lancashire is shown with great fulness. On page 132 we note a very obvious misprint of "clay" for "crag." Altogether, we evidently have in this Memoir the results of some years of really tough work—of work which only a love for science could make pleasant. Mr. De Rance may be congratulated in that he has given us a record of hard facts which will endure and serve as a work of reference for many a year to come.

W. J. H.

Correspondence.

Duration of Life of Cage Birds.—My canary died to-day, aged 15 years and 2 months. The one I had before it lived for 16 years. Are not these ages considerably beyond the average ?—J. B., Leicester, Aug. 24th.

Woodcock.—On the 5th of September I saw a Woodcock put up within half a mile of this place, by the side of a large pool of water. When flying off, it appeared to be at a loss to know where to go, and evidently seemed to feel like a fish out of water. I am not aware that this bird is usually seen in England before October; possibly some of your correspondents can give some information on this point.—W. S. Gresley, Overseile, Ashby-de-la-Zouch.

Cuckoo.—In the August number of the "Midland Naturalist" I read that Mr. J. R. Thompson, of Tamworth, has "obtained a Cuckoo's egg in the South of England as early as March 3rd." Will that gentleman kindly inform your readers in what year that occurred, also by whom taken and authenticated ? I have never yet heard of a really trustworthy record of the appearance of the Cuckoo in any part of England before the 6th of April; and, personally, although I have noted the arrivals of migrants for nearly twenty years in the South of England, I have no record of the arrival of the Cuckoo before the 12th of April; neither have I known during the whole period of my observations the times of appearance to vary more than five or six days.—Henry Reeks, Manor House, Thruxton, near Andover. [Mr. Thompson replies :—"The Cuckoo's egg referred to in my letter (see ante p. 227) was sent me as a curiosity by the father of one of my pupils named Boult, the son having taken it from a nest in a hedge, Couch Lane, Winkfield, Windsor, 1848, not a particularly open year, but which had some very cold weather even late in April when there were sleet and snow storms. The shrubs which had a few hours before given an appearance of summer were enveloped in snow. I am enabled to fix the date with much exactitude by circumstances which I need not mention. Mr. Boult, who was then about sixty years of age, sent me the egg to prove that the bird in some cases arrives very early among us though seldom heard till mid-April, and the circumstance was a great surprise to himself."—Eds. M. N.]

The Cuckoo's Note.—It is with the greatest pleasure I hail the arrival of the "Midland Naturalist" from month to month, and feel deeply interested in its general subject matter, its meteorological notes, its gleanings, correspondence, &c., and never peruse it without deriving profit; and my idea is that encouragement should be given to those who ask for information through its interesting columns, as this may lead many young Naturalists to pursue a study which a rough style of answer might cause them to forsake. Hence my having replied to the enquiry of "N." in your July number, imagining some might not deign to answer a question apparently so unimportant; but the number of replies has convinced me that a hard and fast line of action is not common to the Cuckoo, (as your correspondents' experience in different parts of the country help to show,) and that its cry somewhat varies under diverse circumstances. I should like, however, to state the opportunity afforded me in times past of observing the bird; not with any view of gainsaying the statements of your correspondents, Mr. E. J. Lowe and the Rev. A. S. Male, kindly furnished in your September number, but with a view to a more accurate knowledge being gained by further observation in various localities. In the summer of 1845 I left London, my birthplace, for a sweetly retired village, four miles west of Windsor, and on the edge of the forest, where I resided till 1854; and, being of a very retiring disposition and loving secluded nooks, most of my waking hours, when duties were over, were spent in the broad glades of the forest, in its deep recesses, or in wanderings over the neighbouring heaths; always alone, and avoiding the residence of man; consequently, I have had many opportunities of observing the actions of the denizens of the forest, and the peculiarity of some members of the feathered tribe, which those journeying in company might not have had. The Cuckoo is an extremely shy bird, and I have found many country persons who have never seen one, unless it has been when flying; and they may even then have supposed it to be a pigeon. A person must be very quiet, and hidden, or, in a general way, he will not get a near sight of this shy bird. Hence arise many mistakes. It is certainly here some days, at least, before uttering a cry at all, and then it is very infrequent and indistinct; but, as time goes on, the bird is heard very frequently and distinctly, and just before its departure it utters the repeated cry alluded to very frequently. I have never heard the peculiar cry *early* in the season; but it is evident, from Mr. Male's letter, that in some places the cry is so heard. The aged cottagers, in the neighbourhood I speak of, used always to remark, when the repeated sounds were uttered, "The Cuckoo is off, he does not like the haycocks;" and the better class would say, "The Cuckoo is bidding good-bye to Old England." In fine, in that part of the country, the cry was an acknowledged sign of its departure. With respect to the observation of Mr. E. J. Lowe, I must remark his observation will not apply to all parts, as I have watched the bird fly into a tree, utter the single cry two or three times, then the reiterated cry, and lastly fly off, perhaps uttering "cuckoo" while on the wing. So it is clear the habit of the bird is worthy of a closer observation, and that over a more extensive area than has yet been given it.—J. R. Thompson, Tamworth.

Rosa latebrosa (Nob.) in Warwickshire.—About five years since, I found a rose in one of the Solihull lanes which seemed to me to be a variety of *Rosa canina*, but distinct, as I thought, from any of the varieties described in Mr. J. G. Baker's valuable monograph of the genus, and as it was very nearly allied to *Rosa verticillacantha*, (Merat,) I labelled it in my herbarium, *R. verticillacantha* variety. Recently, however, I received from Mr. T. R. Archer Briggs, of Plymouth, one of our best authorities on Roses, a specimen labelled *Rosa latebrosa*, (Nob.,) and I at once saw that my rose from Solihull was identical with Mr. Briggs's plant; but to be more sure, I sent Mr. Briggs a specimen of the Solihull plant out of my herbarium, and received the following reply:—"Some time ago I arrived at the conclusion that a rose collected by yourself was identical with the plant from this neighbourhood (Plymouth) that M. Deseglise labelled *Rosa latebrosa* (Nob.) The flowering specimen you have sent certainly puts the matter beyond all doubt. I am very pleased to see that this rose keeps up its characters in so widely separated parts of England." Plymouth and Solihull are at present, I believe, the only British stations for this rose. Mr. Briggs says it is abundant in his neighbourhood, but at present I have only seen it near Solihull, in Warwickshire, two fine bushes growing near together in that locality. It is closely allied to *Rosa verticillacantha*, (Merat;) in fact, would follow that plant in natural sequence, but differs in having intermediate armature on the flowering shoot, in this respect apparently approaching some of the *spinosissima* group. This plant is, therefore, an addition to our Warwickshire rose flora. No English description has yet been published of this rose.—James E. Bagnall.

Notes on the Flora of Napton.—Understanding that the neighbourhood of Napton-on-the-Hill has not been much worked by botanists

I made an excursion thither on August 17th, with the object of looking up and recording, if worth while, any rare or interesting plants. A single visit, and that so late in the year, can hardly give a fair idea of the flora of a district; however, I submit to your readers some notes on that excursion. Starting from Birdingbury Station, on the Rugby and Leamington line, I noticed, just outside the station, *Lotus tenuis*, *Sison Amomum*, *Silaus pratensis*, *Carduus eriophorus*, *Senecio crucifolius*. In former years I have turned up *Galium tricorne*, *Linaria spuria* and *Elatine* in the first corn-field, adjoining the road to Frankton. Leaving Birdingbury village, on my way to the wharf, I observed *Scabiosa columbaria* and *Carduus acaulis*, both growing abundantly in a meadow on the right of the road, some 300 or 400 yards past a windmill, and a little further on *Brachypodium pinnatum* growing with *B. sylvaticum*, *Silene inflata*, and *Picris hieracioides* in abundance. From Birdingbury Wharf I followed the canal to Napton, observing on my way *Sparganium simplex*, *Alisma lanceolata*, *Lotus tenuis* again in plenty, and close to Napton *Rumex viridis*. By the reservoir I saw *Nasturtium amphibium*, *Helminthia echioides*, *Polygonum amphibium* and *terrestre*, *Stachys palustris*, *Potamogeton lucens*, *Juncus lamprocarpus* and *compressus*, *Carex hirta;* in a cornfield on Napton Hill were *Centaurea Scabiosa*, and a plant which seemed to be some hybrid form, possibly *Stachys ambigua*, a hybrid between *S. palustris* and *sylvatica*, but much more nearly approaching the former than the latter. In fact, it appeared to differ from *S. palustris* only in having less elongated racemes, terminating somewhat abruptly, all the leaves shortly petioled and oblong-lanceolate, and in its habitat, growing as it did in a dry cornfield on a hill of considerable elevation, (from which, by the way, I obtained a magnificent view of the surrounding country,) and not a single specimen only, but in great abundance. The leaves are all shortly petioled, petioles one to three lines long, smaller than in *S. palustris*, rather crenate than serrate, and the whole plant is smaller generally than in *S. palustris*. It has been suggested to me that the spot might be a reclaimed marsh, and that this plant is the remains of the marsh vegetation, and hence its starved appearance. This I do not think at all likely; the appearance of the ground seemed to me to preclude the possibility of its ever having been a marsh or anything approaching one, being, as I have said, on a hill of considerable height, and of a dry soil; and, moreover, the plant was in great abundance growing amongst the wheat. Perhaps some reader of the "Midland Naturalist" can give some explanation. The last observations I made were at Shuckburgh, viz., *Conium maculatum*, *Circæa lutetiana*, and remarkably luxuriant forms of *Brachypodium sylvaticum*, attaining, I should say, over 4ft. in height.—H. W. Trott, Rugby.

The Royal Oak at Boscobel.—In the report of the excursion of the Shropshire Archæological and Natural History Society, in the last number of the "Midland Naturalist," the age of the tree now shown as the Royal Oak is discussed. It is said that in 1857 its girth was 11ft. 4in. at 4ft. from the ground. I have counted the rings and measured the average rate of growth of a good many trees of various kinds, and have adopted as a rough but fairly accurate estimate of the age of oaks, that every foot diameter represents about fifty years of growth. The increase is greatest in middle life. The annual ring of wood is never less that $\frac{1}{20}$ of an inch thick, and not often more than $\frac{1}{4}$ inch. Taking the average as $\frac{1}{8}$ all round the trunk, the diameter would increase $\frac{1}{4}$ inch annually, or a foot in forty-eight years. A tree 11ft. 4in. in girth is 3ft. 9$\frac{1}{3}$in. in diameter, which according to this calculation would represent about 180 years of growth. But the tree in which the King took shelter must have been in 1857 about 250 years old. The rapidity of growth is affected by soil and climate, and I do not know the soil of Boscobel. If it is poor and shallow the annual increase would be less, and the tree might be 200 or even 220 years old, but I think it is scarcely possible to carry back the origin of an oak of the dimensions given so far as 250 years, and, therefore, there seems a strong probability that the present tree is not the original but the descendant spoken of by Dr. Stukeley.—F. T. Mott, Leicester.

Gleanings.

The Annual Fungus Foray of the Woolhope Naturalists' Field Club will be held at Hereford on October 3rd.

The Cryptogamic Society of Scotland will hold its Annual Conference at Edinburgh, on October 9th, 10th, and 11th, under the presidency of Professor Balfour. The programme includes excursions, a dinner, and an exhibition of fungi.

Locusts.—The United States Entomological Commission have issued their report on the ravages of the Rocky Mountain Locust. *Nature* says it is "a very important addition to the scientific and practical literature on this subject."

Plant List for Derbyshire.—The Rev. W. Hunt Painter, of 2, Belgrave Street, Derby, is engaged in editing a "Plant List for Derbyshire." He will be glad of any assistance that botanists, residing in the neighbouring counties, can render him. Specimens of the plants found will be thankfully received, and, if desired, others will be given in exchange.

Microscopical.—Mr. Thos. Bolton, Naturalist, 17, Ann Street, Birmingham, announces that for a subscription of £1 1s. per half-year, paid in advance, he will supply a tube of living specimens every week. The specimens will include all varieties of which he may obtain a sufficient supply, and will be forwarded as nearly as possible in twenty-six consecutive weeks. To some subscribers he has agreed to forward the twenty-six tubes during twelve months, or one per fortnight, and to others (science teachers) more rapidly as they may require them for class work or exhibition. To such subscribers he also will from time to time post any notices or sketches that he may print of the various objects he is distributing.

Thos. Oldham, born (Dublin) 1816, died (Rugby) 1878.—Mr. Oldham received his first lessons in geology at Edinburgh, from Prof. Jamieson. Returning to Ireland he aided Portlock in the survey of Derry and Tyrone, (1843,) and afterwards held several offices in connection with the Geological Society of Dublin and the Government Geological Survey; in 1849 he discovered the fossil named after him by Prof. E. Forbes, *(Oldhamia radiata,)* the then oldest known fossil organic remain. In 1850 he was appointed first director of the Geological Survey of India, and in ten years he succeeded in mapping geologically (with the aid of about twelve assistants) an area in Bengal and Central India of about twice the extent of Great Britain. The publications of the Indian Survey, issued under his direction, are of a magnificent description—quite equal to those which Dr. Hayden sends forth with such liberality from Washington. He was awarded the gold medal of the Royal Society in 1875, and shortly afterwards retired from his post of Superintendent of the Indian survey. His last days were spent at Rugby, where he took much interest in the School Natural History Society. His obituary (from which this short notice is mainly compiled) appears in the "Geological Magazine" for August, as do also two reviews by him (his last work, he wrote them but did not live to correct the proofs) on Barrande's "Cephalopoda of Bohemia" and Hayden's "Geological and Geographical Atlas of Colorado."

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—August 6th.—GENERAL MEETING. The Chairman made some general remarks upon the recent excursion to Arran, and spoke in high terms of the cordial disposition displayed by every individual composing the party, which contributed so much towards the general success. He also stated that the unanimous opinion of the party was that the next excursion should be for fourteen days, and that it be to Falmouth. Mr. J. F. Goode exhibited a photograph of the steam boat "Lizzie," and described the arrangements on board and the mode of dredging. Mr. W. H. Wilkinson exhibited a number of plants collected in Arran, amongst which were *Drosera anglica*, *Pinguicula lusitanica*, *Polypodium Phegopteris*, *P. Dryopteris*, *Lastrea montana*, *L. recurva*, *Asplenium maritimum*, and *Lycopodium alpinum*. Mr. W. R. Hughes made some observations upon some of the more remarkable specimens which were dredged. These included the rare star fish, *Luidia fragilissima*, and *Carinella lineata*, a Turbellarian worm, one of the most handsome and graceful of the whole order, also several Nudibranchiate Mollusca, notably *Doto coronata*, *Doris pilosa*, and *Ancilla cristata*, new to the district. The collection, which was very numerous, included an undescribed worm, and a species of Goby not yet determined. Mr. Hughes said the specimens would be carefully examined and a further report made. The results with the towing net devised by Mr. Allport were very successful, and included *Bipinnaria* and larval forms of Echinoderms and living Foraminifera. Mr. Miles exhibited a beautiful series of mounted specimens of Marine Algæ, from Drummadoon Bay.—MICROSCOPICAL GENERAL MEETING.—August 20th. Mr. Bolton exhibited *Cristatella mucedo*, and the cast shell of a small crab; Mr. M. Browne exhibited the larvæ of the Death's Head Moth, *(Acherontia Atropos,)* taken in George Street, Spring Hill; and (on behalf of Sir Arthur Scott) two specimens of an African Moth, *(Leto venur.)*—September 2nd.—GENERAL MEETING. Mr. Bolton exhibited *Lacinularia socialis*; Mr. J. Levick exhibited *Actinophrys Eichhornii* in conjugation, and *Spirostomum ambiguum*. Mr. T. J. Slatter exhibited *Fredericella sultana* and *Paludicella Ehrenbergi*, from near Redditch. Mr. W. Southall exhibited the following plants, from the Lake district:—*Parnassia palustris*, *Utricularia vulgaris*, *Saxifraga stellaris*, *S. aizoides*, *Lycopodium selaginoides*, *Equisetum sylvaticum*, and *Oxyria reniformis*. —On Monday, September 16th, an excursion took place, when about sixty ladies and gentlemen visited Malvern and Eastnor Park and Castle. The party left Birmingham at 9 30. Carriages were in waiting at Malvern Link to convey the visitors to the British Camp. After luncheon the Rev. W. S. Symonds, of Pendock, near Tewkesbury, delivered a graphic and interesting address on the geological and historical features of the Malvern range. Afterwards a portion of the party walked over the hills to Eastnor. Mr. Symonds' intimate acquaintance with the neighbourhood eminently qualified him for his position of guide, and enabled him to point out the numerous objects of interest both on the hills and in the distance. On Midsummer Hill, Mr. J. T. Burgess, of Worcester, gave a brief description of the British Camp formerly existing on that spot, and also indicated the probable site of the camp occupied by the opposing Roman forces. Having inspected the quarries at Ragged Stone Hill, the party proceeded to Eastnor, where, in the meantime, the Castle and grounds had, by permission of Earl Somers, been visited by another portion of the company. Mr. W. Coleman (the Head Gardener) courteously conducted the members over the grounds, which are most lovely. Having been joined by the contingent who had explored the hills, ample justice was done to an excellent tea provided in a tent adjoining the Somers' Arms Hotel. During tea the Rev. W. S. Symonds gave a short account of the Ragged Stone Hill, and related some interesting legends connected with its history. Votes of thanks were then passed by acclamation to the Rev. W. S. Symonds and Mr. J. T. Burgess, for the admirable way in which they had acted as guides; and to the Right Hon. Earl Somers for his kindness in allowing access to his Castle and grounds. A charming drive to Malvern Link in the fresh autumn air, and then a two hours' ride by rail, brought the party safe back again, everyone being delighted with one of the most enjoyable excursions of the season, the arrangements for which were admirably carried out by the hon. sec., Mr. J. Morley.

BIRMINGHAM AND MIDLAND INSTITUTE SCIENTIFIC SOCIETY. —The sixth annual meeting was held on September 11th, in the Council Room, at the Institute, Mr. G. H. Twigg (President) in the chair. Large attendance of members. The annual report stated that the number of members is 123, the number from the industrial department being 96, from the general department 12, and life members 15. This showed an increase of 14. Papers had been read during the past session on various scientific subjects, the annual soirée was held on January 2nd, and eight excursions had been made to places of interest. The Librarian reported that 580 scientific books were issued last year, against 393 in the previous year. The committee had decided to join the Midland Union of Natural History Societies, and delegates attended the annual meeting of the Union. The finances of the Society were in a flourishing state. The report having been adopted, a vote of thanks was passed to the Council for the use of the room. Mr. Robert Birbeck was elected President, Mr. C. J. Watson Vice-President, Mr. Robinson Treasurer, and Mr. Crick Librarian. The retiring President (Mr. Twigg) then delivered an address, in the early part of which he called attention to the lack of convenience which formerly existed for students at the Institute, who were desirous of conferring with each other on the subject of their studies. The formation of the Society provided a room where students might readily confer with each other, and the gradual but certain supply of high-class scientific books to the library of the Society had given Institute students the opportunity of consulting the works of the best writers in all scientific subjects. Mr. Twigg further said—"I commend the ardent study of all science for its own sake, and think we ought not to content ourselves with taking such science as comes ready to our hand without making exploration in its domain for ourselves. With regard to Botany, for instance, it might be asked, What have we near at hand wherein original research can be made on this subject? I am no Botanist, and cannot presume to indicate the most likely fields for discovery, but I think I could find a green bank under any hedgerow, and place my hat on so much of it as would afford subject for inquiries of absorbing interest, on which I doubt whether any one could give me full information. Take an example. I pluck a small star-shaped flower, and show it a botanist. 'Oh yes,' he says, '*Bellis perennis*.' This is, doubtless, valuable information. I, however, know it as the common daisy; and what I wish to learn is, why the outer circle of the flower is white whilst its centre has a yellow colour, and, when partly satisfied on this point that it is considered to be so coloured in order to attract the visits of insects for the purpose of fertilisation, I proceed to enquire how the flower has become so entirely changed in colour from its green stalk, and where is the laboratory in which the process is conducted. Is it due to the power of light alone, or to some chemical quality? Waiting for an answer, I see near me the common dandelion in seed. What a graceful tuft of feathers is there, and what a contrast to the flower of the same plant. On attempting to gather it the slight motion causes the feathers to become detached and fly away! I am told that this is the method by which the seed is scattered; whereas the former plant seems to grow on from year to year in the same spot without any provision for becoming diffused. And why do we find the leaves of the daisy broad and even, and those of the dandelion long and deeply indented? I think I have indicated just a grain of sand on the seashore of investigation stretched before us, whilst there remains an infinity of speculation as to the vast area hidden to our view beyond the waves of eternity." Turning to another subject, Mr. Twigg said—"I have for a long time in leisure moments thought of the natural forces at our disposal, and asked myself the question, Do we make the best use of those at our command? We see primitive methods put into practice for utilizing the force of the wind, and the power of running water; but these suffer such frequent fluctuations that, since we have had the power of steam placed at our disposal, they have received little consideration, and remain in about the same state of improvement which they had reached a hundred years ago. Is steam, as now procured, our most readily available force, or is there not some other equally constant and more advantageous power? What can we do with the sea, situated as we are on an island indented with numerous channels subjected to its influence: even in an inland town like this we feel that it is at our doors. Cannot then something be done with the immense power of its daily tides, rising all around our coast, and exercising such a stupendous force that no diminution of it could possibly be experienced, no matter to what extent we might find it in our power to utilize it? And when we also find it similarly exerted in such sheltered places as the Avon Gorge, where the violent storms of the sea coast would not be encountered, is there not some justification in hoping that a subject, which has been the day-dream of many others as well as myself, may at no distant date receive such attention as will render it no longer a mere visionary's idea?" The address was listened to with great attention, and a hearty vote of thanks was awarded to Mr. Twigg.

BIRMINGHAM SCHOOL NATURAL HISTORY SOCIETY. — This society, under the presidency of the Rev. A. R. Vardy, M.A., (Headmaster,) is in a thriving condition. The fortnightly general meetings have been held regularly throughout the year, at which papers have been read by various members, the chief of which are the following:—February 1st, "The Purple Loosestrife," by Mr. Levett; May 17th, "Coal: its Origin, Structure, and Distribution near Birmingham," by Mr. Atkins. The Society consists of forty-five members. President, Rev. A. R. Vardy, M.A.; Vice-presidents, Rev. E. F. MacCarthy, M.A., R. Levett, Esq., M.A., Rev. J. H. Smith, M.A., J. Turner, Esq. The Botanical Section has made two excursions, the first to Hagley and thence to Barnt Green, on April 24th; the second, on May 25th, to Haywoods, near Kingswood, where the following uncommon plants were found:—*Polygala depressa*, *Myosotis sylvatica*, *Convallaria majalis*, *Carex pendula*, in addition to ninety other species. Mr. Turner is president of this section. The Entomological Section has been doing some good work, under the presidency of Mr. Levett. Numerous rare and interesting specimens, brought by various members, have been exhibited at the Sectional Meetings. The Geological Section has also been working well, under the presidency of Mr. Atkins, having made excursions to Dudley and other places of interest in the neighbourhood, and having held Sectional Meetings regularly.

BURTON-ON-TRENT NATURAL HISTORY AND ARCHÆOLOGICAL SOCIETY.—The last excursion of the season was made on August 14th to Tamworth, Mr. W. C. Owen being leader. The church was first visited, where the Vicar, the Rev. Brooke Lambert, pointed out the objects of interest. The earliest portion of the church is of Norman date. In the tower is a double winding staircase of unique construction. The church, which contains many interesting monuments, has been lately restored. The parish register dates back to 1556. Tamworth Castle was next visited, Mr. Cooke, the present resident, kindly guiding the party. The Moat House, a fine old Elizabethan mansion, was next seen by permission of the owner, Mr. J. F. Woody. After tea, the party drove to Seckington, calling at Stalfold Hall to see the interesting chapel adjoining. At Seckington is a large mound and a series of entrenchments, supposed to be an ancient British earthwork. Mr. A. Clarson, of Tamworth, described it, and told what is known of it. The excursion was greatly enjoyed.

CARADOC FIELD CLUB.—The third Field Meeting was held at Lilleshall, on Tuesday, Aug. 27th. Heavy rain in the morning prevented more than a cursory examination of the geologic features of Lilleshall Hill, on which light has been cast by the recent labours of Dr. Callaway; but, as the weather cleared, a pleasant afternoon was spent in inspecting the ruins of the Abbey and a walk through the woods. Mr. R. W. Ralph (secretary of the Severn Valley Field Club) kindly and hospitably acted as guide through the day.

DUDLEY AND MIDLAND GEOLOGICAL AND SCIENTIFIC SOCIETY AND FIELD CLUB.—The sixth Field Meeting of the year was held on Tuesday and Wednesday, September 17th and 18th, at Chester and Northwich. A goodly party assembled at Chester, and accompanied by a large number of members of the local scientific societies, proceeded to Northwich under the guidance of Mr. Thos. Ward. By the courtesy of the Weaver Trust, a small steamer was in waiting to enable the visitors easily to go to the hydraulic canal lift at Anderton, which was explained by Mr. Wells, the engineer, and its action tried by most of the party either riding up or down in the floating boats. The way was then taken to the Witton Salt Mines, which were illuminated, and the mode of blasting and working the rock salt was explained by Mr. Thompson, the owner, and great interest was taken in collecting specimens of the fine crystals reformed in the water remaining on the floor of the mine. Returning to Chester, all dined together at the Grosvenor Hotel, after which the Chester Society of Natural Science received the members at their Museum, where great preparation was made by collections of microscopic and other objects. A hearty welcome was expressed by Prof. Hughes, the President, and most interesting addresses were given by Messrs. Hughes, Shone, Shrubsole, and De Rance, on Local Antiquities, the Boulder Clay, the Origin of Salt, and Local Geology. On Wednesday, Mr. Hughes conducted the party around the walls of the city and the other objects of interest which so abound there. At the Town Hall, Mr. Jeafferson showed some of the more interesting of the public documents, which he is examining on behalf of the Historical Commission. After dining together at the Queen's Hotel, the party separated with hearty thanks to those who had received the Club and taken so much pains to make the visit one of exceptional interest.

EVESHAM FIELD NATURALISTS' CLUB.—On Saturday afternoon, August 31st, by the kind permission of E. C. Rudge, Esq., of the Abbey Manor, Evesham, the Club visited his grounds, and a very instructive and pleasant afternoon was spent in viewing his garden, greenhouse, and collection of curiosities, mostly dug up on the site of the Abbey. The party were accompanied by Mr. Herbert New, who gave some valuable information relating to Simon de Montfort, the Battle, the Abbey, &c. A meeting of the Club was held on Thursday evening, the 5th instant, Mr. J. S. Slater in the chair. It was decided to pay a visit to the Worcestershire Natural History Museum at Worcester, on Saturday, the 21st September. The annual meeting of the Club was arranged for Wednesday, the 23rd October.

NORTHAMPTON NATURAL HISTORY SOCIETY.—The principal field-day of the year was the one to Fotheringhay and Burleigh. A large party of members and friends proceeded on August 20th, by L. & N.-W.R., to Elton Station, and then walked to Fotheringhay Castle, of which but one fragment of masonry is left, although the general plan of the castle can still be made out. From the keep a very picturesque view is obtained over the valley towards Oundle, and the moat sides are interesting to Botanists, as being the only habitat in Northants for *Ranunculus parviflorus; Papaver somniferum*, *Hyoscyamus niger*, *Onopordon Acanthium* (relics of the old castle garden) were also found, the thistle being called by the villagers Queen Mary's Thistle. In what was once the castle yard a fine bush of *Cratægus oxyacanthoides* was noticed. A short description of the old castle having been given, the interesting church was next visited. There an owl was disturbed and flew about the churchyard, close to the members, affording a close view of a rarely day-flying bird. Vehicles conveyed the members by portions of the old woods ot Bedford Turlieus, the borders of the forest here and there being festooned with *Clematis vitalba* in rich profusion. The woolly-headed thistle *C. eriophorus*, *Inula conyza*, *Calamintha menthifolia*, *Origanum vulgare*, *Campanula glomerata*, vars. *cœrulea* and *alba*, and *Euphrasia officinalis*, were noticed passing Wansford, where *Verbascum nigrum* is to be found, and looking to the Nene specimens of *Sium latifolium* were seen. The party proceeded by the old north road to Thornhaugh, where the botanists left the party to visit Southorpe Marsh, and were well rewarded by finding *Juncus obtusiflorus*, *Carex flava*, *Schœnus nigricans*, *Menyanthes trifoliata*, *Parnassia palustris*, *Pedicularis palustris*, *Carex vesicaria*, *Eriophorum angustifolium*, *E. latifolium*, *Eupatorium cannabinum*, &c. The calcareous borders of the road from here to Southorpe Quarries yielded *Campanula glomerata*, *Asperula cynanchica*, *Gentiana Amarella*, and *Chlora perfoliata*, the same plants being found on the quarries of Southorpe and Barnack. These quarries are the most productive of all the Northants localities for rare plants in spring time, being covered with *Anemone Pulsatilla*, *Aceras anthropophora*, *Hippocrepis comosa*, *Astragalus hypoglottis*, *Antennaria dioica*, *Habenaria viridis*, &c., but in August, as was to be anticipated, a different flora was observed, the most conspicuous plants being *Atropa Belladonna*, *Cynoglossum officinale*, *Gentiana Amarella*, var. *alba*; *Erythræa Centaurium*, a single specimen of *Hypochæris maculata*, *Calamintha Acinos*, *Verbascum nigrum*, &c. In the fields leading to Burleigh, *Centaurea cyanus*, (a rare Northants plant,) *Linaria minor*, *Stachys arvensis*, *Calamintha Acinos*, *Nepeta Cataria*, &c., were gathered. The Entomologists succeeded in capturing some fine *Cynthia cardui*, the Bedford Blue, the Red Admiral, and large Heath butterflies. Rejoining the party at Burleigh House, to visit which special permission had been given by the Marquis of Exeter, an hour was pleasantly spent in looking at the splendid collection of paintings, and the interesting state rooms with their relics of Queen Elizabeth and Treasurer Burleigh, after which but short time was spared for Stamford before tea, the return journey being by the Welland Valley and Market Harborough.

PETERBOROUGH NATURAL HISTORY SOCIETY.—A botanical excursion took place on July 4th. The river near Wansford Station was first visited, and yielded *Nymphæa alba* in abundance; then Stibbington Wood, where *Orchis pyramidalis*, *O. maculata*, *Vicia hirsuta*, *V. tetrasperma*, *Anthyllis vulneraria*, *Lathyrus pratensis*, *Prunella vulgaris*, *Erythræa Centaurium*, *Euphrasia officinalis*, *Hieracium Pilosella*, *Helianthemum vulgare*, *Tamus communis*, *Bryonia dioica*, *Centaurea Scabiosa*, *C. nigra*, *Scabiosa arvensis*, *Hypericum perfoliatum*, *Fragaria vesca*, *Festuca elatior* were collected. Leaving the wood and proceeding to the river, (through Stibbington village,) the banks of which were followed to Wansford Stanch, where *Stellaria glauca*, *Nuphar luteum*, *Thalictrum flavum*, and *Spiræa ulmaria* were gathered. Sutton Heath and adjoining meadows were next visited, when the following plants were collected: *Spiræa filipendula*, *Anagallis arvensis*, *A. tenella*, *Lychnis Githago*, *Centaurea Cyanus*, *Iris pseudacorus*, *Orchis conopsea*, *Pinguicula vulgaris*, *Samolus Valerandi*, *Lysimachia nummularia*, *Scrophularia nodosa*, *Pedicularis palustris*, *Ranunculus Flammula*, *Astragalus glycyphyllos*, *Melilotus officinalis*, *Poa pratensis*, *P. nivalis*, *P. nemoralis*, *Hordeum pratense*, *Cynosurus cristatus*, *Phleum pratense*, *Alopecurus geniculatus*, *A. pratensis*, *Briza media*, *Eriophorus polystachyon*, and *Equisetum limosum*.

TAMWORTH NATURAL HISTORY, GEOLOGICAL, AND ANTIQUARIAN SOCIETY.—At the general monthly meeting, held on the 2nd September, Mr. W. G. Davy, gave a description of the Wood Ants, (*Formica rufa*,) the largest of our British species. An account of the materials employed in the structure of their nests was given, and many instances of the wonderful economy of these insects recorded. He exhibited a large number of the ants in their nest within a glass case. Several donations were made to the Society's Museum, and the proceedings terminated with the usual vote of thanks.

WOOLHOPE NATURALISTS' FIELD CLUB.—August 22.—The fourth Field Meeting was held at Leominster, and the British camp at Croft Ambrey was visited. On arriving at the park gates leading to Croft Castle the party was met by the Rev. J. Edwards, Rector of Croft, who acted as leader. The celebrated grove of sweet chestnut trees was visited, and of the trees measured at the club level of five feet, one was found to be 20ft. 9in. in girth, and another, a magnificent specimen, 22ft. The latter has a long horizontal limb, about eight feet from the ground, 10ft. 3in. in girth. The church and its interesting monuments were inspected. The business of the Club was transacted at the British camp, which was carefully examined. The return was made through a lonely dingle, where many ferns were found. After a refreshing cup of tea at the Rectory, the party returned to Leominster and dined. Subsequently an interesting paper on "The Cedar Tree" was read by the President, (the Rev. H. W. Phillott, M.A.,) and another "On Remarkable Trees in the Neighbourhood of London" was contributed by Mr. Swinburne.

EXCHANGE.

Wanted *Alisma natans* and *Pyrus communis* in exchange for rare plants.—G. C. DRUCE, Northampton.

FRESHWATER LIFE.—III. INFUSORIA.

BY EDWIN SMITH, M.A.

If a little hay is steeped in water for a few days, and the infusion is then examined, it will be found to teem with microscopic life. Similarly the natural infusions offered by accumulations of water containing decaying animal and vegetable matter, or ponds where the simpler forms of vegetation flourish, are tenanted by countless millions of minute animals of various kinds, which, from their mode of occurrence, were named by the earliest observers *Infusoria*. The term at first included many organisms which, further investigation showed, could not be retained in the same class; plants mistaken for animals, because they moved about; animals of higher organisation, such as the Rotifera; others of a lower type, like the Amœba. This sifting process is even yet far from complete. It is not improbable that many forms now placed in this class, when their life history comes to be written, will have to be separated from the Infusoria properly so called. The number of species may also be reduced. For in the imperfection of our knowledge it is well to remember that forms which to-day are counted as distinct species may hereafter prove to be only different stages of the same animal.

Like other members of the sub-kingdom Protozoa, the creatures we are considering possess a simple body not divided into segments, and one which cannot be cut into two exactly corresponding halves. There is no definite alimentary canal, but digestion is effected indifferently in any portion of the fluid contents of the body. Pellets of food may be lodged in vacuoles extemporised in various parts of the interior, but they are not enclosed in stomachs separated by any sort of wall from the surrounding mass. Compared with other Protozoa, the *Infusoria* exhibit a more advanced differentiation of structure. The fluid protoplasm or sarcode, of which the bulk of the body consists, passes externally into a denser portion, the so-called cortical layer; which again is often protected by a still firmer covering termed the cuticle. Food is admitted by a distinct ciliated mouth opening into a short ciliated gullet, whence it passes, together with a small quantity of water, into the general body-cavity. When a proper mouth is not present, there is at least an oral region where a mouth may be extemporised. Refuse is excreted at a particular spot situated near to or remote from the mouth; but the discharging orifice is not, as a rule, permanently visible. One, two, or more contractile vesicles, having a fixed position in the cortical layer and connected with channels leading inwards, serve by their slow expansion and quick contraction to keep up a sort of circulation in the fluid interior, and to purify the sarcodic contents. In the same layer are found a nucleus, the female element, and, attached thereto, a nucleolus, the male element of the reproductive process. Reproduction takes place either by self-division lengthwise or crosswise, or by the conjugation of two individuals; the former method being characteristic of the sedentary, the latter of the free-swimming Infusoria. The same species may multiply in both ways.

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With regard to external appendages, the three sub-groups of Infusoria are differently furnished. The *Flagellata* have one or two long filaments like a whip-lash; the *Acinetæ* have numerous radiating tubular tentacles, which act as suckers; and the *Ciliata* have vibratile cilia, employed as organs of prehension and locomotion. In the last group the cilia may be distributed over the whole body and be all of one kind, or widely scattered over the surface and of different kinds, or limited to the under side of the body, or placed in a circlet or short spiral round it. In some species the cilia all move in concert when the animal swims. In others only the smaller cilia at certain points appear to assist locomotion, while the larger resemble non-motile bristles and only occasionally move by the twitching of the superficial coat. Certain bell-shaped forms, *e.g.*, *Vorticella*, possess a tubular stalk by which they are attached to water-plants during the principal stage of their existence. This stalk contains a contractile thread, which, on the slightest shock, shortens into a spiral and jerks back the bell.

Of the ciliated kinds some have the power of secreting a soft gelatinous envelope or an open vase-like case, into which they retract and from which they extend themselves at pleasure. The case is mostly fixed by a very short stem, or by its closed end to some aquatic plant; but occasionally it is carried about by the animal, which has broken away from its support, and swims freely through the water. Many Infusoria, possibly all, undergo, at certain periods, what is called the encysting process; that is to say, they enshroud themselves for a time in a gelatinous covering, which hardens into a thin membrane, and meanwhile they become quiescent. The process appears to be subservient to preservation through the cold season, or to multiplication, or to metamorphosis.

To the above brief description of the class I will now subjoin a few notes on such common examples as have occurred to me in the ponds about Nottingham. *Stentor* may be looked for at all seasons in clear water covered with duck-weed. I have taken specimens in February during frosty weather. The body is trumpet-shaped when extended, but is drawn up at times into various figures from obtusely conical to ovate or globular. It often fixes itself by the narrow extremity, which spreads out a little adhesive foot for the purpose. When free, it swims with a moderately quick rolling motion. The surface of the whole body is covered from end to end with lines of minute cilia; while a broken spiral of longer ones surrounds the head with a wreath like a figure of six. The break in the wreath indicates the position of the mouth, near which may be noticed a contractile vesicle and its connected channels. I have occasionally seen three or four transparent vacuoles at a time bulging out from the side of the animal, but they did not contract. The nucleus, when I have observed it, has had the form of a horse-shoe. As to colour, my specimens have been either pellucid, or tinted dull blue, green, or even black, by their granular contents. The last were evidently specimens of *S. niger*, and were got from a pond in Bestwood Park; length, $\frac{1}{36}$ of an inch. It is interesting to notice diatoms, small animalcules, and so forth, in the food vacuoles. Instances of self division or conjugation may often be observed; and I once met with a whole colony, produced by progressive self-division, all thrusting out their heads from the middle of a lump of jelly, which served as their common envelope.

The bell-shaped *Vorticellæ* are familiar to every microscopist, and they are as beautiful as they are common. They are often so abundant as to look like a white fluff clothing the roots and stems of aquatic plants. The bell has no cilia on its surface; but from the open rim protrudes a disk which bears a rotary wreath of these organs. In the depression between rim and disk lie the mouth and the excretory orifice close together. The former opens into a well-defined gullet, which extends some way into the interior, where also a contractile vesicle and a curved nucleus may readily be discerned. Careful illumination is needed to show the contractile thread inside the tubular stalk. When a Vorticella breaks away from its place of attachment, as not unfrequently happens, the bell may swim off with the stalk in tow. In one such instance I observed the bell come to rest by its cilia on a bit of weed; and while in that position, the stalk every now and then contracted spirally as usual, although the movement could be of no possible use to the creature. This led me to think that the movement is ordinarily quite independent of anything of the nature of will. Specimens may be met with in various stages of fission; and occasionally one or two small oval bodies are found adhering to the stalk where it joins the bell, but what part they play in the life-history of Vorticella I have not been able to witness.

Continuous self-division increases the number of individuals by a sort of geometrical progression. In such a way are probably formed those splendid compound clusters which, as in *Carchesium polypinum*, exhibit the magnificent spectacle of forty or fifty bells connected by their ramifying threads with one common trunk. It is a fine sight to behold a number of bunches all contract their fibres at the same moment to one centre, the top of their common pedicel, and to spread out again in loose array as before; and to see this done again and again, not by one specimen alone, but by a colony of specimens crowding the bit of water-plant under examination. I have taken Carchesium on *Anacharis* from under the ice in the month of January.

Minute Vorticelline forms are found in parasitic clusters on the carapaces of Cyclops, Daphnia, and other Entomostraca; on the shells of water-snails, on water-beetles, and on various aquatic larvæ. Not that the so-called parasites actually feed upon the substance of their host; they do not claim board, but only lodging. They feed in the surrounding element, as usual, by their cilia. *Epistylis digitalis* infests in thick masses the abdomen of Cyclops, having the appearance of an elegant but rather cumbersome train. The bell-part is $\frac{1}{430}$ of an inch long; the little stalk is branched and non-contractile. A much smaller species, with a simple stalk, has a length of no more than $\frac{1}{2625}$ of an inch. I have also met with a sessile form, filled with grains of chlorophyll, and completely colouring the abdomen of the unfortunate Cyclops green. Length of body from $\frac{1}{512}$ to $\frac{1}{1028}$ of an inch.

There is a family of Infusoria closely allied to the Vorticellæ in their form and habits, but distinguished by the absence of a stalk and by the possession of a roomy sheath resembling a very thin transparent vase, into which the animal can withdraw itself by a general contraction of the whole body. The two kinds with which I am acquainted are *Vaginicola* and *Cothurnia*. The sheath of the former is sessile; that of the latter is supported on a short stem. They multiply by self-division. Hence they frequently occur in pairs, each pair occupying a common vase. From the vase the twins protrude their ciliated crests by a simultaneous impulse, and after feeding awhile suddenly close up and shrink to the bottom of their cell. The retreat, however, is only momentary. Immediately they begin to rise again slowly and steadily, until they once more stretch forth to fish for prey. A contractile vesicle is situated not far from the mouth. The sheath of *Cothurnia* may be yellow, brown, or rusty red. I have seen *Vaginicola* sailing about, case and all, attached to a fragment of weed. Both kinds continue active through the winter.

[TO BE CONTINUED.]

HOW WE FOUND THE MICROZOA IN THE BOULDER CLAYS OF CHESHIRE, &c., AND WHAT WERE THE RESULTS.

BY W. SHONE, ESQ., F.G.S.

During the early part of the year 1873 I had frequently washed the boulder clay of Chester for Foraminifera without success, until in September of that year my friend, Mr. J. B. Manning, (Governor of Chester Castle,) found in the upper boulder clay of Newton-by-Chester a boulder bored by *Saxicava rugosa*, in the cavities of which fragments of the shells remained. Wishing to possess these fragments, he proceeded to wash them out; but in doing so observed that the holes were not filled with the red clay in which the boulder was found, but with sand. Mr. Manning shortly afterwards showed me this sand, and as I was aware that the bore holes of recent Saxicavæ frequently contained sand full of Microzoa, which fills the space once occupied by the flesh of the Mollusc, I suggested we should go to our mutual friend, Mr. J. D. Siddall of Chester, and examine it. We did so, and, on placing the sand beneath the microscope, were rewarded with the sight of several shells of the Foraminifer—*Polystomella crispa*. Mr. Manning thereupon remarked "if we are to succeed in finding Foraminifera in the boulder clay we must look for stones with holes in them." I, at the time, thought this very hopeless, as out of the thousands of boulders I had examined this was the first that I had seen with cavities in it.

After parting with my friends that evening, it occurred to me that the turbinated shells of *Turritella terebra* would offer a still more effective shelter to the Microzoa. These were very abundant in the boulder clay of Chester, and I possessed a great number of them.

This idea was further strengthened, as I had previously observed these shells were filled, not with the red clay in which they were found imbedded, but with a greyish-white sandy material—not occurring elsewhere in the boulder clays. So I put the idea that evening into practice by washing out, in a test tube, the substance which filled the inner whorls of the Turritellæ and other Gastropoda. After pouring off the fine muddy particles, there remained behind a fine sandy residuum which, on being placed beneath the microscope, I found to be *full* of Foraminifera, Ostracoda, Sponge spiculæ, and the spines of Echini. So thus was accomplished, after many unsuccessful attempts, the discovery of the Microzoa in the boulder clays.

The next question was, whether this was a mere local phenomenon, or was general in the boulder clays of the district. In order to determine this, in the spring of the following year, 1875, I made various excursions, and I found the Microzoa in the Gastropoda of the boulder clay of Madeley, in Staffordshire; Whitchurch (Salop,) Colwyn Bay (Denbighshire,) St. Asaph, Hawarden in Flintshire, Dawpool, Newton, (Cheshire,) also 700 feet above the sea at Macclesfield and Arnfield, (Cheshire,) Liverpool and other parts of Lancashire, the Isle of Man, &c.; in fact, wherever on the west coast I found Gastropoda in the boulder clay, the Microzoa abounded in the sand within them.

We then began to question ourselves how these Gastropoda became filled with the greyish-white sand, though they occurred imbedded in a matrix of red boulder clay? In the early part of 1875 there was a short, but, for the time, a very severe frost. At the mouth of the Dee there is an island, called Hilbre, some five acres in extent; it is distant about a mile and a half across the sands from the Cheshire shore. This space is covered with water at half tide. The dead shells of the Mollusca, Ostracoda, and Foraminifera, which live in the laminarian zone, are cast up and left by the receding tide between the ripple marks. The dead shells of the Gastropoda, as they lie in these hollows, get more or less filled with the *greyish-white* silt containing the Microzoa. The frost was severe enough to freeze the sea-water left by the tide in these hollows. Consequently the Gastropoda filled with this silt, the broken shells, &c., were enclosed in thin sheets of ice, which were broken up on the return of the tide, and such as were cast ashore on Hilbre Island were piled together and frozen into blocks. When the thaw commenced, it set the blocks free. Charged with the Gastropoda, filled with silt and broken shells, these tiny ice-rafts floated short distances away, distributing, as they melted, their load of broken shells, and casting the silt-filled Gastropoda over the mud flats of the delta of the Dee.

Recently Mr. R. D. Darbishire, B.A., F.G.S., gave me some silt containing Foraminifera, &c., gathered from the beach at Gorteen, Connemara, Ireland. My mother, Mrs. Shone, on examining this *debris*, observed that the fry of the Gastropoda, which abounded in it, were filled with this Foraminiferal silt, and only awaited the formation of ground ice on the shore, to transport them and repeat the phenomena of the Gastropoda of the boulder clays.

Thus, a flood of light was thrown on a subject which had puzzled even the late Professor Edward Forbes, who suggested the "ploughing up action of ice-bergs, and the sweeping action of great waves coming from the north." But the mud of the boulder clays required a still sea for its deposition; and its depth in Lancashire and Cheshire may be judged from the fact that the upper boulder clay of Macclesfield is 700 feet, and of Arnfield, Cheshire, upwards of 600 feet above the sea level; yet the broken and fragmentary shells of the Mollusca occur throughout at all levels, and are all littoral or sub-littoral in their habits—some living on rocks, others on sand, others on sea-weeds, yet found in a common matrix of red clay—none of the bivalves with valves united, and all more or less broken.

The presence of the glaciated erratics and arctic Mollusca tells us the climate was severe enough for the formation of ice in the winters along the then shores, when the north of England was sunk, perhaps, a thousand feet or more beneath the glacial sea; when glaciers ground their way down the valleys of Wales and the Lake district, sending forth their turbid streams of mud into the sea to form the boulder clays. Along these shores lived the Mollusca; from these shores the ice-rafts distributed them over the sea-bed, together with the glaciated stones with which they lie entombed, which bed, since upraised, has become the plains of Lancashire, Cheshire, and, perhaps, the Midland Counties. The granite boulders in the boulder clays of Lancashire and Cheshire have been traced to their sources in Eskdale, Cumberland, and Criffel, Scotland; and their distribution extends far beyond the limits of these counties, in a southerly direction. There is, therefore, a fair field of research open to the Midland Geologist in the boulder clays of those districts. The boulder clays of the north-west of England were once thought to be azoic, yet they have yielded to research a large fauna. In the upper boulder clay of Newton-by-Chester, I have found 148 species of Mollusca, Ostracoda, Foraminifera, &c., where no one thought of looking for a shell before 1873.

A word or two in conclusion may be spared for the middle sands and gravels, which occupy considerable areas in Lancashire and Cheshire. Professor Hull, M.A., F.R.S., was the first to observe that the drift clays and sands and gravels could be separated into three divisions—1st, in descending order—an upper boulder clay; then, 2nd, this was succeeded by (middle) sands and gravels; and, 3rd, a lower boulder clay. The physical features and the fauna of the upper and lower boulder clays are very similar, except that the lower boulder clay bears evidence of more glacial conditions than the upper. All the phenomena I have described are applicable to both clays. The middle sands and gravels differ from the boulder clays—first from the total absence in them (except near the mountains) of glaciated stones. The shells, too, of the Gastropoda are *not* filled with Microzoa, like those of the clays, but with the coarse sand or fine gravel, in which they are generally found embedded. The rolled character of the broken shells of the Mollusca also points to a different mode of distribution to those of the boulder clays.

The bands in which the shells occur in the middle sands and gravels bear evidence, too, of current bedding, all of which facts taken together with the presence of southern types of Mollusca, appear to indicate an inter-glacial period, when the sea was free from floating ice, and the glaciers—if any—ceased to pour into it the mud which formed the lower boulder clay. The partial denudation of the lower boulder clay, however, supplied the materials for the middle sands and gravels, together with the *derived* Arctic shells—sometimes found mingled with the southern ones in a common tomb. The agency which distributed the shells in the middle sands and gravels I believe, with Mr. De Rance, C.E., F.G.S., to have been marine currents.

All this, and more, came of the preserving of a pinch of sand out of the Saxicava-bored boulder found in the upper boulder clay of Newton-by-Chester.

Anyone wishing for the more detailed results will find them stated in my papers, viz.: In the Quarterly Journal of the Geological Society of London for May, 1874, on "The Discovery of Foraminifera in the Boulder Clays of Cheshire," and in the one for May, 1878, "On the Glacial Deposits of West Cheshire, together with Lists of the Fauna found in the Drift of Cheshire and adjoining counties."

PARASITES OF MAN.*

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

[*Continued from page 213.*]

Considering the importance of the new parasite *(Filaria Bancrofti)* it was thought advisable to devote more space than usual to the literature of the subject; consequently, the remaining species of filariform nematodes may be dismissed with comparative brevity. It happens, moreover, that much doubt hangs over the question of the genuineness of several of the forms that require to be noticed. The human strongyloids, on the other hand, are all of them well defined species; and, as will be seen in the sequel, they play almost as important a *rôle* in the production of endemic disorders as do the Filariæ themselves. In a general sense, the Guinea-worm may be spoken of as a Filaria, but, for reasons given in my introductory treatise and elsewhere, I prefer to consider this parasite as the type of an osculant genus *(Dracunculus.)* The nematoids variously placed by helminthologists under the genera *Sclerostoma*, *Anchylostoma*, *Dochmius*, and so forth, are all of them closely related to the *Strongyli* properly so called. As regards the question of nomenclature, I must leave it to Mr. Grove to say whether, in the genera above mentioned, it is permissible for us to retain the final component *stoma* unaltered. Many continental helminthologists no

* Communicated by Mr. Hughes to the Microscopical Section of the Birmingham Natural History and Microscopical Society, October 15th, 1878. On Dr. Cobbold's behalf a microscopic slide was shown, containing numerous embryos of the Guinea worm. The young worms had been mounted some twenty-five years previously. They were originally taken from adult Dracunculi in the possession of the late Sir George Ballingall, of Edinburgh. Altogether the specimens had been preserved for upwards of half a century.

longer speak of the genera *Distoma*, *Tristoma*, *Polystoma*, *Sclerostoma*, and so forth ; but, following Diesing, they prefer to convert the final Greek component into a true Latin syllable. Thus we have *Distomum*, *Polystomum*, *Sclerostomum*, and the like. Long habit has so fully familiarised us with the old plan of retaining the Greek termination unaltered, that I confess to some reluctance in parting with the final component *(stoma)* although the form is not strictly classical. On the other hand, the introduction of new and more striking departures from the legitimate method of employing the binomial nomenclature is much to be deprecated. Such a barbarism as *Hyperöodon butzkopf*, for example—intolerable as it must sound to the scholar's ear—is, nevertheless, freely accepted by well-known Naturalists both at home and abroad. In helminthology there are probably fewer glaring errors of nomenclature than occur in other departments of Natural History science. Nevertheless, I think Mr. Grove's criticism in the matter of the family term *Distomidæ* perfectly just.* Following the practice of the late Edward Forbes and others, I have frequently, and as I think fittingly, employed the names of *savans* for the purpose of forming new genera and species. Thus, by almost universal consent (on the Continent, at least,) my genus *Bilharzia* has been adopted; its general acceptance being in part due, no doubt, to the fact that, as a generic term, it had priority over the various other titles severally proposed by Diesing, Weinland, and Moquin-Tandon.

NEMATODA CONTINUED.

28.—*Filaria lentis*, Diesing.

Synonymy.—*Filaria oculi*, Owen ; *F. oculi-humani*, Von Nordmann.

Remarks.—This small worm was originally discovered in a case of lenticular cataract, under the professional care of the distinguished oculist Von Gräfe. Similar cases have also been recorded by Jüngken and Sichel, by Gescheidt and Von Ammon, and by M. Fano. There is no certain evidence as to the sexual maturity of the worms obtained in these cases, although in one instance the parasite measured three-quarters of an inch in length.

Literature.—The standard works of Leuckart (l. c. Bd. II., s. 622,) and Davaine, (l. c. deuxième edit., p. 831,) and in my Entozoa, (p. 332.)

29.—*Filaria labialis*, Pane.

Syn.—None.

Remarks.—The original description of this species was based upon the "find" of a medical student at Naples. The worm (of which the female only is known) was an inch and a quarter in length, and occupied a pustular cavity in the upper lip.

Lit.—Quoted by Leuckart (s. 616) and Davaine, (Synops, c. VII.,) from Pane's Nota di un elminte nematoide, in Annali dell. Accad. degli aspirante Naturaliste, Napoli, 1864, (Ser. 3, Vol. IV.)

30.—*Filaria hominis oris*, Leidy.

Syn.—None.

Remarks.—This apparently sexually immature worm was described by Prof. Leidy, from a specimen preserved in alcohol, and labelled as having been obtained from the mouth of a child. It measured five and a half inches in length.

* See the "Midland Naturalist" for May, p. 123.

Lit.—Leidy, J., in Proceed. Philad. Acad. Nat. Sci. for 1850, (p. 117.)

31.—*Filaria trachealis*, Bristowe.

Syn.—*Nematoideum tracheale*, Bristowe and Rainey.

Remarks.—Minute worms, each measuring about $\frac{1}{50}$ of an inch, were found by Rainey in the trachea and larynx, (post mortem.) Their mature condition is unknown.

Lit.—Bristowe and Rainey, in the Path. Soc. Trans. for 1855.

32.—*Filaria Loa*, Guyot.

Syn.—*F. oculi*, Gervais and Van Beneden; *F. lacrymalis*, Dubini; *F. medinensis*, Gmelin; *Dracunculus oculi*, Diesing; *D. Loa*, Cobbold.

Remarks.—This worm is found beneath the conjunctiva of negroes. It is rather more than 1¼in. in length; being particularly abundant in the Gaboon region of Western Africa. It has also been seen in Brazil and other countries. When the worm voluntarily quits the eye, a natural cure of the disease is thus produced.

Lit.—Fully noticed in the standard works of Leuckart, Küchenmeister, Davaine, Moquin-Tandon, and especially Gervais and Van Beneden. The descriptions are chiefly taken from the writings of Lestrille, Guyot, and Arrachart.

33.—*Dracunculus medinensis*, Cobbold.

Syn.—*Filaria dracunculus*, Bremser; *F. medinensis*, Gmelin; *Dracunculus*, Lister; *D. Persarum*, Kaempfer; *Furia*, Modeer; *Gordius*, Linnæus; *Vermis*, Grundler.

Intermediate Host.—The Russian traveller and helminthologist Fedschenko discovered that small freshwater crustaceans, of the genus *Cyclops*, harbour the larvæ of the Guinea-worm. In the free embryo stage these larvæ perforate the abdominal segments, and thence proceed to coil themselves within the limbs of the crustacean bearers.

Remarks.—The Guinea-worm disease, so common in India and other Oriental countries, is undoubtedly the same disorder as the Dracontiasis of Plutarch. It corresponds also with the Israelitish endemic affection described by Moses as due to fiery serpents. Küchenmeister's learned historical narrative leaves no room for doubt on this point. The older writers frequently confounded nematoid worms with serpents. As regards the mode of infection, there can be little doubt that the advanced larvæ of Dracunculus are swallowed with potable waters, and thus pass into the human stomach. Thence the female worms migrate to the surface of the body, in which situation they rapidly grow to maturity. The female parasite in its sexually mature state has been very fully anatomised by Professor Bastian. The embryos have likewise been carefully studied by Bastian, Busk, Carter, Fedschenko, Leuckart, Robin, Davaine, Lewis, and myself.

Lit.—All standard works, especially that of Leuckart, which offers an admirable *resumé* of the whole subject, including an exhaustive summary of Fedschenko's writings. Extensive literary references are given in Davaine's well-known work, and also in the Bibliography appended to my introductory treatise.

[TO BE CONTINUED.]

NOTE ON SOME FOSSILIFEROUS CLAY, AT WOLVERHAMPTON.

BY THE REV. H. W. CROSSKEY, F.G.S.

Some time ago I received an ounce or two of clay, which had been found in excavating a drain at Wolverhampton. On examination it yielded the following fauna:—

FORAMINIFERA.

Polystomella crispa. *Polymorphina lactea.*

Mr. H. B. Brady (who kindly examined the specimens) informs me that they are typical forms, far too widely distributed for anything positive as to habitat to be said about them, but that the chances are they belonged to a starved, shallow water marine fauna. They are more probably starved with cold rather than fresh water; and Mr. Brady would "guess" them Arctic rather than brackish.

MOLLUSCA.

Tellina balthica.—Fragments.

Dr. J. Gwyn Jeffreys obligingly examined these fragments, and states that "they must belong to *Tellina balthica*, because of their fleshy and loose calcareous texture." On the card to which I had affixed the fragments Mr. Jeffreys detected the minute portion of a univalve, which (he states) is "petrified and probably Liassic, being derived;" and refers to the paper by the Rev. W. Lister, "On the Drift, containing Recent Shells, in the neighbourhood of Wolverhampton," published in the "Quarterly Journal of the Geological Society," Vol. XVIII., p. 159. In this paper it is noted that in the drift at Bushbury Junction rolled shells and other fossils, derived from Liassic rocks, such as Gryphæa, Ammonites, Cardiniæ, and Belemnites, accompany *Nassa reticulata*, *Turritella communis*, *Purpura lapillus*, *Littorina squalida*, *Astarte Arctica*, *Cardium edule*, *Tellina solidula*, and *Cyprina Islandica*.

Of these species, two are decidedly Arctic, viz., *Astarte Arctica* and *Littorina squalida*, but the others are common to British and Arctic waters.

ECHINODERMATA.

Echinus —— ? Two spines.

These spines are too worn for the species to be determinable, but undoubtedly they are spines of an Echinoderm.

Dr. Jeffreys remarks generally upon the specimens submitted to him by Mr. Lister—"It is possible that these shells may have been carried off with the pebbles from a beach in the Arctic regions by an iceberg, which, after traversing a considerable distance in the glacial sea, may have stranded or melted and deposited its load in the spot where the shells and pebbles had now been found. The present data are, however, insufficient to enable me to form any opinion on this point."

The specimens now recorded do not enable any more decided opinion to be given. If not *in situ*, they must have been in the mud intermixed with the stones and boulders brought down by one of the numerous icebergs which stranded in this district. In either case, however, they add to the proof of the submergence of the Midland area during the last great geological epoch, and encourage us to hope that other shell beds may yet be found.

A SKETCH OF THE HISTORY OF THE LEICESTER LITERARY & PHILOSOPHICAL SOCIETY.

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

In the year 1835 two young men of Leicester, a physician and a lawyer, met at an evening party and discussed with unusual earnestness the condition and prospects of the town. It was a period of great political excitement; party passions separated friends and made general intercourse difficult. The question arose as to how this condition of things could be ameliorated. The young physician had recently been studying in Manchester, and described to his friend an institution of which he had been a member there, and which struck him as a useful means of bringing cultivated men together on a neutral platform This was the Manchester Literary and Philosophical Society. The lawyer listening to the physician's lively description of the beneficial action of that society, became inspired with a strong ambition to establish a similar institution in his own town. His friend entered warmly into the scheme, and they began at once to discuss preliminaries. It happened that in politics and theology they were diametrically opposed, but as the new Society was to ignore these irritating topics this was rather an advantage than otherwise.

It was agreed that each should invite half a dozen of his personal friends to a preliminary meeting to be held at the Medical Library in the month of June. At this meeting the Leicester Literary and Philosophical Society was established. Thirteen gentlemen were present, of whom six are still living; and among those six are the two founders of the Society —Dr. Shaw and Mr. Alfred Paget.

Dr. Shaw was elected its first President, and Mr. Paget its first Honorary Secretary. A room was engaged, a code of rules drawn up, and the first meeting of the Society was held on the 7th of September, 1835, when the President delivered an admirable opening address on the "Influence of Science upon the Happiness of Mankind."

At that time the population of the town was about 45,000, and the Society started with sixty members subscribing one guinea a year each.

The population is now about 120,000, and the members of the Society about 300.

For the first three years ladies were not admitted, and the attendance at the meetings, which were held monthly at half-past seven in the evening, varied from about ten to thirty.

During these three years many excellent papers were read before the Society, but occasionally a meeting was adjourned for want of an audience. The proposal to admit ladies was warmly debated at four successive meetings, and was at last carried.

At the meeting on October the 18th, 1838, each member was allowed to introduce one lady, and the advertisements and circulars of the succeeding session bore the words "ladies invited." At the same time the meetings began to be held fortnightly instead of monthly.

This change appears to have put new life into the Society. From that period it made continual progress both in numbers and in social influence.

In October, 1837, a dinner was given by the Society to Professor Sedgwick, who had come to Leicester to investigate the Geology of Charnwood Forest.

In the summer of 1841 the Society's Museum of Geology, Natural History, and Antiquities was established. In February, 1843, it had grown to such importance that it was resolved to give free admission to the public during three days a week, and Mr. John Plant, then a young man, was appointed Curator. Mr. Plant has since become well-known in the scientific world, as the Curator of the Peel Park Museum, Salford. The public were greatly interested in the opening of the Museum, 5,000 persons being admitted during the first fortnight.

In 1849 the Museum was handed over to the Town Council, who, having adopted the Museums Act, and levied a half-penny rate, purchased for its reception, at a cost of £3,000, a building erected twelve years previously for the Proprietary School. In this building it has remained for nearly thirty years.

The collection at that time contained about 10,000 objects. It has now about 22,000. Many of the original specimens, such as stuffed birds and insects, have decayed and been thrown away. In some cases this has happened twice over. Natural History specimens exposed to the light will only remain good for a limited period. The increase has, therefore, been more than would at first appear.

An arrangement was made between the Town Council and the Society, in an informal manner, not in writing, that the Society should retain the supervision of the Museum, should have rooms provided in the building for its meetings, should select the curator, and should pay £52 a year towards his salary. This arrangement, with slight modifications, was continued till the year 1872, and worked with remarkable smoothness and fair success. The half-penny rate, which realised at first only about £100 per annum, increased with the increase of the town, until in 1872 it produced about £450. But the whole of this was expended in salaries, repairs, new cases, and sundries. No specimens were purchased with it. The increase of the Museum collection depended entirely upon donations, a large part of which came from the Society, which continued to devote its funds to this purpose.

In 1872 a new *régime* was introduced, which is still in operation. The government of the Museum is now in the hands of a Special Committee, consisting of ten members of the Town Council, who appoint also six gentlemen, not members of the Corporation, as co-optative members of the Committee. The Council of the Society are entitled to recommend *four* of these six. The Committee thus constituted of sixteen members appoints six of its own body as Honorary Curators of the Museum, each with his own special department; and these Curators, who generally include all the four co-optatives recommended by the Society, become practically the medium of communication between the Society and the Museum Committee.

The removal of the Society in 1849 to the rooms provided for it in the Museum was the beginning of a new era in its history. There was a great accession of members, the numbers soon rising from the former level of 90 or 100 to 150.

The Lecture Room, however, would barely seat 200, and it became necessary to limit the privileges of members in introducing friends.

For twenty years the Society kept steadily on its course, selecting its annual Presidents alternately from opposite political parties, though prohibiting political discussions on its platform; giving every season, from October to April, a course of about fifteen lectures, every one of them offered gratuitously mostly by members of the Society, and nearly all of a highly creditable character; and doing its part in a quiet way towards maintaining the higher education of the town.

But at last the interest and life of the Society began to flag, and the members to fall off. Several Presidents made spasmodic efforts to rekindle the general interest in the Society's work, but in 1870 a resolute and experienced organiser, the Rev. Robert Harley, F.R.S., was elected to the Presidential chair, and with remarkable skill and vigour completely rejuvenised the Society. Under his guidance and advice several plans previously projected or talked over were promptly carried out. It was decided to introduce into the annual course of lectures six by professional gentlemen of the highest reputation, regardless of cost; to establish an annual excursion in the month of May or June for the members and their friends; and to appoint a new officer under the title of Corresponding Secretary, who should be the prime minister of the President's government.

These, with other minor reforms, were completely successful in restoring the Society to health and progress. The number of members increased annually. The professional lectures were inaugurated by Professor Huxley, the largest public hall in the town being taken for the occasion and well filled.

The first excursion was devoted to the Geology of Charnwood Forest, under the able guidance of Mr. James Plant, F.G.S.

Hitherto the Society has done little in the way of publication. It has issued an annual report in a pamphlet of from thirty to fifty pages, and in 1855 a volume of 380 pages was published, containing *in extenso* a selection of seven lectures recently delivered before the Society. This volume was presented gratuitously to every member, but the expense was about £60, and the experiment was not continued. From a very early period of its history, the publication of its Transactions has been debated at intervals, but the necessity of devoting its funds to the Museum, and the feeling that the strength of the Society did not lie in the direction of original research, always prevented it. In 1875, however, it was resolved to collect the early records of the Society's work, and to publish them in brief abstract, in parts, to be issued at intervals until the current date was reached.

Of the Transactions in this form, four parts have been issued, including the fifteen sessions from 1835 to 1850, giving abstracts of a large number of papers, many of them of great local interest.

The Society was never more vigorous and flourishing than it is at the present moment. It has about 300 members subscribing a guinea each, about twenty lady associates subscribing half a guinea, and about twenty-five honorary members, all except one residing at a distance. Its sectional committees, established in 1849 for the pursuit of special branches of Art and Science, but most of which remained for many years in a dormant state, are wakening into real life. The Council have undertaken several additional courses of educational lectures for the general benefit of the town, as well as the members. The Corporation have recently provided, partly by public subscription, and partly from the borough estate, a new block of buildings in connection with the Museum, in which a very handsome Lecture Hall, seating 500 persons, is devoted to the use of the Society, and there can be little doubt that when the Midland Union holds its annual meeting in Leicester next May, it will receive a very warm and hearty welcome from the Literary and Philosophical Society, under the auspices of its President for the year, George Stevenson, Esq., who is one of its oldest and most valued members, an Alderman, and an ex-Mayor of the borough.

NOTE ON ŒCISTES PILULA.

At the meeting of the Birmingham Natural History and Microscopical Society, held June 11th, 1878, (see "Midland Naturalist" at p. 202,) I exhibited the very rare Rotifer *Melicerta pilula*, or, more correctly, *Œcistes pilula*, which I had then just found in Sutton Park. The history of this species appears to be as follows:—In the journal of the Quekett Club, 1868, this animal was described by Mr. J. G. Tatem as a *variety of Melicerta*, in which "only rudely shaped excrementitious masses adherent to the gelatinous investment are observed," but no distinctive specific name was suggested for it. This description was accompanied by drawings, which are fairly accurate so far as they go.

In "Science Gossip," 1872, Dr. F. Collins described the same organism as a new species, and gave a very incorrect account of it, stating that "the pellet with which the animal builds its tube is formed in a *kind of sac*, situated at the lower extremity of the abdomen," &c. In the "Monthly Microscopical Journal," July 1st, 1872, Mr. C. Cubitt takes this species as illustrative of the structural differences between Flosculariæ and Melicertidæ, and speaks of it as a form with which he had been acquainted for some years, and which he had called *M. pilula*, from the fact that "she fortifies the gelatinous basis of the theca with her own excrementitious pilules."

In this paper the author proposed to divide the whole thecated section of Rotifera into two families only, distinguished primarily by the position of the marginal wreath of setæ and the cingulum or secondary belt of cilia and of the ganglion, relatively to a line or axis drawn from the mouth to the anus. Of these two families he proposed to make Melicertidæ include the genera Melicerta, Œcistes, Limnias, and Tubicolaria under the term Melicerta, while Conochilus, Lacinularia, and Megalotrocha were to be grouped together under the common name of Lacinularia.

But later observers have added several species to each of the old genera, the characters of which are sufficiently distinct to justify the retention of the older divisions. The difference of the form of the disc is a sufficient distinction between Melicerta on the one hand and Limnias and Œcistes on the other, while the two latter are separated by the different form of the lobes, the character of the theca, and their general habit.

If we accept the genus Œcistes at all, the species we are now describing should certainly be included in it. My friend, Dr. C. T. Hudson, says on this point—" They are Œcistes, and good specimens of the genus."

Mr. Cubitt's description of the singular habit of this animal is quite correct, but he does not appear to have observed the precise manner in which the remarkable operation is performed, from which it derives its name. It is self-evident that only a minority of the excrementary pellets discharged by the creature can be required or used to fortify its theca. The larger part are whirled away from the vicinity of the animal in the manner familiar to all who have observed the thecated Rotifers or the freshwater Polyzoa—but those which are utilised for building purposes are ejected between the rotifer and its tube or theca, and received under the lower margin of the ciliated trochus, where they remain for a few seconds as if the animal were making sure of its proper hold, and then by a sudden retraction of its body it dabs the pellet into a proper position on the margin of the theca, and instantly resumes its usual condition. The amount and regularity of the pellets with which the tube is fortified varies very much. One finds occasionally an individual in which they are so few and irregular as only to suffice for the identification of the species. Regular feeding with water containing abundant food produces a corresponding increase in their number and regularity, and a supply of carmine and indigo on alternate days is followed by the deposition of very regular alternate layers of red and blue courses on the outside of the tube, which, when viewed by strong dark background illumination, then forms a very pretty object.

My specimens produced abundant ova, which were formed in the usual manner in the ovary, and thence extruded into the space between the animal and its theca, and deposited upon the lower part of the foot, as is customary with this division of the Rotifera. I have not yet observed their development nor, although I have examined a large number of specimens, have I yet been fortunate enough to see the male of this species.

A. W. Wills.

Reviews.

The Geology of the Fenland. By S. B. J. Skertchley, F.G.S. London: Longmans and Co., 1877. 8vo. Price 40s.

Another Geological Survey Memoir of 335 pages, with some good maps, sections, and woodcuts, but which should have been issued at about half the price mentioned above. The Survey is supported by a Parliamentary grant, its officers receive nothing extra for the memoirs they write, the publication of which is, indeed, absolutely necessary if the public is to be put in possession of the information which it has a right to expect, and yet this is long delayed, and finally published in a badly got up style and at a high price, contrasting ill with similar publications of other nations, and even with those of our own colonies.

The Fenland embraces an area of about 1,300 square miles, lying round the Wash, and reaching to Wainfleet and Lincoln on the north, Stamford and Peterborough on the west, and Ely and King's Lynn on the south and east respectively. All this is a low flat country, under which lie the great Oolitic clays—the Kimmeridge and the Oxfordian. But upon these are spread a great thickness of boulder clay, and of gravel, peat, and silt of later date.

Mr. Skertchley has not confined himself to the strictly geological features of his district; he has considered, and rightly so, that the Archæology and the Physical Geography of the region are so closely bound up with the Geology that the one cannot properly be described without the other, and hence his memoir is, perhaps, the most readable which has ever been issued by the Survey. He has carefully studied old documents, and traces the history downwards, from the time of the Romans to that of the present day.

The oldest deposit noticed is the *Great Chalky Boulder Clay.* This varies from dark to light blue in colour, and is full of striated lumps of chalk; it also contains specimens of basalt, quartzite, coal-measure sandstone, Silurian limestone, slate, flint, &c. In a deep well sunk at Boston in 1828 this deposit was found to be of the enormous thickness of 460 feet. It was here underlain by sands and gravels (Middle Glacial) which were pierced to the depth of 88 feet, while it was overlaid by 24 feet of silt. The author strongly advocates the terrestrial origin of this boulder clay. He believes that it was formed underneath a great glacier, which came pushing down from the northward. In age he would correlate it with the *Lower Boulder Clay* of Lancashire. At Roslyn Hole, near Ely, a great mass of cretaceous rocks is described, which some Geologists have tried to account for by a complicated system of faults, but which Mr. Skertchley shows to be an enormous boulder, he having seen true boulder clay surrounding and underlying the whole. This transported mass is about 400 yards in length by 60 yards in breadth, and may be compared with the one at Ponton, through which the Great Northern line is cut, and with several of similar character in East Leicestershire and Lincolnshire.

Over the boulder clay we get true Fen deposits, first beds of gravel, and then layers of peat and silt. The two latter deposits inosculate, and there are at least three distinct beds of peat, which is largely composed of moss *(Hypnum fluitans.)* Buried forests are found on five horizons, and the manner in which the newer trees are found seated upon the broken stumps, or astride the prostrate trunks of the older ones, is extremely curious. The trunks of the buried trees almost invariably lie pointing to the north-east. and this is also the direction in which those now growing incline, except quite close to the sea coast, where the sea breezes assert their influence, and the trees all bend away from the water, as may be seen to perfection at Hunstanton. The silt is shown to be a marine deposit.

A great amount of information is given in the appendix, including 211 measurements of sections, and lists of inundations, rainfall, and local terms; also 120 titles of papers written on the district. Mr. Skertchley has done the main work, and in first-rate style, but he writes :—" I do not consider the Geology of the Fens to be by any means exhausted. Indeed, no one can be more sensible of the numerous points of interest barely hinted at or unnoticed ; but an area of 1,300 square miles involves the work of a lifetime, instead of the four pleasant years I spent in the Fenland. . . The local peculiarities must be worked out independently by local Geologists, who will I trust find in this volume a conscientious and trustworthy guide." W. J. H.

Report of the Burton-upon-Trent Natural History and Archæological Society for 1877-8. Burton-upon-Trent: J. C. Perfect, 1878.

This Report bears the date 1878-9 on its cover, and also contains an abstract of an address delivered to the Society on "Nov. 27th, 1878," (p. 73,) from which it would appear that our Burton friends are "ahead of the times." At all events, there can be no doubt but that they are thoroughly well up with them, for the Report evinces a vigour and thoroughness which show that this young and active Society is doing good work in its district. In the account of the eight whole day excursions undertaken during the past year we note some interesting remarks on the grand oaks in Bagot's Park, Needwood Forest. That on Swilcar Lawn is 65ft. in height, and girths 26ft. at 4ft. above the surface of the ground. The branches of the "Beggar's Oak" stretch out for 108ft. from north to south, and 95ft. from east to west.

This Report contains also two excellent papers—one by the Rev. C. F. Thornewill, on "The History of Burton Abbey from its foundation (A.D. 1002) to the end of the Twelfth Century;" and another by Mr. J. T. Harris, on the "Economy and Natural History of Beetles, as Affecting our Grain and Vegetable Productions." A very valuable feature of the Society is the "Junior Section," composed of young students of Natural History, for whose encouragement prizes are annually offered for the best local collections of plants, shells, rocks, &c. We also note a Meteorological Table, showing the principal elements of the weather of 1877 in a concise form, prepared by the energetic Secretary, Mr. C. U. Tripp.

Tourists' Guide to Derbyshire. By J. Charles Cox. London: Stanford. Price Two Shillings.

This is a guide book forming one of a series published by Mr. Stanford. It is not without defects, but it possesses many excellencies. To refer first to short-comings: The information as to inns is imperfect, and the distances are not always accurate. Several of the most picturesque bits in the county are not even mentioned; as instances of such omissions we may call the author's attention to the romantic road from Hayfield into Edale, Cave Dale at Castleton, Alport Castles, the head of Dove Dale, and the Lathkill Valley. A tone of depreciation of Derbyshire scenery is often assumed, which runs counter to popular judgment; as for example, the slur cast on Chee Dale and Monsal Dale. The lover of the moorlands also will certainly be surprised to learn that Kinder Scout and Axe Edge are not worth the trouble of ascending.

On the other hand, however, to the ecclesiologist the book will be invaluable; the descriptions of the churches are full and accurate; indeed, when we remember who is the author, praise becomes needless. In the Church Mr. Cox is thoroughly at home, and the reader gets the best information in the handiest form.

Coming to matters scientific we are glad to see a good description of Derbyshire Geology, and we can only regret that space seems to have prevented a similar chapter on the Botany of the county. The geological sketch is well done, and includes a reference to the important discoveries of Pleistocene mammalia and traces of Palæolithic man in the Derbyshire caves. It would have been as well had the high merit of the Rev. J. M. Mello, as discoverer of the Cresswell deposits, been recognised; the results of that exploration (the chief part of which was carried on by a committee under the superintendence of Professor Boyd Dawkins, whose valuable aid is not referred to) have been divided amongst the museums at Derby, Manchester, Castleton, Sheffield, and other places, and are not all at Derby as supposed by the author. The general conclusions drawn by Mr. Mello, Professor Busk, and Professor Dawkins are, however, stated with accuracy.

The reader will find frequent references to the monuments of prehistoric archæology which abound in the Peak. He may not believe them all to be of Celtic origin, or accept Mr. Fergusson's "Rude Stone Monuments" as any sort of an authority on British antiquities; but he will find Mr. Cox's descriptions very useful.

Altogether the book is a valuable addition to Derbyshire literature, and the stranger who uses it will find his way to many an object of interest or beauty which Black or Murray entirely ignore.

METEOROLOGY OF THE MIDLANDS.
THE WEATHER OF SEPTEMBER, 1878.

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

The first fortnight of the month was dry and pleasant weather, only broken by a severe thunderstorm on the 8th, in which at Pitsford 1·60 inches of rain fell between 6 30 A.M. and 9 A.M. In the same storm, ·33 inches fell at Bishop's Castle in ten minutes, ·66 inches in one hour at Shifnal, and 1·21 inches in one hour at Kinver. A severe westerly gale blew on the 15th, and was followed by showery and cloudy days to the end of the month. On the morning of the 30th, another heavy thunderstorm was experienced at most stations, doing much damage near Coventry, and largely denuding the trees of their leaves.

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.	2·47	.84	7	13	88·0	3	3·60	21
Cheltenham	R. Tyrer, Esq.	2·58	·59	7	15	72·4	5	33·0	21
Stroud	S. J. Coley, Esq.	2·37	·76	8	11	70·0	6 & 7	37·0	21
SHROPSHIRE.									
Haughton Hall, Shifnal	Rev. J. Brooke	3·03	·66	8	15	70·0	5	35·0	24
Whitchurch	A. B. George, Esq.	2·85	·70	21	13				
Woolstaston	Rev. E. D. Carr	2·80	.84	22	15	72·0	11	40·0	24
Leaton Vicarage, Shrewsbury	Rev. E. V. Pigott	3·48	·89	8	15	72 1	5	32·0	24
More Rectory, Bishop's Castle	Rev. A. Male	2·00	·79	22	15	71·0	5	29·0	24
Larden Hall, Much Wenlock	Miss F. R. Boughton	2·43	·60	22	16				
Bishop's Castle	E. Griffiths, Esq.	2·15	·65	22	13	73·0	11	35·0	24
Cardington	Rev. Wm. Elliot	2·33	·63	22	13				
Adderley Rectory	Rev. A. Corbet	2·82	·85	22	17				
Stokesay	Rev. J. D. La Touche	1·96	·66	22	10	73·6	6 & 11	32·3	24
HEREFORDSHIRE.									
Whitfield	W. Wheatley, Esq.	2·75	·75	7	12			30·0	24
Stoke Bliss	Rev. G. E. Alexander	4·15	1·10	25	12	70·0	5 & 6	39·0	20, 23, 25
WORCESTERSHIRE.									
Orleton, Tenbury	T. H. Davis, Esq.	3·66	1·00	22	14	73·5	5, 6, 11	32·8	26
West Malvern	A. H. Hartland, Esq.	2·67	·82	22	12	74·5	6	38·5	20 & 25
Pedmore	E. B. Marten, Esq.	3·59	·84	22	14	71·0	5 (17	37·0	25
Stourbridge	Mr. J. Jeffries	4·13	1·02	7	13	74·0	3,4,5,6,7,	34·0	20 & 25
St. John's, Worcester	G. B. Wetheral, Esq.	2·96	·90	22	13	72·0	6	36 0	24
STAFFORDSHIRE.									
Thorganby Villa, Wolverhmtn	G. J. C. Broom, Esq.	2·46	·72	22	16				
Barlaston	W. Scott, Esq.	3·05	·71	21	17	74·6	6	28·4	23
Amblecote	Mr. J. Robins	3·55	·76	22	13				
Dudley	Mr. J. Fisher	3·14	·72	22	13	74·0	2 & 5	36·0	20 & 21
Sedgley	Mr. C. Beale	2·22	·68	22	14	68·0	3 & 6	40·0	25
Kinver	Rev. W. H. Bolton	3·76	1·24	8	14	72·0	5 & 6	35·0	20 & 23
Walsall	Mr. N. E. Best	2·46	·45	22	15	68·0	8	38·0	23
Grammar School, Burton	C. U. Tripp, Esq.	2·10	·44	8	14	75·0	7	33·0	24
Patshull Gardens	Mr. T. W. Dell	2·60	·63	23	11	78·0	6	35·0	24
Weston-under-Lyziard R'tory	Hon. and Rev. J. Bridgeman	2·82	66	22	17	72·0	5	34·0	24
Wrottesley	E. Simpson, Esq.	2·75	·78	8	14	70·6	7	37·5	24
Tamworth	W. Arnold, Esq.	1·62	·45	8	11				
Tean Vicarage, near Cheadle	Rev. G. T. Ryves	2·77	·63	22	16	72·5	6	33·0	24
Heath House, Cheadle	J. G. Philips, Esq.	2·81	·60	22	12	69·0	6	39·0	20 & 26
Alstonfield Vicarage	Rev. W. H. Purchas	3·94	·40	15	15	71 1	11	33·0	24
WARWICKSHIRE.									
Coundon, Coventry	Lieut.-Col. R. Caldicott	2·44	·58	7	16	71·0	5	37·0	23
Coventry	J. Gulson, Esq.	2·92	1·27	7	13				
Bickenhill Vicarage	J. Ward, Esq.	2·75	·64	7	18	75·0	36	38·0	30
St. Mary's College, Oscott	Rev. S. J. Whitty	1·70	·37	22	14	72·7	11	34·9	24
Henley-in-Arden	T. H. G. Newton, Esq.	3·09	1·18	8	14	73·0	3, 5, 6, 11	34·0	24
Rugby School	Rev. T. N. Hutchinson	2·37	·96	7	17	73·6	6	38·0	26
DERBYSHIRE.									
Buxton	E. J. Sykes, Esq.	5·41	1·24	17	17	69·0	4	32·7	24
Stoney Middleton	Rev. U. Smith	3·40	.69	29	13	70·0	6 & 11	26·0	23
Fernslope, Belper	J. G. Jackson, Esq.	2·34	·38	29	17	71·0	4 & 6	37·0	24
Matlock Bath	R. Chadwick, jun., Esq.	3·09	·66	29	12	67·5	3 & 6	36·0	24
Linacre Reservoir, Ches'field	C. E. Jones, Esq.	2·60	·95	30	9				
Willesley Gardens, Cromford.	J. Tissington, Esq.	2·88	·6[illegible]	29	11				
Stuffynwood Hall	Mr. R. Rolfe	1·75	·35	22	14	71·0	4	38·0	23
Spondon	J. T. Barber, Esq.	2·24	·58	7	11				
YORKSHIRE.									
Hesley Hall	B. J. Whitaker, Esq.	2·68	·81	30	15	74·0	7	38·0	24
NOTTINGHAMSHIRE.									
Hodsock Priory, Worksop	H. Mellish, Esq.	1·92	·44	29	13	72·9	6	34·9	24
Grove House, Mansfield	W. Tyrer, Esq.	1·54	·32	22	14	71·8	4	35·5	24
Tuxford	J. N. Dufty, Esq.	2·15	·48	22		72·0	7	39·0	23 & 24
Park Hill, Nottingham	H. F. Johnson, Esq.	1·60	·45	29	11	69·3	3 & 4	37·8	23
LEICESTERSHIRE.									
Loughborough	W. Berridge, Esq.	1·64	·33	22	13	74·6	11	33·4	24
Ashby Magna	Rev. E. Willes	1·81	·83	8	13	72·0	5 & 7	39·0	24
Market Harborough	S. W. Cox, Esq.	2·05	·50	7	12	72·0	7	31·0	24
Kibworth	T. Macauley, Esq.	1·91	·49	8	14				
Town Museum, Leicester	W. J. Harrison, Esq.	1·82	·45	7	14	70·3	3, 6, 7	33·6	24
Belmont Villas, Leicester	H. Billson, Esq.	1·92	·30	22				35·5	24
Syston	J. Hames, jun., Esq.	1·48	·36	22	16	72·0	7	38·0	24 & 25
Waltham-le-Wold	E. Ball, Esq.	1·51	·21	29	11	67·0	29	36·0	26
Little Dalby Hall	G. Jones, Esq.	1·26	·21	22	12	76·0	4 & 7	34·0	24
Coston Rectory, Melton	Rev. A. M. Rendell	1·27	·27	29	13	70·0	6	29·5	24
Belvoir Castle	W. Ingram, Esq.	1·65	·27	1	14	73·0	7	35·0	21
NORTHAMPTONSHIRE.									
Towcester Brewery	J. Webb, Esq.	1·59	71	7	7				
Castle Ashby	R. G. Scriven, Esq.	1·41	·26	7	13	73·0	5	40·0	23
Pitsford	C. A. Markham, Esq.	1·77	1·60	7	16	80·0	5	32·0	24
Kettering	J. Wallis, Esq.	1·02	·25	22	11	72·0	6	41·0	24
Althorpe	W. F. Jakeman, Esq.	2·24	1·29	7	11	71·0	3 & 6	34·0	23
Northampton	H. Terry, Esq.	2·24	1·31	7	15	75·0	5	37·0	23
RUTLAND.									
Burley-on-the-Hill	W. Temple, Esq.	1·77	·31	9	15	72·0	6	37·0	13
West Deyne, Uppingham	Rev. G. H. Mullins	1·12	·27	25	8	74·5	5	38 1	26
Northfields, Stamford	W. Hayes, Esq.	1·56	·46	8	9	70·0	7	32·0	20
Radcliffe Observatory, Oxford	Mr. H. E. Bellamy	1·35	·37	19	10	73·2	5	35·2	23
Spital Cemetery, Carlisle	T. Bell, Esq.	4·15	1·04	22	19	74·5	5	35·0	20
Ventnor Hospital	H. Sagar, Esq.	1·91	·63	17	11	74·2	6	45·8	20
Altarnun Vicarage	Rev. G. Tripp	4·51	·93	8	19	80·0	6	42·0	13, 23, 26

The rainfall on the whole is below the average for the month, and so too is the temperature. The barometer has been unsteady, and westerly winds have blown on about twenty-four days, thus largely preponderating. Solar halos are recorded from Oxford on the 3rd and 4th, and lunar halos on the 3rd, 13th, and 16th. A fine aurora was seen at Cheltenham on the night of the 6th, the luminous streams reaching quite up to the zenith. The last swallows left the neighbourhood of Stroud on the 30th, and the same date is recorded for their departure from Coventry. Probably the storm of that day was the signal for a general exodus of these feathered migrants. On the 29th six snipe were seen in the meadows by the River Nene. Near Stroud the wood strawberry *(Fragaria vesca)* was seen in blossom, and (unripe) fruit on the 19th. Several observers remark on the comparative absence of butterflies this season.

Correspondence.

White Variety of Harebell.—It will, perhaps, be interesting to "H." (page 106) to know that I have found during the past summer several white specimens of the *Campanula rotundifolia*, within six miles of Aberystwith. They were all of a pure white, and, though there was an abundance of the blue, I could in no place find any of a shade between the two. Last year I found a specimen of the primrose, perfectly white, near Barnt Green.—H. D.

Nottinghamshire Ferns.—Perhaps the following list of ferns found in North Nottinghamshire will be interesting to some readers of the "Midland Naturalist." They have all been found either at Pleasley Vale, (Notts. side,) Creswell Crags, (Notts. side,) or the Woods at Welbeck, by Mr. R. A. Rolfe :—*Polypodium vulgare, Polystichum angulare, Lastræa filix-mas, L. cristata, L. dilatata, Athyrium filix-fœmina, Asplenium ruta-muraria, A. trichomanes, Scolopendrium vulgare, Pteris aquilina*, and *Cystopteris fragilis*.—C. T. Musson.

The Cuckoo's Note.—In Norfolk they have a saying—

In May he sings all day.
In June he changes his tune.
In July away he'll fly.
In August go he must.

I believe that this is a tolerably correct account of his proceedings; and I suppose that the action in July is borne out by his being seen on the wing in that month more than in the other months.—G. B. R. B., Nottingham.

Junior Members.—It has often occurred to me that it would be a wise plan if our Natural History Societies would offer facilities for intelligent youths, under eighteen years of age, to become members, (they might be called associates,) for in them would, I feel sure, be found the best material out of which valuable working members of the future would naturally be developed. As youths are not usually overburdened with money, the subscription they should be called upon to pay should be as nearly nominal as possible; at the same time they should be treated with encouraging courtesy to warm them to working pitch. They should be made to feel that they are valued, and good results would invariably ensue. I have no hesitation in asking the Societies to give the subject due consideration.—B. W. E.

NOTTINGHAMSHIRE CONCHOLOGY.—Two specimens of *Testacella Maugei* have been found at Welbeck, in Nottinghamshire, by Mr. R. A. Rolfe. In company with that gentleman I found the following species of shells which I have never hitherto found in Nottinghamshire :—*Clausilia laminata*—one specimen only at Pleasley Vale. *Helix lapicida*—seven dead specimens at Pleasley Vale, and fifteen at Creswell Crags, and after a long search at the latter place I succeeded in finding one live specimen. *Cochlicopa tridens*—three specimens at Pleasley Vale. Of species that I have before found in Nottinghamshire, I also found on this occasion *Helix caperata*, plentiful at Creswell Crags. *Bulimus obscurus*, rare, at Pleasley Vale and Creswell Crags. *Helix aculeata*, rare, at Creswell Crags. *Vertigo pygmæa*, rare, at Creswell Crags. *Pupa umbilicata*, very plentiful in the same locality. I am not aware that either *Clausilia laminata*, *Helix lapicida*, or *Testacella Maugei* have ever before been found in Nottinghamshire. I should be glad to hear if they have been found in other localities.—C. T. MUSSON, 68, Goldsmith Street, Nottingham.

BORINGS IN LIMESTONE ROCKS.—In a geological walk, lately taken across Derbyshire, I kept a close look out for those cylindrical holes in limestone masses about which an animated correspondence took place in the "Geological Magazine" (Vols. VII. and IX.) a few years ago. Walking at the rate of twenty miles a day does not allow a very close examination of the rocks *en route*, and I saw nothing of the objects of my search till I reached Arbor Low, (or Arbelow as it is sometimes spelt,) the fine Druidical circle which occupies an elevated and lonely hill-top between Hartington and Youlgreave. Here we have a raised ring of earth, about 80 yards in diameter, formed of material thrown up from the inside, where, accordingly, there is a corresponding fosse or hollow, mound and hollow being each three or four yards wide. In the centre (which is at the natural level) we find oblong masses of limestone, lying in a circle, with a central mass or altar-stone. Whether these limestone blocks were originally set upright or not I do not know; I should imagine that they were, but now they all lie flat, and, owing to centuries of weathering, their surfaces and edges are much worn and fretted. Crawling along on the grass, and examining the under surfaces of projecting ledges, I was much pleased to find some very fine examples of the burrows or "lithodomous perforations," as they have been termed. They were truly circular, about an inch in diameter, and from one to two inches deep. In the controversy which raged in the "Geological Magazine" these burrows were assigned by one party to the marine bivalve shell *Pholas*, but by others to the common land snail, *Helix*. In the former case they were done when the land was depressed below the level of the sea, and must date back many thousands or tens of thousands of years. If, however, they are the work of *Helices*, their formation may be comparatively recent ; and, in fact, may still be going on. My discovery of these burrows on the Druidical stones which form the circle of Arbor Low, seems to me to settle the question in favour of the *Helices*, for the stones are, undoubtedly, artificially blocked-out masses, rectangular in outline, though they have suffered much from weathering. The snail, it appears to me, decomposes the limestone by means of an acid secretion, aided by the action of its cartilaginous toothed strap or *odontophore*, (palatal organ,) which was also the view advocated by Mr. John Rofe. The burrows which I examined were empty, but I believe they are made and used by the *Helices* as places of hibernation or shelter, and they should be examined again in winter. It is very desirable that the creature should be watched in the act of excavation, and its secretions tested for acid by means of blue litmus paper. Here is a task for any patient observers dwelling in mountain limestone districts. I should be pleased to hear if any other observers have noticed these burrows.—W. J. HARRISON, Leicester, August 9th.

Artizan Naturalists.—The following extracts are taken from a letter written by a Leicester stocking-maker, George Robson, who has found means for self-cultivation while bringing up a large family on the earnings of his frame. There are probably not a dozen men in Leicester of all classes who know as much about the Natural History of the district as he does, and none who love Nature more truly and reverently.—F. T. Mott.

"I have at last managed to pay, once more, a visit to the home of *Oreopteris*, and you will be pleased to learn that it is not extinct in our forest yet, but even flourishes more plentifully than before. It is very pleasing to know that I did not aid in obliterating one species of our native flora from our much-loved Charnwood. I would be a *sower* of grass, not a *mower;* a builder up, not like a dark iconoclast, a breaker of God's own artwork. Last year there seemed to be but little of the fern *Oreopteris* growing near the wood, and, as you thought, it seemed to be dwindling out; but on reaching the lane last Sunday I was very much surprised to find so many plants scattered along the wall that forms the boundary of the wood. Indeed, I was much in doubt at first whether they were not seedlings of *N. Filix-mas.* There were at least twenty roots of it in the ditch, off which I brought about a dozen fronds. Enclosed are specimens, so that you may verify it yourself. *Scutellaria minor* was also very plentiful at the foot of Old John Hill, and what was more surprising was to find *Hydrocotyle vulgaris* growing wonderfully fine in the lane, near the *Oreopteris*, even finer than at Groby Pool. Enclosed, too, is a specimen of *Polypodium calcareum*, from Miller's Dale, Derbyshire, which may interest you. I have paid two visits to this district this year. The hills and vales are magnificently grand, both in shine and storm, for I have seen them in both, and shall never forget the awful beauty of a thunderstorm witnessed from the Heights of Abraham. The storm-clouds came up the vale like night advancing in column. They seemed to reach from earth to sky, first grasping the hills, then enwrapping all in Cimmerian darkness. As it approached, the great rain-drops fell heavy and fast. It was like a mighty and evil spirit ushered in by furies. The jagged lightning ran up the dark as though a band of elastic fire had been stretched from heaven to earth, and suddenly let go, the whole stroke being in view. The storm moved past, and then came another sight I had never before beheld. The sun gleamed forth, and there, right below, was a beautiful rainbow stretching the whole length of the Dale, and parallel with the river. It really seemed like being in another sphere to have a rainbow at our feet. What a rush of feeling takes possession of one mid such scenes as these, where we are shown new wonders, new beauties, and grandeur on every hand. We both take a new flight of thought and feeling ourselves, and are enabled to better appreciate the deepened thought of others. One could scarcely witness such scenes as these without thinking of Byron, who courted nature in her anger, and who has, perhaps, given us the best description of a thunderstorm. Then the sunshine, and the rainbow! One, who had read it, would almost be sure to think, on witnessing such a scene, of that beautiful simile in Eliza Cook's poem—

> I'd climb on any rainbow bridge,
> To let my heart look farther out.

And truly the soul does seem to look farther out, to be with nature in all her wildness, and to be, as it were, nearer to God. The botany of Matlock Bath is very rich and rare. *Geum rivale* grows in the street; *Cardamine impatiens* along the Derwent, on the Lover's Walk, with many others; and on the hills any amount of *Thlaspi alpestre*, var. *virens*, can be got. The botany of Miller's Dale was rather disappointing, but the geology is grand. There was plenty of such ferns as *Cystopteris fragilis*

Aspidium aculeatum, and the one enclosed, which is the rarest. *Centaurea scabiosa* and *Solidago virgaurea* waved from the wall-like rocks everywhere. I was fortunate enough to meet with three Ashton-under-Lyne botanists who were acquainted with the district. They said the Dale was very rich in *Cruciferæ* in the early summer and spring. They pointed out a spot where a Mr. Whitehead had found a new sedge. It was on a tunnel between Monsal Dale and Cressbrook, but I had not time to visit the place. From conversation that passed it seems working men in that district are much before the Leicester working men as Naturalists, and they meet with more encouragement from the upper classes. They gave me a card on which is a list of names of landowners who have given them liberty to go over their grounds, and nearly at the top is our own Lord Stamford. To come back to our own hunting ground. Enclosed is a curious rush from Bradgate Park which I don't quite understand. It seems to be an instance of exuberance of growth, or chloranthy, I think you call it. I have a specimen of white clover similar in growth, also a bifid frond of *N. filix-mas*. I am told there are specimens of *Scolopendrium* on the Narborough Road with trifid fronds. I intend going to see them. But, perhaps, the greatest curiosity of the year was a sparrow I had. Its wings and tail were white, with a white ring round the throat. It could not peck, nor was it full feathered when caught. My intention was to keep it a while, and on being hung out of doors in a cage it caused much amusement by the old birds coming regularly to feed it. They seemed to sympathise with it and make a great to do. If it was taken in the house at night they—that is the old birds—would come in through the window when left open very early in the morning, and often the younger members of the family, too, to feed and condole with it. It knocked itself about much in the cage, so when it could peck it was turned in an empty room where I thought it would soon get fine, but the silly thing fretted and died.—G. R., 92, Cranbourne Street, Leicester."

Gleanings.

Herefordshire Pomona.—The first part of this magnificent work has just been issued. It is the work of the Woolhope Naturalists' Field Club. In our next number we hope to give some account of it. In the meantime we urge all who are interested in the cultivation of hardy fruits to buy the book.

Birmingham Library.—The Committee have recently issued a supplement to the catalogue of books added from April, 1876, to December, 1877 ; and to this is subjoined an "experimental classified index of subjects," prepared by the Librarian, Mr. Charles E. Scarse. We are led to make this announcement, in order to point out that this classified index is but the outcome of a recent rearrangement of the books in the Birmingham Library in Subjects, the books in each division being further arranged alphabetically as to authors. Mr. Scarse, in undertaking this arduous task, (the library contains upwards of 50,000 volumes,) was encouraged by the hope that he would thus render the treasures of the library much more accessible to young students than they were previously. A public library, the books in which are thus classified, must obviously be a great boon to those whose knowledge of literature is more or less limited. We have carefully examined the large collection of Scientific books, (each science being separately arranged,) and find them so disposed, that in whatever department information may be desired it is at once and readily accessible. Mr. Scarse has executed this work most satisfactorily, and he has set an example which may be advantageously followed in other public libraries.

Midland Union.—The Small Heath Literary and Scientific Society has joined the Midland Union of Natural History Societies.

Examination of Glacial Deposits (Scheme proposed by Mr. W. J. Harrison, F.G.S.)—At a meeting of the Geological Section of the Birmingham Natural History and Microscopical Society, on October 22nd, it was unanimously resolved that the Section should take part in the suggested examination. The Rev. H. W. Crosskey, F.G.S., (who kindly undertook to act as Secretary,) will be glad to receive communications on the subject from local observers, addressed to 28, George Road, Edgbaston, Birmingham.

Those Interested in the Progress of Natural Science at our old Universities should take notice of the fact that, after considerable opposition of the "Board of Studies of the Natural Science School," the majority of that Board (chiefly by the aid of the examiners, who are London, and not Oxford, men) have carried a series of resolutions which provide that "candidates for honours in Biology" may be examined in Experimental Physiology. The necessary encouragement to the study of this subject, viz., examination in it as an "honour subject" now existing, we may hope to see as the result some activity in the Physiological Laboratory of Magdalen College. Similarly we have to notice the recognition of the Morphology and Physiology of the vegetable kingdom as a necessary part of the study and examination of the Oxford student who is a candidate for "honours in Biology." Botany was long resisted and sneered at in Oxford. External pressure has, however, reinstated Botany in the Oxford School of Natural Science, and it rests with the examiners in future to maintain the study of this subject in the direction indicated by Sachs' admirable treatise on Botany published by the University press.—*Nature.*

Roman Milestone.—The most perfect miliare, or Roman milestone, yet found in Great Britain is that in the Leicester Town Museum. It is cylindrical in form, and is fashioned out of the coarse sandstone known as millstone grit. It is 3ft. 2in. in height and 5ft. 6in. in circumference. It bears the inscription :—

IMP CAES.
DIV TRAIANI PARTH. F. DIV. NER. NEP.
TRAIAN. HADRIAN. AVG. P.P. TRIB.
POT. IV. COS III. A. RATIS
II

showing that it was erected in the year A.D. 120, during the reign of the Emperor Hadrian, at a distance of two miles from the station of Ratae (Leicester.) The letters are from 2in. to 4in. in height, deeply cut and quite distinct. It was probably erected to commemorate the visit of the Emperor to Britain. It was found in 1771 close to the road from Leicester to Melton, (the Roman Fosse-way,) and was at first destined for a garden-roller! Rescued from this fate, it stood for forty years in the centre of the town of Leicester, but fortunately escaped any serious injury, and finally found a safe resting-place in the Museum. In the same room with this fine object of antiquity is a smaller stone cylinder, measuring 1ft. 9in. in height by 4ft. in girth. It bears the letters IMP only, and was found at Six Hills, (also on the Fosse-way,) about ten miles north of Leicester, in 1854. When this stone was seen by a well-known antiquarian, he remarked that he was once much puzzled when examining the neighbourhood of the Roman Wall in Northumberland by hearing the natives speak of an "Imp stone." When they took him to see it, he found it was one of these rude milestones. Altogether about fifty-four of these Roman milestones have now been found in Britain, of which the fine specimen above described is the earliest in date so far as is known.

BOTANICAL LOCALITY RECORD CLUB.—The officers of this Club have issued an appeal, asking the co-operation of Botanists in general, but more especially of Bryologists, to aid in a scheme for investigating the geographical distribution of Mosses in the British Isles. Mr. C. P. Hobkirk, F.L.S., and Mr. H. Boswell, have consented to act as recorders. The subscription is 5s. per annum. When thirty additional Botanists have joined the Club, the funds will justify the issue of a report on mosses. Names should be sent to Dr. H. F. Parsons, Goole; or Mr. C. P. Hobkirk, F.L.S., Huddersfield. We trust some of our readers may be induced to join this useful Club.

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—BIOLOGICAL SECTION.—August 13th. This meeting was devoted principally to the exhibition by Mr. W. R. Hughes of the specimens taken by members of the society during their recent excursion to Arran, and to a summary of its general results. As a detailed report will be presented to the society when the examination of these specimens is completed, it will suffice for the present to state that among them are numerous representatives of the principal orders of marine animals, from Rhizopoda to Pisces, many of them of very high interest. Mr. Hughes also showed on behalf of Mr. Simpson, of Wylde Green, the egg of the common Tortoise, *Testudo Græca*, laid in that gentleman's garden by a tortoise lately placed there, and being one of seven which she deposited between eight A.M. and seven P.M., in holes about four inches deep scooped out in the soil. It was nearly spherical, and of a pure white colour; also, on behalf of Mr. C. J. Woodward, eggs of Cuttle-fish, *Sepia officinalis*, from Bournemouth. The outer shell of one of these being removed, the contained embryo forms a beautiful object when viewed in the microscope by dark back-ground illumination. Mr. Short contributed specimens of the flower of *Agave Americana*, from Sir R. Wallace's gardens, in Suffolk, (see ante page 254.) A large number of botanical specimens were also exhibited by Messrs. J. Bagnall, G. Caldwell, T. Butterfield, and others.—BIOLOGICAL SECTION.—September 10th. Mr. A. W. Wills showed on behalf of Mr. Wm. Spencer a remarkable specimen of an oyster shell, bought by that gentleman as apparently containing a pearl, but which on being split open was found to enclose a small but perfect individual of the genus *Pinnotheres pisum*, a crab belonging to the decapodous short-tailed crustacea. This animal inhabits the shells of living bivalves, such as the common mussel, cockle, oyster, &c. One species of this genus inhabits the large Pinna of the Mediterranean, and was well known to the ancients, who believed that a kind of "commensalism" existed between the two animals, the crab warning the mollusc of approaching danger, and receiving house room and shelter as a *quid pro quo*. Mr. Spencer also contributed specimens in which a small pebble and the operculum of a Turbo had respectively been covered with the pearly secretion. In the course of the discussion which ensued, Mr. W. Graham mentioned that the natives of the Chinese seas are in the habit of preparing small leaden images of Buddha, which, being inserted between the mantle and the shell of certain species of oyster, are covered with nacre and then sold as charms. The thanks of the section were unanimously accorded to Mr. Spencer for his interesting contribution.—At the same meeting Mr. Bolton exhibited a small submerged leaf of Bladder-wort, *(Utricularia vulgaris,)* with a crown animalcule *(Stephanoceros Eichhornii)* attached to it, together with many specimens of *Melicerta ringens*, *Limnias ceratophylli*, and *Œcistes crystallinus*, a *Philodina*, and a *Brachionus*. In addition to the preceding Rotifers, this little bit of weed, although not exceeding a quarter of an inch square, was covered with numerous attached specimens of Infusoria, including several species of *Vorticella*, *Carchesium polypinum*, three species of *Epistylis*, *Stentor Mülleri*, *Cothurnia imberbis*, *Dendrosoma radians*, and two other species of *Acineta*. This was the only piece of weed he had found time to examine under the microscope out of a large collection he had made the previous day in a locality near Chester, to which he had been kindly introduced by Mr. Chantrell, the President of the Liverpool Microscopical Society, as a locality now abounding in a beautiful Rotifer *Lacinularia socialis*, and in a variety of fresh-water Polyzoa, of which Mr. Bolton also exhibited some specimens. The next day Mr. Bolton found on the same bit of weed the flower animalcule, (*Floscularia cornuta*,) another species of Rotifer, and afterwards *Cephalosiphon limnias*, and great numbers of the new collar-bearing flagellate monads, discovered and described by Mr. W. Saville Kent.—September 17th.—Microscopical General Meeting. Mr. H. E. Forrest exhibited living specimens of *Spirorbis nautiloides*, a marine Annelid, showing compound ciliated tentacles, operculum, &c. Mrs. Robinson, a lady who has recently returned from India, exhibited and described a very interesting and extensive collection of specimens, consisting of ferns, butterflies, reptiles, &c.—24th September.—Geological Section. Mr. W. R. Hughes, on behalf of Mr. Councillor Pattison, showed interesting specimens of fossil wood and shells from Budleigh Salterton. Mr. W. Graham exhibited some specimens of rocks collected during the excursion to Eastnor and Malvern. Mr. S. Allport mentioned that he had prepared a section of one of them, and it showed that the rock was a fine grained hornblendic rock greatly altered. Mr. W. Graham and Mr. C. Pumphrey communicated an offer made by the Rev. W. G. Symonds of named specimens of the rocks of the Malvern district, for the purpose of microscopical and general examination. The Secretary was directed to accept the offer with thanks.—General Specimens exhibited by Mr. Levick and Mr. Forrest included (among others) from near Barnt Green:—*Lacinularia socialis*, *Dendrosoma radians*, *Chætospira Mülleri*, *Stephanoceros Eichhornii*, and *Polyarthra platyptera*. By Mr. Slatter, *Verbascum Blattaria*, the fruit of the cherry laurel. Mr. Southall, *Utricularia minor* and *U. intermedia*, the latter being very rare. Mr. Wilkinson showed some monstrosities in radishes.—October 1st.—General Meeting. Mr. Bagnall exhibited some bladders of *Utricularia minor*, &c. Mr. W. Southall exhibited *Phalaris arundinacea* infected by ergot, (*Claviceps purpurea*.) Mr. S. Allport exhibited specimens of the Malvern rocks, consisting of contorted Mica-schist, hornblendic gneissoid rock, containing bitumen and syenite from the North Hill. Mr. C. T. Parsons exhibited *Lycium barbatum* in fruit from Alton. Mr. T. Bolton exhibited *Philodina roseola* with *Protococcus pluvialis*, both in the motile and quiescent state, from Handsworth. Mr. H. E. Forrest exhibited living specimens of *Zoothamnium*, a lovely species of Vorticella, *Stephanoceros Eichhornii*, *Lacinularia socialis*, and other rare Rotifers all on one twig; also *Stentor* in the act of self division.—October 8th.—Biological Section. A number of interesting objects were exhibited. These included mounted specimens ot *Carchesium polypinum*, which had been killed by immersion in hot water, contributed by Mr. T. Bolton; branched colonies of *Limnias ceratophylli*, containing about twenty individuals, shown by Mr. H. E. Forrest; and a series of microscopic preparations of *Utricularia*, by Mr. J. E. Bagnall, showing the bladders *in situ*, and illustrating the structure of the valves and of the peculiar quadrifid processes. Mr. Bagnall accompanied the exhibition of his very interesting collection by notes on the geographical distribution of Utricularieæ, and by remarks on the structure and function of the bladders, recording the result of observations many of which were made previous to the publication of Mr. Darwin's researches on the same subject. Mr. A. W. Wills exhibited the rare Rotifer *Melicerta*, or more properly *Œcistes pilula*, which he had shown under some disadvantage at a previous meeting, and referred to the classification of the thecated section of the Rotifers proposed by Mr. Cubitt, and to the structure of the genera Melicerta and Œcistes respectively, as justifying the inclusion of the species now referred to in the latter genus. Also a Rotifer belonging to the same genus, and secreting a large semi-transparent theca, also found in Sutton Park, and apparently identical with or closely resembling a species described by Mr. Oxley at a recent meeting of the Royal Microscopical Society. As no name appears to have been proposed for this animal, Mr. Wills suggested that it should be called *Œ. longipes*, from the great length of its slender foot.—October 15th.—Microscopical General Meeting. Mr. Bolton exhibited *Chætophora endiviæfolia*, one of the fresh-water algæ, sent by Mr. Chantrell, president of the Liverpool Microscopical Society. Mr. Simcox exhibited a partition of *Nautilus*, ornamented by a native of New Caledonia; a large caterpillar, found with several others, three feet deep, in a creek near Sydney, N.S.W.; and a large operculum, and other parts of shells, from the waters of Sydney. He also exhibited a section of Steatite, (rare,) from the Bleak Head, Lizard. Mr. W. R. Hughes, F.L.S., read, on behalf of Dr. Spencer Cobbold, F.R.S., a further instalment of his valuable communication on "The Parasites of Man," (see p. 295.)

BIRMINGHAM AND MIDLAND INSTITUTE SCIENTIFIC SOCIETY. —September 2nd. A party of members left Snow Hill for Coalbrookdale, whence they proceeded to Maw's Encaustic Tile Works, where, by special permission, they were shown the various processes of making the tiles. The moulding of the tiles from a nearly dry powder by simple pressure, making them fit to be put at once into the kiln, occasioned much surprise. The various processes of putting the patterns on and glazing the tiles were then inspected, and much interest was shown in the forming the seggars out of powdered fire-clay by a pressure of 140 tons. The party then proceeded to Benthall Hall, where Mr. G. Maw kindly showed them the many objects of interest in the hall, and also the fine collection of foreign plants in the garden. Benthall Edge was descended to Buildwas, the well-preserved Abbey visited, and an adjournment then made to the Bridge Inn for refreshment. Here Dr. Callaway joined the party, and led the way to Shineton Brook, where are the exposures of shale described by that gentleman in the August number of the "Midland Naturalist." Numerous impressions of trilobites *(Asaphus Homphrayi)* were found ; and the party then proceeded to Cressage, whence the return was made at 7 20.—October 9th. Mr. C. J. Watson read an interesting paper to the members, entitled "Scientific Jottings on the Continent."

CARADOC FIELD CLUB.—The last Field Meeting of the season, specially devoted to the study of Cryptogamic Botany, was held at Downton Castle, near Ludlow, on Wednesday, September 25th. In spite of a rainy morning, there was a fair attendance of members. Several rare specimens of Fungi, amongst others *Clavaria amethystina*, *Lycoperdon echinatum*, *Strobilomyces strobilaceus* were collected on the walk through the woods, which were thrown open to the party by the courtesy of A. R. Boughton Knight, Esq. After dinner at the Feathers Hotel, Ludlow, a paper "On the Cup-Funguses of Shropshire" was read by Mr. W. Phillips, and Mr. J. P. Blunt made some remarks in continuation of a paper read last year, on the researches which he and Dr. Downes are pursuing in regard to the influence of "Light on Bacteria." This was a highly successful meeting.

CHELTENHAM NATURAL SCIENCE SOCIETY.—This Society held its Annual Meeting on Thursday, the 4th October, when T. Wright, Esq., M.D., F.R.S., &c., was unanimously re-elected President for the session of 1878 and 1879. Col. Basevi was also re-elected Honorary Secretary, and the following gentlemen the Committee of Management :—Major Barnard, F.L.S., F. Day, Esq., F.L.S., F.Z.S., H. Elwes, Esq., F.L.S., F.Z.S., G. Ferguson, Esq., M.D., H. A. James, Esq., Sir Brook Kay, Bart., R. M. Lingwood, Esq., F. D. Longe, Esq., F.G.S., Dr. F. Maier, and T Wilson, Esq., M.D. The accounts for the past year were read and passed. October 17th.—General Meeting. Major General Cox presided, in the unavoidable absence of Dr. T. Wright, F.R.S., through severe domestic affliction. The minutes of the meeting on the 4th inst. were read and confirmed. Ballot was taken for the admission of three members. Mr. Badger's circular, dated 26th September, relating to Mr. Harrison's interesting paper on the Glacial Deposits was read, and copies of the paper distributed. Major Barnard read a most interesting paper on "New Zealand : Botanical and Zoological." A cordial vote of thanks was awarded. The paper was illustrated by some specimens of curious birds and dried ferns, and the author drew comparison between the ferns of New Zealand and of England.

NOTTINGHAM LITERARY AND PHILOSOPHICAL SOCIETY.—Natural Science Section.—September 20th. Mr. E. Wilson, F.G.S., exhibited a fractured quartzite pebble, containing a clear cast of the Caradoc fossil, *Orthis redux*. The pebble was recently picked up by Mr. J. H. Jennings, of the High School, from a roadside heap of broken quartzites, on the south of Bulwell Forest, near Nottingham. It was not therefore *in situ*, but was probably derived from the subjacent Bunter conglomerate of the district (see "Geological

Magazine," for May, 1878.) Mr. Musson exhibited a fossiliferous piece of quartzite, found by him resting on the Bunter conglomerate of Nottingham "Forest." Mr. Wilson also exhibited a fine specimen of *Ceratodus altus*, found by him some time since in the "bone bed," present in the Rhætic (*Avicula contorta*) Shales, recently exposed in the Barnston cutting, on the new line, near Bingham, Notts. This section was visited by the members about a year ago. Mr. Wilson also noted the occurrence of the same genus (once thought to be confined to the Aust locality) at Stanton-on-the-Wolds, near Nottingham, at Leicester, and another locality. He pointed out its affinities to the fossil genera *Ctenodus* and *Dipterus*, and to the modern *Ceratodus* of Australia. September 27th.—Mr. H. Marshall Ward read a valuable paper on "Starch, and its Uses in Plant Life." October 5th.—A Geological Excursion was made to Froghall, Caldon Low, and Alton. Arriving at Froghall at 9 40 A.M., the members spent some time in examining the "Froghall hæmatite," which is worked in this district, and which occurs near the base of the "coal-measures" series of the Cheadle Coalfield. A ride up the tramway then brought the party to the Caldon Low Quarry. This quarry is in the lower beds of the "mountain limestone," and in one part of the quarry the "white sands and clays" lying underneath the boulder clay were seen. These beds are also well exposed in the Ribden Pit, (near the base of the Weaver Hills,) which was next visited. An interesting walk, *via* Cotton, brought the party to Alton, where a luncheon at the "Shrewsbury" terminated a very pleasant excursion.

NOTTINGHAM NATURALISTS' SOCIETY.—Meetings have been held during the last month as follows:—September 18th, when Mr. L. Lee gave a lecture on "The Lower Forms of Vegetable Life." October 9th, Microscopical evening. October 16th, Lecture on "Coal," by Mr. C. T. Musson.

STROUD NATURAL HISTORY SOCIETY.—October 8th.—First Meeting of Session. A paper was read by Mr. J. A. Tannahill on "Bees and their Habits." A short description of some scientific objects in the Paris Exhibition was given by the President, Chas Playne, Esq., followed by a brief account of some kinds of Entozoa by Dr. Partridge, the secretary, illustrated by drawings and specimens.

WOOLHOPE NATURALISTS' FIELD CLUB.—The usual annual Fungus Foray took place on October 3rd. There was a large attendance, including many scientific visitors from a distance. The members and visitors drove to the lawns of Sufton Court, and were very kindly received by Mr. Hereford. The mycologists were soon successfully occupied in the woods, whilst the less scientific portion of the company wandered up the hill to the British Camp at Adam's Rocks, Backbury Hill. Later in the day a meeting of the members was held in the Club Room, at the Free Library, Hereford, when the following officers were elected for the ensuing year:—President, Mr. Arthur Armitage; Vice-Presidents, Rev. W. H. Phillott, Mr. W. A. Swinburne, Rev. A. Ley, and Rev. G. M. Metcalf; the Central Committee, Messrs. T. Curley, J. Griffith Morris, C. G. Martin, and O. Shellard; Treasurer, Mr. Cam; Auditors, Messrs. J. Davies and J. T. Owen Fowler; Secretary, Mr. Theo. Lane. The annual dinner took place at the Green Dragon, when the two fungusses, *Hygrophorus pratensis* and *Agaricus nebulosus* were served to the guests. The latter, which is one that is rarely eaten, proved to be a species well worthy of the occasion. Dr. Bull, after dinner, gave the cordial welcome of the Club to the scientific strangers present, and then gave a report on the progress of Mycology during the past year. The Rev. Augustus Ley read a carefully prepared paper on "The Mosses of Herefordshire," which was very highly applauded for the results of real work in the fields which it contained, and which was ordered to be printed in the Transactions of the Club. A soirée was held in the evening at the house of the Treasurer, Mr. Cam, which was well attended by the members and visitors. Dr. Cooke read an elaborate paper on the genus *Corticium*, with observations on the modes of distinguishing the British species. Mr. Phillips, of Shrewsbury, described a new Peziza, (*P. crucifera.*) which gave rise to a long and animated discussion. The Rev. J. E. Vize exhibited an *Æcidium* from the Cape of Good Hope, one of the finest of its tribe. He showed a number of other interesting objects under the microscope.

Plate V.

NOTE ON A THECATED ROTIFER FROM SUTTON PARK.

The last number of the "Midland Naturalist" contained a description of the rare Rotifer *Œcistes pilula*, which I first exhibited at a meeting of the Birmingham Natural History and Microscopical Society on the 11th of June last. The same pool in Sutton Park, whence I obtained that species, has since yielded a thecated Rotifer of large size and singular beauty, apparently not yet described, unless indeed it be identical with one recently shown by Mr. Oxley at a meeting of the Royal Microscopical Society, of which Mr. T. Bolton exhibited a drawing at the June meeting of the Birmingham Society. In the absence of all measurements it is difficult to decide whether these two animals represent the same species, but the diameter of the trochus in Mr. Oxley's drawing appears greater than it is in my specimens, and the latter clearly show two tentacular processes, while his figures show only one, though this may result merely from the position in which the animal was sketched. But as both my observations and drawings were made before I had heard of that gentleman's, I beg leave to append a brief description, together with figures drawn under the microscope to an accurate scale, premising that, as I have only found two individuals, such description is necessarily imperfect, and that I hope next season to be able to renew my observations.

If the species has not yet received a name, I would suggest that, from the length of its slender foot-stalk, it may be appropriately christened *Œcistes longipes*.

I also give figures of *Œcistes pilula*, drawn to the same scale.

Œcistes longipes.—Total length of animal when fully extended, ·045in.; when retracted, ·026in.; diameter of trochus, ·014in.; height of theca, ·035in.; greatest diameter of theca, ·029in. Theca semi-transparent, milky-white when viewed by dark back-ground illumination. Cilia of the circular trochus conspicuous, those of the cingulum clearly visible under a 1in. objective. Mastax occupying more than half the diameter of the neck. Tentacular processes two, apparently without terminal setæ.

Ova carried after emission at base of foot-stalk. Foot-stalk corrugated, especially when retracted.

Œcistes pilula.—Dimensions of an average specimen:—Total length of animal when fully extended ·025in.; longer diameter of trochus, ·005in.; shorter diameter, ·003; height of theca, ·018in.; greatest diameter of theca, ·007in.

A. W. Wills.

Description of Figures.—Plate V.

Figs. 1 and 2.—*Œcistes longipes.*

Figs. 3 and 4.—*Œcistes pilula.*

MOSS HABITATS.

BY JAMES E. BAGNALL.

(Continued from page 272.)

A moss-grown tree is always an attractive object to me, and many a pleasant hour has been spent looking over these mossy invaders in search of some rare or local species. The trees most prolific in moss tenants in Warwickshire, (better known to me than any other county,) are the ash, elm, lime, Ontario poplar, sycamore, and apple. The oak is often moss-grown, but not to the extent of the above-mentioned, nor are its inhabitants so truly tree-loving species. On the beech and the coniferæ I rarely find mosses. In other climates these also have their special tenants. The mosses which I should designate tree-loving mosses are such as the *Orthotrichums*, *Cryphœa*, *Leucodon sciuroides*, *Zygodon*, *Weissia cirrhata*, *Leskea polycarpa*, &c.

The Orthotrichums are very distinct looking mosses, occurring in larger or smaller tufts. The fruit-stalks are very short and usually hidden by the surrounding leaves. The capsules with one exception are striated or streaked, and always erect, the calyptra bell-shaped, longitudinally plaited, and more or less covered with erect hairs, the leaves in most cases erect when dry, and more or less covered with minute papillæ, and the leaf margin in most cases turned over towards the upper surface or involute, leaf cells roundish. If the above characters are borne in mind they will be great helps.

Orthotrichum affine will be found frequently on the ash, elm, and poplar in large, loose, dark green tufts, a rather coarse-looking moss, with a pale yellowish-green calyptra. The capsule is oblong, pale brown, with a longish straight beak when ripe, but becomes whitish and somewhat spindle-shaped when dry.

O. Lyellii is abundant here on the elm and ash, forms large yellowish-green loose tufts, has the leaves much recurved when moist, twisted when dry, the leaf margins plane, and both surfaces covered with prominent papillæ or minute elevations, and much clothed with brownish jointed conferva-like processes. The fruit very rare.

O. diaphanum will be found on many habitats, trees, old palings, walls, &c. It grows in small bright-green tufts, and has the leaves terminated by translucent toothed whitish tips.

O. leiocarpum is rare in the Midlands, and is readily known from the other species by the capsule, which is quite smooth, *i.e.*, without striæ, when dry. This I find on the Ontario poplar.

The Ulotas have most of the characteristics of the Orthotrichums, but have usually more hairy calyptras, and narrower leaves, much crisped when dry.

Ulota crispa, which occurs on both elm and ash, forms little yellowish-green tufts, and has the leaves much twisted when dry. From May to July is the best season for all the above in perfect fruit.

Cryphæa heteromalla is a local moss, occurring mostly on the ash, has a creeping pinnate stem, fruiting branches erect, the capsule immersed n the surrounding leaves, the calyptra conical, brownish, and the fringe or peristome white ; fruiting in June.

Leucodon sciuroides I find upon the ash, elm, and apple trees, often very abundant, but very rarely fruiting. This species has also a creeping stem, with numerous erect shoots ; the leaves are spreading when moist, but imbricate (overlapping) when dry ; the shoots are thickened at the end and incurved, and the leaves are nerveless ; marginal leaf cells round, central ones oblong.

In calcareous and marly soils I find the yellowish-green tufts of *Zygodon viridissimus* not unfrequently on the lower part of the trunks of elm, ash, and sometimes oak trees ; when moist and fresh-gathered the leaves are spreading, but when dry they are crisped and somewhat twisted ; the leaves are widely lance-shaped, have plane margins, very small dot-like cells, and a pellucid nerve. I have not seen this in fruit, but it should be sought for in spring.

Weissia cirrhata is an abundant moss on trees, gate-posts, and rails, forming dark-green cushions. The leaves are lanceolate, with the margins turned over towards the underside, crisped when dry, leaf cells minute and opaque ; the capsule is terminal, borne on a short, straight foot-stalk, has a long straight beak, and a fringe of sixteen rudimentary teeth.

Leskea polycarpa I have found most frequently on the roots of willows, especially near water, but it also occurs in drier habitats. It forms matted yellowish-green tufts ; the stem is creeping, somewhat divided with pinnate branches, leaves spreading, somewhat oval in shape, slightly roughened or papillose on the back, leaf cells roundish. The fruit stalk is lateral, [Plate IV., *5a*,] * the capsules erect and the lid conical, the fringe consisting of an outer and an inner row of sixteen teeth.

Woods will yield many of our most beautiful mosses, the borders where the shade is not too great being usually the most prolific spots. Many of the species already mentioned will be found, but the most characteristic are such mosses as *Mnium undulatum*, *Polytrichum formosum*, *Hypnum tamariscinum*, *H. triquetrum*, *Dicranum scoparium*, *Mnium hornum*, &c.

Mnium undulatum is a very noble-looking moss, not unfrequent in shady woods and on shady banks in a marly soil. It grows in large green patches, and has a very tree-like habit ; the leaves are tongue-shaped, obtuse, with a slightly thickened margin, which is toothed with distinct simple teeth ; towards the top of the stem the leaves form a rosette, and from this arise arched or pendulous whip-shaped branches. The leaves are undulated when moist, crisped when dry. The fruit, which is rare, is terminal, the fruit-stalks are long, and the capsules pendulous.

Mnium hornum, a denizen of like places, is far more frequent. This grows in dense green tufts, the stems being matted together with reddish rootlets. The leaves are lance-shaped, the margin thickened and

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

bordered by a double row of teeth ; fruit-stalk terminal and arched at the top like a swan's neck ; capsule oblong, slightly drooping ; lid convex, with a small point ; in both these mosses the fringe is double, and forms a beautiful object for the microscope. Fruiting in May or June.

Polytrichum formosum rejoices in open woods, and forms extensive loose tufts. The stems are often five or six inches high, and are terminated by long fawn-coloured fruit-stalks. The capsules are large, four or five angled, and slightly swollen at the base, this swollen portion being called the apophysis, [Plate IV., Fig. 14 *c*.] The mouth of the capsule is closed by a reticulated diaphragm, (Fig. 21 *c*,) and fringed by sixty-four short, pale teeth. The lid is long and rostrate, (Fig. 13 *a*,) and the calyptra is clothed with numerous down-like hairs.

Hypnum triquetrum is frequent in many woods and on shady banks ; grows in tall, rigid, shining tufts, several inches long, yellowish-green. The stems are red, and more or less branched. The stem leaves much recurved, clasping the stem at the base, thence gradually tapering to an acute point, minutely toothed on the margin, and striated or streaked on the surface ; and with a lens two parallel veins will be seen, reaching more than half way up the leaf. The fruit-stalk proceeds from the side of the stem, bearing a short slightly curved capsule, with a conical lid. The fringe is double (Fig. 20, *a*, *b*.)

Hypnum tamariscinum is fond of like places, and occurs in loose, deep green tufts. This is one of the most beautiful of the feather mosses. The stem is tripinnate, and more or less clothed with numerous branched thread-like bodies (villi.) The leaves are heart-shaped, toothed on the margin, and covered on both surfaces with minute projections (papillæ.) This moss is often proliferous, *i.e.*, produces young plants from various parts of its surface. Hence the old name *H. proliferum.* The fruit is lateral and very rarely seen.

Dicranum scoparium is a beautiful moss occurring on marly banks and in woods, growing in yellowish tufts. The leaves are turned to one side and curved like a falchion, narrow lance-shaped, and sharply toothed. The nerve is well marked, and has several projecting ridges on the back. The fruit-stalk is terminal, the capsule curved, lid long and rostrate, (13*a*,) and the fringe consists of sixteen deep-red cloven teeth, beautifully marked with transverse bars. Fruiting in July.

[TO BE CONTINUED.]

FRESHWATER LIFE.—III. INFUSORIA.

BY EDWIN SMITH, M.A.

(Continued from page 292.)

Interesting as the sedentary Infusoria prove, the more closely they are studied, those kinds which swim about freely are even more striking on account of their varied and ceaseless movements. Let us next consider a few examples of this latter division.

Trachelius ovum, which I have taken from a lodgment of water in a meadow on New Year's Day, is from 1-50th to 1-80th of an inch long, or ess. It is egg-shaped, and has the lip of its mouth prolonged on one side to form a flexible proboscis. The entire surface is banded with longitudinal rows of cilia, these organs being most distinct near the mouth. The general colour is faintly brown, becoming darker backwards. Near the hinder extremity I have noticed a relatively large spherical space, loosely occupied by a globular mass, containing a body of horse-shoe form, which I take to be the nucleus. Under pressure the globular mass was expelled, apparently by a definite passage edged with cilia. Though distorted in the process, the animal quickly resumed its normal shape, and, following the proboscis, turned continuously round its centre. Numerous small vacuoles are usually scattered through the interior. They disappear one by one for half a minute at a time, and then reappear. A constriction running lengthwise along the under-surface gives the body, viewed from behind, a kidney-like outline, the proboscis then curving towards the right. A digestive tract is plainly visible, extending with finely branching channels from the funnel-shaped mouth to what looks like a distinct anal orifice. Mr. Slack's drawing ("Marvels of Pond Life," p. 179) gives an accurate idea of the appearances presented.

Trachelocerca olor, the swan-neck animalcule, is always a pleasing object, as it sails smoothly and deliberately across the field, waving this side and that its long, lithe neck, sometimes backing water for a moment, or curling itself about some fragment of weed in quest of food. In length it may reach 1-40th of an inch; but some specimens are much smaller. At the tip of the long neck is a short projecting disc, which marks the position of the mouth, and is armed with a tuft of fine cilia. Near the hinder extremity, which is more or less tapering, I have noticed a contractile space. Occasionally the neck appears forked, due, it has been supposed, to the commencement of fission. On the other hand, it is said that free-swimming Infusoria never multiply by longitudinal, only by transverse fission. The body has its surface prettily chequered, a feature which is still more distinct in an allied genus called *Lacrymaria*. My specimens of the latter weie got in May, in a clay-pit, amongst Sphagnum.

Colpoda cucullus, common in stagnant water, has somewhat the shape of a bean narrowed in front. The cilia are strongest on the fore part, especially at the mouth, which is situated in a depression towards one side. Near the hinder end, which shows no signs of cilia, may be seen a contractile space. Entire minute diatoms are often found mingled with brown or reddish matter in the food vacuoles. The animal is of a rather soft consistence, and puts itself through contortions, during which the greenish granules lining the transparent envelope seem in constant flux. Should a portion of the body carrying cilia become accidentally detached, the fragment continues highly active like an independent being.

Paramecium, from a Greek word meaning *oblong*, comprises several species which approach more or less to an elliptical figure. Stein has made a special study of *P. bursaria*. His drawings show equal and similar cilia covering the entire surface, a distinct cortical layer beneath the transparent envelope, two contractile spaces, a nucleus and nucleolus, short gullet, mouth, depression on the ventral side leading thereto, and chlorophyll granules diffused through the fluid contents of the interior. Transverse fission has been observed, when the nucleus separates into two, each half being accompanied by its nucleolus. At the same time contractile cavities form themselves in each segment into which the body divides. I have observed frequent instances of true conjugation of *Paramecia*, twice in the month of January. They pair by placing themselves side by side. But I have occasionally seen two individuals swim about for a long time grappled end to end, and then come apart without actual conjugation. The cilia were unusually active at the point of junction. In *Paramecium aurelia* two contractile vacuoles are seen, each branching out star-fashion into short canals, which appear distinct during the contraction of the central cavity, and are almost obliterated during dilatation. I have found this pretty species swarming in stagnant pools in spring.

Kerona, or *Stylonychia*, may be recognised by its slipper-like form, and the long spines and bristles with which it is furnished at both ends. In length it ranges from 1-275th to 1-100th of an inch. The body is also beset with smaller setæ, besides the active cilia by which it moves. A line of these organs leads to the mouth, which is fringed with them. The mouth itself is placed a little to one side, and is clearly indicated by the streams of floating particles which set towards the spot. In the rear of this opening is situated a contractile space, which dilates slowly but contracts suddenly, the whole movement taking about six seconds to complete. These animalcules have the queer habit of jerking back at short intervals, as they make their way through the water. Sometimes two individuals will fasten on to each other by their terminal spines, and swim about so connected for a considerable time. The two species answering to the above description are *K. mytilus* and *K. silurus*. Another common species, *K. polyporum*, is bean-shaped, filled with numerous vacuoles, and armed with several hooks, but not with the long spines or bristles of the preceding. It is parasitic on other freshwater animals.

Euplotes charon belongs to a family of Infusoria which are characterised by the possession of a lorica. The body, in fact, is encased above in a boat-shaped horny shield, ornamented with lines of prominent dots. The organs of locomotion are very highly developed. Cilia, bristles, and hooks make the little creature quite formidable, and enable it to swim, crawl or climb, back upwards or downwards, with the greatest agility. A contractile vesicle and a nucleus are present. *Euplotes* may be looked for amongst Algæ and other water-plants at all seasons.

Amphileptus resembles, both in form and movements, a small leech, having a highly extensible proboscis, or prolonged upper lip. The other extremity tapers to a tail. Rows of cilia are disposed lengthwise over the entire body; but these organs, as usual, are most conspicuous about the mouth. The interior is diversified by numerous food-vacuoles. One species, taken last June, seemed to me to be undergoing transverse self-division. I have generally found it amongst duck-weed.

Peridinium may be cited as a good example of the Flagellata. My specimens, got from a clay-pit in December, were of a rich Indian yellow hue, about 1-300th of an inch long, furnished with a belt of active cilia running round the middle, a minute mouth near the centre, and on one side of the mouth a lithe filament, the so-called flagellum. Provided with such ample means of locomotion, the little acrobats kept up their rolling and tumbling movements with untiring vigour. I watched them at all hours, and never caught them reposing. My belief is that they never once rested from birth to death.

I shall not add any remarks upon the *Tentaculifera*, about which competent opinions are as yet divided. All who are interested in the microscopic forms of Freshwater Life must hail with expectation Mr. Saville Kent's new book on the Infusoria, a work which, side by side with other well-known authorities, cannot fail to be of great assistance to the student.

HELIX CANTIANA, (Montagu.)

Since Martin Lister, in the latter part of the seventeenth century, indicated the existence of this Mollusk, which, he thought, might be a variety of *H. rufescens*, or a distinct species, giving as its habitat "Kent," an almost complete knowledge of the Mollusks inhabiting Britain has been attained, and it is of much interest to Conchologists to note the distribution of species over these Islands.

Montagu, in 1803, called it *Cantiana*, after its early recorded habitat. We know now that it occurs not only in the south and south-eastern counties, but has spread northward and westward, following the theoretical line of migration of the Mollusca of this country.

We have authentic records of its occurrence in twenty-one counties—twenty in England and one in Wales, as follows:—Sussex, Surrey, Kent, Middlesex, Hants, Somerset, Essex, Hertford, Oxford, Gloucester, Monmouth, Suffolk, Warwick, Worcester, Cambridge, Norfolk, Stafford, Lincoln, Yorkshire, Northumberland, and Glamorgan. This being the case, we should expect to find it in the central counties of Buckingham, Bedford, Huntingdon, Leicester, Northampton, Nottingham, and Derby; and southward in Berks, Wilts, and Dorset.

If any of our friends, while reading these notes, will take the map of England, they will readily see that, with three exceptions, the counties enumerated as habitats, are contiguous ; and whether we ascribe its distribution to the creature's own powers of migration, or to man's agency, the result is the same ; and we should scarcely expect that, in its spread, it would skirt the eastern coast from the south, and travel from south up the central counties, and miss those indicated.

It will be of much interest if any of our friends, having observed it in any of the counties named, would kindly inform us of the fact.

In our own district it occurs at Henley-in-Arden, where it was first observed by Mr. W. G. Blatch; and we have, during one of our pleasant walks with that learned but modest Naturalist, Mr. Jas. Bagnall, seen it plentifully distributed along the canal bank at Holywell, about four miles from Henley. Mr. Slatter, of Redditch, says it is common at Littleton, near Evesham; and we have taken it near Evesham Railway Station. In all these places it extends for a considerable distance along the road. Nearly all the shells are rufous and white, white shells being uncommon; for, although Reeve says "the lower half of the shell is always tinged with a rufous foxy rust colour," it is not so; pure white shells are not uncommon in the south-eastern counties on the chalk, and occur occasionally wherever the species is plentiful.

The shells vary in size and texture, according to the nature of the creature's habitat; specimens from the chalk or limestone, where the plants upon which it feeds contain abundance of lime, are large and smooth, while those from the sparsely clad sand-dunes of Deal are stunted and rough. We have examples in our cabinet of a truly *minor* form, its dimensions are B. 0·55, Alt. 0·35, the ordinary size being B. 0·70, Alt. 0·40. We have shells B. 0·80, Alt. 0·50.

Dr. Turton says this species was introduced by "colliers" into Northumberland, where it occurs on the banks of the Tyne. In the "Quarterly Journal of Conchology" for August, 1878, our excellent correspondent, Mr. J. S. Gibbons, M.B., notes its occurrence on the Chalk Cliffs, near Flamborough Head, in Yorkshire, "in a locality so retired that it is impossible to suppose it otherwise than indigenous;" it is very common in some districts of central Yorkshire, and it is possible, therefore, that it may be found in Durham.

The locality, "near Dublin," is given in Gray's Turton, (p. 36,) probably on the authority of its being named as occurring there in Welsh and Whitelaw's History of Dublin; but Dr. J. Gwyn-Jeffreys says "subsequent writers on Irish Conchology have not confirmed the correctness of such statement."

Reeve says (p. 67) Mr. Guise believed it to have been introduced into Glamorganshire, where he found it between Swansea and Oystermouth.

We shall be very pleased to receive any further notes of the occurrence of this species in places not known to us.

G. Sherriff Tye.

Handsworth, Birmingham.

A PIECE OF CHALK.

BY FRED. F. GRENSTED, MAIDSTONE.

Only a piece of chalk, of no appreciable value, and yet it has preserved a decipherable record of marvellous events which happened numberless ages ago! Judging by analogy, where England now stands, water a mile or two in depth was "once upon a time" lashed into ocean waves by the passing wind. Travelling in thought to the bottom of this unnamed sea of an unknown era we find the ocean floor covered with a white, soft, sticky mud, the exact counterpart of that which is found in the Atlantic at the present day. This mud would be almost entirely composed of very minute but lovely shells, which are now known by the generic name Foraminifera. They are so small as to require the aid of a good microscope to reveal their lovely forms. As in thought we gaze upon the scene with eyes enlightened by modern scientific research, we see these shells slowly falling through the water like a snowstorm, unceasingly day by day and year by year. as their tenants, once alive and swimming about in the water above, die off in countless myriads. Thus, generation after generation died and sank to the ocean bottom, and in turn was buried beneath the remains of its offspring. Thus, slowly but surely, fragment by fragment, were the chalk cliffs and downs of Albion deposited beneath the deep waters of a mighty sea.

All who may desire to be satisfied that this is no legend or fancy picture, have within easy reach the means of forming an independent judgment. They have merely to take a piece of chalk, or preferably some of the naturally formed powder found in chalk pits and on exposed cliffs, and ascertain of what it is composed. I will describe an easy and effectual method of doing this. If the natural powder is not within reach, any soft piece of chalk reduced to powder by being scraped with a knife will do almost equally well. Place some of the powder in an ordinary medicine bottle, fill up with clean water, and shake vigorously for some time. Then let the milky fluid settle for about ten minutes. Next, by means of a syphon, easily made with a piece of indiarubber tubing, draw off the contents of the bottle to within half an inch of the bottom. Fill up the bottle with fresh water, shake up as before, once more let the fluid settle, then draw off with the syphon to within the same distance of the bottom. Do this again and again until the fluid ceases to be milky, and becomes, as it were, diffused with fine dust, the separate grains of which will be plainly visible when the bottle is held close to the eye against a bright light. These grains are the treasures we are in search of. Besides them, however, the bottle will contain some small particles of chalk. To separate the one from the other is our next object, and it may be effected by shaking the bottle well, and instantaneously drawing off the fluid into another bottle by means of the syphon. This operation, if properly done, will remove the lighter shells and leave some of the heavier and the chalk behind. Having allowed the shells in the second bottle to subside, the water must be drawn off by the syphon. A good layer of these tiny shells may be obtained by repeating the process above described over and over again. The bulk of the water having been syphoned off, the shells should next be carefully filtered on blotting paper, then dried and stored in a pill box, or other convenient receptacle.

The shells thus obtained, if the operation has been properly done, should be perfectly clean, though fragments of shells will, of course, be found mixed with perfect ones. In the various stages of the process it is advisable to ascertain by means of the microscope that all is going on well. The method will be found very simple, and I can vouch for its success, for it has yielded me most satisfactory results.

To mount the specimens for the microscope all that remains to be done is to take as many as will lie on the point of a knife and boil them for a short time in a test tube containing a little turpentine. This is done to expel the air from the shells. Transfer a few of the specimens to the centre of a glass slip, add a spot of Canada balsam, and immediately place a thin cover glass on, and when dry finish off according to taste. The slides thus inexpensively provided will then be ready to answer the enquiry "What does the chalk contain?"

PARASITES OF MAN.*

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

[*Continued from page 297.*]

The few nematoid parasites that remain to be considered comprise several rare and interesting species, and likewise two of the commonest intestinal worms. What I have incidentally advanced respecting the strange way in which the old writers confounded Guinea-worms with little serpents, finds noteworthy confirmation in the circumstance that the great strongyloid kidney-worm has also been looked upon as a species of venomous ophidian reptile. Facts of this order, if duly weighed, inevitably cause us to modify our interpretation of the statements made in ancient records. Thus, to return to the Guinea-worm. Whatever good the theosophical remedies recommended and enforced by Moses may have accomplished for the human victims suffering from the attacks of "fiery serpents," or Dracunculi, it is to be feared that no similar remedial measures of the mystical kind could be rendered available in the case of animals bitten by parasites that have been regarded as renal serpents. It is fortunate, indeed, for man that the great kidney-worm *(Eustrongylus gigas)* has only once been detected in the human body. If this formidable entozoon, capable of attaining a length of three feet, were as common in man as it is in certain animals, no doubt the superstitious people of southern climes would readily invoke clerical aid in view of obtaining miraculous cures. Possibly a mitigation of their sufferings might follow such exhibitions of human sympathy and trust. The case of animals, however, is very different. The unfortunate wolves of the Pyrenees cannot, of course, be expected to secure any very large amount of sympathy; nevertheless, it is the business and duty of the helminthologist to point to the causes of the sufferings of all kinds of animals, whether wild or domesticated, and so far as lies in his power to suggest the means whereby their sufferings may be mitigated. Not only do solitary and large nematoid parasites take up their abode in essentially vital organs of the body, and thus secure the slow destruction of the host, but the minutest forms of the same group

* Communicated by Mr. Hughes to the Microscopical Section of the Birmingham Natural History and Microscopical Society, November 19th, 1878. On Dr. Cobbold's behalf, Mr. Hughes exhibited a slide showing male and female examples of the destructive parasite *(Dochmius duodenalis)* which causes the Egyptian chlorosis.

of entozoa frequently occur in sufficiently prodigious numbers to sweep off their victims by hundreds or even by thousands. Animal epizoötics due to this source have hitherto been little studied.

NEMATODA CONTINUED.

34.—*Eustrongylus gigas*, Diesing.

Synonymy.—*Strongylus gigas*, Rudolphi; *Ascaris renalis*, Gmelin; *Lumbricus in renibus*, Blasius; *Fusaria*, Zeder.

Larvæ.—The embryos are vermiform, and measure about the $\frac{1}{100}$ of an inch in length. In their higher larval state they have been recognised as filariæ *(F. cystica.)*

Intermediate Host.—From the anatomical observations of Schneider and Leuckart, it would seem that the immature worms dwell chiefly in freshwater fishes. Thus, the so-called *Filaria cystica* must be regarded as an immature *Eustrongylus gigas*. Hitherto, this little worm has been found occupying cysts or capsules, situated immediately beneath the peritoneal membrane in *Galaxias scriba*, and in certain oceanic fishes belonging to the genus *Synbranchus*. According to the eminent piscicologist, Müller, the *Galaxiidæ* present strong affinities to the *Salmonidæ*, but Cuvier considered them as essentially modified pikes *(Esocidæ.)*

Experiments.—Balbiani attempted to rear *Eustrongyli* by direct experiment. He administered the ova to dogs, but obtained only negative results. Similarly, his experiments on reptiles and fishes failed.

Remarks.—If the conclusions of Schneider and Leuckart be correct—and these make it appear that we must hold certain freshwater fishes as responsible media of infection—one can only express surprise that man is so seldom victimised by this parasite. The *Synbranchi*, being tropical fishes, can have little part in the infection of animals—apart from seals. One must suppose that pumas, dogs, wolves, gluttons, raccoons, minks, weasels, and other carnivora contract this worm by attacking, capturing, and devouring fishes at times when they are prevented from obtaining other and more readily accessible kinds of food. How this parasite should in some instances gain access to herbivorous animals is not so clear.

Lit.—All standard works, and especially Leuckart's. One of the most remarkable memoirs quoted by Davaine is that of Clamorgan. In this old writer's work, "La Chasse de Loup," dated 1583, the kidney-worms, or Eustrongyli of modern writers, are characterised as "serpents and highly venomous beasts."

35.—*Strongylus bronchialis*, Cobbold.

Syn.—*Strongylus longevaginatus*, Diesing; *Filaria bronchialis*, Rudolphi; *Hamularia*, Treutler.

Larvæ.—Unknown.

Remarks.—This small viviparous entozoon, hitherto only twice encountered in the human body, is doubtless identical with *Strongylus longevaginatus*. The original specimen was discovered by Treutler in Germany, in 1791; the second being found by Dr. Jortsits, in Transylvania, many years afterwards (1845.) The males measure half an inch and the females rather more than an inch in length.

36.—*Dochmius duodenalis*, Leuckart.

Syn.—*Dochmius anchylostomum*, Molin; *Anchylostoma duodenale* Dubini; *Strongylus quadridentatus*, Von. Siebold; *Sclerostoma* Cobbold.

Larvæ.—Although the history of the development of the young worms has not actually been ascertained, it is tolerably certain that the structural characters they exhibit, and the changes they undergo, are similar to those of other closely allied species. Thus, without doubt, the free embryos are rhabditiform, and pass their larval lifetime in water, mud, and moist earth. After having undergone one or more changes of skin, attended with growth, they are possibly transferred to the human stomach.

Intermediate host.—It is not certain that any intermediary bearer is necessary.

Remarks.—Water drinkers in tropical climates readily become the victims of this parasite, either by swallowing the free swimming larvæ, or water insects containing the larvæ in a state of rest. The *Dochmius duodenalis* was discovered by Dubini, at Milan, in 1838, and its clinical importance in relation to the so-called Egyptian chlorosis was first announced by Griesinger. We now know that this destructive little parasite is a fertile cause of the wasting disorders of tropical countries generally; the affections termed *tropical anœmia* or *hypoœmia* being especially prevalent in the West Indies, in Cayenne, in Brazil, in Egypt, and in the Comoren Islands lying to the north-east of Madagascar. The worms are veritable bloodsuckers, behaving like leeches; probably, however, the loss of strength and diminution of vital power which they occasion is not so much due to the actual amount of blood abstracted as to the severe irritation resulting from the injuries they inflict upon the mucous membrane of the infested intestine.

Lit.—The Work of Leuckart; and especially a Memoir by Wucherer in Deutsches Archiv fur Klinische Medicin, Sept. 27, 1872, (s. 379—400.)

[TO BE CONTINUED.]

ON THE MICROSCOPICAL EXAMINATION OF CLAY.

BY THE REV. H. W. CROSSKEY, F.G.S.

A brief record of the results of considerable practical experience in the microscopical examination of clay may be of service to those engaged in the study of the drift beds of this district. As an illustration of what may be done by the employment of a good method, it may be mentioned that when the writer, in conjunction with his friend, Mr. D. Robertson, commenced to deal microscopically with the glacial clays, only two doubtful species of Ostracoda had been observed as fossils in them. We have succeeded, however, in cataloguing 136 species, of which 19 are either now extinct or unknown in the living state, and many are of extreme rarity.*

The first essential point is *thoroughly to dry the clay*. This ought to be slowly done. The clay should not be placed in an oven or close to a

* See Monograph on the Post Tertiary Entomostraca of Scotland, by G. S. Brady, Rev. H. W. Crosskey, and D. Robertson. Published by the Palæontographical Society, 1874.

hot fire, but gradually hardened. Anything like baking is apt to be destructive of delicate specimens. I have been accustomed to treat at one time enough clay to fill an ordinary pie-dish.

The clay, when thoroughly dry, should be placed in a large bowl of water, and allowed to remain undisturbed for a few hours. It should then be gently stirred up in the water, and it will be found to disintegrate in a remarkable way.

After the clay has been stirred up in the water, it should be allowed to settle quietly. If it is at all rich in organisms, a fine whitish scum will soon form upon the surface of the water, and must be carefully skimmed off. This *first scum* is the most valuable of all the treasures the clay can yield. It should be treated by itself, unmixed with baser matter, and placed upon a piece of the finest muslin to permit the water to drain away. A very simple and useful plan is to have a small hollow tin cylinder, and affix the muslin to one end by an elastic band. Through such a cylinder the skimmed water can readily be poured, and the muslin will retain the *debris* in which the organisms will be found. Muslin is preferable to a sieve, since a fresh piece can be used in dealing with the clay from each locality, and the possibility of any accidental accumulation of old material (such as may take place at the edges of a sieve) is prevented. The mesh should be as fine as will permit the drainage of the moisture. When the muslin, with its light burden, is dry, the contents may be placed upon a slate, and any organisms can be readily picked off.

The process described should be repeated until no scum will rise. It is possible that when a clay has failed to yield any more " floatings," after a second drying it may produce some. If the clay under examination be scarce, and a supply not readily obtainable, the water should be poured off as soon as all the " floatings " have been collected. The clay remaining at the bottom of the dish should again be dried, and the scum, if it chance to yield any, again collected. When all the " floatings " have been obtained, the clay itself should be washed. This is effected by pouring water upon it, stirring it, and then, after giving a few moments to permit the heavier material to fall, pouring off the water; and repeating the process until the fresh water is not at all mudded by the stirring of the material that is left. Abundance of water should be freely used; and generally a great many separate washings are required, but at last, if the clay has been really dry at the outset, the fine mud will disappear.

The remaining material will consist of grains of sand and pieces of gravel, together with such organisms as would not float; and must be dried for examination.

If the method described be carefully pursued, nothing ought to escape except the finely comminuted mud; and the observer ought to have every organism (the Diatomaceæ being of course excepted) preserved either in the " floatings " or the " washings."

Reviews.

The Herefordshire Pomona, containing coloured figures and descriptions of the most esteemed kinds of Apples and Pears. Edited by ROBERT HOGG, LL.D., F.L.S., &c. Issued by the Woolhope Naturalists' Field Club, Hereford. London: Hardwicke and Bogue. Part I., price 15s.

THE Woolhope Naturalists' Field Club is to be warmly congratulated on this sumptuous publication, by the preparation of which they have engaged in a work of national importance. The hardy fruits of the country are of vast economic value, while their importance as articles of food, and from a sanatory point of view, can scarcely be overstated. Of all the fruits which this country yields in abundance none are more deservedly appreciated than apples and pears. They may be profitably grown to a greater or less extent in nearly all parts of the British Islands; in many places they are successfully grown in enormous quantities. Apples and pears vary much in flavour and quality: some of the most esteemed are also the most prolific. To know which are the best kinds for any given locality and climate is manifestly important to all possessors of orchards or gardens. As knowledge on the subject becomes more general fewer mistakes will be made, and there is now no reason why a worthless or unsuitable variety should ever again be planted. "The Herefordshire Pomona" will spread sound knowledge on these and other points; and we trust this valuable publication will speedily become as widely known as its merits deserve.

To the labours, intelligent, unremitting, and beneficial, of the late Thomas Andrew Knight, a native of Herefordshire, and for years the President of the London Horticultural Society, may be traced what may not improperly be called the revival in recent times of hardy fruit cultivation. Dr. Bull (one of the most valuable members of the Woolhope Club) gives an interesting account of Mr. Knight's useful work in pages 29-38 of the work before us. He discusses at length the theory which Mr. Knight so thoroughly believed, that a graft can live no longer than the original tree from which it is taken. He plainly shows how incorrect it is. "The notion," he says, "seems to rest upon the assumption that the new wood which proceeds from the graft is not a new tree but only a detached part of the parent. But this is evidently a mistake. A branch produced by a graft is as distinctly a new and separate individual as a branch produced by a cutting. In both cases the bud is the source of new growth; and, physiologically speaking, a seed itself differs little from a bud, except in being more carefully protected, and in being spontaneously detached. The embryo in a seed, the bud inserted in budding, the buds in a graft or in a cutting, differ only in their position; and each, as it develops, becomes a new individual, not a mere dependent portion of the parent."* This unsound theory of Knight's led him to make experiments for the origination of new varieties of our hardy fruits worthy of general cultivation, with a view to restock our orchards and

* Any of our readers interested in this subject, and desirous of investigating it, will find an able and full discussion in Dr. Lindley's "Theory of Horticulture," chap. xvii., pp. 463-480, ed. 1855.

gardens with vigorous trees. And hence, however mistaken he was as to the duration of varieties, his labours were in the direction of the public good, and were most successful. Although previous to his time the uses of hybridisation were understood, Knight was one of the first to apply it in raising improved sorts of fruit trees. In Dr. Bull's sketch very full particulars are given of the work he did, and the success he achieved. It may to some seem a small matter now that he gave us better kinds of apples, cherries, nectarines, pears, plums, and strawberries, and some improved peas and other vegetables, for we are familiar with improved fruits and vegetables as things of constant introduction now-a-days, and we are apt to hold cheaply whatever comes easily. But it is a fact to be remembered that our present plentiful supply is due to the initial labours of Thomas Andrew Knight, and the example he set. Dr. Bull has then done a fitting thing in giving some details of the life history and work of one of Herefordshire's chief worthies in the "Herefordshire Pomona."

The plan of the book in reference to the fruits described is to tell the origin or history, and give a technical description of each fruit and its uses, with particulars as to the soils and situations in which it has been found to thrive. Each fruit is also depicted in a coloured drawing, and these illustrations must have been produced at great cost. They are some of the most successful instances of colour-printing we have seen. It is needless to add that while greatly adorning the work they add immensely to its practical value.

"The Herefordshire Pomona" is a work to be proud of, and everyone interested in the cultivation of apples and pears will feel bound to possess himself of a copy. The second part will be issued next year. Dr. Hogg, a well-known authority on Pomology, and an honorary member of the Woolhope Club, has kindly undertaken the arduous labour of editing the work. E. W. B.

West Yorkshire: An Account of its Geology, Physical Geography, Climatology, and Botany. Part I., Geology. By J. W. Davis, F.G.S., &c. Part II., Physical Geography and Botanical Topography. By J. W. Davis and F. Arnold Lees, F.L.S., M.R.C.S., &c. With maps and plates. London: L. Reeve and Co. 8vo., pp. 414. Price 21s.

Whilst comparatively few of us can adequately appreciate and thoroughly understand the minute descriptions of specific differences, and the elaborate articles on foreign Geology which form the more important records contained in the leading journals devoted to this science, it is with much pleasure that we take up a work devoted to the Geology and Botany of a district so near, and in many points so similar to our own as West Yorkshire. Nothing tends so much to show the value of local scientific societies as the publication of the results of the work of their members, especially when devoted, as is the goodly volume before us, to the elucidation of the physical phenomena peculiar to the several districts over which such societies claim special rights of investigation.

West Yorkshire is by no means a small area, for it contains 2,760 square miles; and it will therefore be seen that the examination of the Geology and Botany of so large a district is a very arduous undertaking.

In the work before us there is every evidence that on the part of each author this labour has been a work of love, and the perusal of the book will convince everyone that the work has been thoroughly and well done.

Commencing with a useful list of books written on the Geology of West Yorkshire, we have an introductory explanation of the chief physical features, main faults, and measures of the district, which is followed by a succession of chapters devoted to the several divisions of rocks—from the Silurian to the Post-tertiary—represented in the locality. The county, as a whole, furnishes a most comprehensive field for geological study, for the author says, "If the whole of the county be taken, we have all the great divisions well represented, except . . the Cambrian and Laurentian, thus presenting in so small an area a more glorious epitome of the strata comprising the earth's crust than can be found in any other locality of similar, or even much larger extent in the world."

The Silurian beds are the Coniston Limestone, with the superincumbent Flags and Grits and the Bannisdale Slates, which altogether attain a great thickness, and represent the beds above and below the line of division of the Lower and Upper Silurian beds, as laid down by Sedgwick, who devoted a great deal of time and attention to the examination of the Coniston Rocks. The occurrence of a bed of sandstone 20 feet thick, with fossils of the Ludlow type, at so great a depth (1,200 feet) below the Ludlow beds, is an interesting and remarkable circumstance.

The succeeding period of Sedimentary Rocks (the Devonian) is but imperfectly represented in West Yorkshire. At page 41 the author gives an interesting account of what was going on between the deposition of the Silurian beds and that of the Carboniferous Limestone.

The Carboniferous Rocks, consisting of the Mountain Limestone, Yoredale Beds, Millstone Grit, and Coal Measures, seem all to be peculiarly well developed in this district, and they are very particularly described, with the faults, &c. The numerous sections and long lists of fossils show how accurately these beds have been investigated, and, apparently, they offer a very wide field for examination. The purity of some of the coals of the district is of great economical importance, among which we may especially mention the Better Bed Coal, of which the author says (p. 113:)—"It is extensively worked in the Lowmoor district, for the purpose of smelting the iron ore found in the shale above the Black Bed Coal. Its freedom from sulphur and other impurities renders it peculiarly valuable for smelting purposes; and it is partially to this coal that the excellence of the Lowmoor iron is attributed." We believe it was this bed of coal which Professor Huxley described as being entirely composed of lycopod spores, to which, probably, it owes its great purity. We notice our author does not give us any lists of fossil coal plants, the study of which seems unfortunately to have an attraction for only very few of our Botanists. The Permian rocks of the district seem to be more developed than in our own district, but we notice the absence of the several sub-divisions of the Bunter beds which are found in the Midlands.

There is an interesting chapter devoted to the Glacial and Post-glacial deposits, together with a brief account of the exploration of the Settle and other caves.

The second part of the work commences with an outline of the physical geography of West Yorkshire, and is followed by an examination of the flora of the ten divisions into which the district is sub-divided, according to river drainage. This is accompanied by a good map, from which can be seen at a glance the several districts treated of in the successive chapters. The flora is an extremely rich one, for the author says (p. 242) it "is almost more than any other equal area not possessing the advantage of a long varied coast-line could produce, and the causes are not far to seek. The possession of a tidal river-board giving it some maritime plants, its extent and diversity of surface ranging from near sea level to 2,400 feet, from fen and warren to elevated peat-bogs and Alpine rocks, and the wide variation in its climate consequent upon these, are all factors in the sum of its flora." The various influences affecting the distribution of plants are described in an interesting manner, and a comparison is made with the flora of neighbouring counties, together with lists, &c., of plants of Atlantic and Germanic types. For the manner in which the Botany of the district has been worked out we must refer our readers to the work itself, adding that the lists of plants are so carefully reported under the several localities as to give most satisfactory evidence of the pains taken to make this information as complete as possible.

In the preface the authors say that "The Climatology, the 'Flora' proper, and their connections are reserved for a second volume," which we understand will be published next month, thus completing a record of investigation and research most creditable to the authors, and one which cannot fail to be extremely useful. W. MADELEY.

CORRECTION.—Report of the Burton-upon-Trent Natural History and Archæological Society.—In the notice of this publication (ante p. 305) a mistake is made by attributing the authorship of the paper on "The History of Burton Abbey" to the Rev. C. F. Thornewill. The paper was written by Mr. Robert Thornewill.

METEOROLOGY OF THE MIDLANDS.

THE WEATHER OF OCTOBER, 1878.

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

Most of our observers agree in describing the weather as fairly fine and dry up to the 20th, but wet and stormy after that date to the end of the month. Whilst the rainfall was about the average, temperature was decidedly higher. The pressure of air, as indicated by the barometer, was very variable, a fact due to the rapid succession of depressions and anti-cyclones passing over our Islands from the south-west to the north-east.

Thunderstorms are reported from Stroud on the 9th, Buxton on 28th and 30th, Weston-under-Lyziard on the 29th, Leicestershire 25th, Brampton St. Thomas on 28th, Spondon 28th to 30th.

Snow fell very generally on the 29th and 30th, but melted very soon; at Uppingham it was four inches in depth. Hail-storms were also frequent on the last three days of the month.

There was little or no frost till the very end of October, and, as a consequence of the mildness of the weather, many migratory birds delayed their departure, while flowers continued to bloom freely. Swallows appeared again at Stroud on the 16th; three were seen at Tamworth on the 15th. At Worksop these birds were seen as late as the 26th. The fieldfare arrived at Tamworth on the 16th; redwings and woodcocks were seen near Bishop's Castle on the same day. At Waltham bees were in full work on ivy and chrysanthemum till 22nd, and at Shifnal the red admiral and tortoiseshell butterflies were out till the 19th, when also a large dragon fly was seen hawking for flies, as in the height of summer. Primroses were gathered near Melton Mowbray on the 19th.

STATION.	OBSERVER.	RAINFALL. Total for M. In.	Greatest fall in 24 hours. In.	Date.	No. of rainy days.	TEMPERATURE. Greatest ht. Deg.	Date.	Great'st cold. Deg.	Date.
GLOUCESTERSHIRE.									
Cainscross, Stroud	W. B. Baker, Esq.	4·48	·75	31		70·0	7	30·0	31
Cheltenham	R. Tyrer, Esq.	3·39	·67	31	19	71·5	5	27·4	30
Stroud	S. J. Coley, Esq.	3·86	·85	24	15	68·0	7	34·0	29, 30, 31
SHROPSHIRE.									
Haughton Hall, Shifnal	Rev. J. Brooke	3·70	·59	9	17	[illegible]	5 & 6	30·0	31
Whitchurch	A. B. George, Esq.	3·[illegible]1	·55	9	19				
Woolstaston	Rev. E. D. Carr	6·28	·94	9	22	66·0	5	29·5	30
Leaton Vicarage, Shrewsbury	Rev. F. V. Pigott	4·50	·60	6	21	66·0	6	29·8	31
More Rectory, Bishop's Castle	Rev. A. Male	5·43	·90	9	21	68·0	5	29·0	30
Larden Hall, Much Wenlock	Miss F. R. Boughton	4·9[illegible]	·84	9	20				
Bishop's Castle	E. Griffiths, Esq.	4·[illegible]9	·91	9	22	67·0	5 & 6	30·0	30
Cardington	Rev. Wm. Elliott	5·33	·92	9	23				
Adderley Rectory	Rev. A. Corbet	3·27	·55	21	24				
Stokesay	Rev. J. D. La Touche	4·38	1·03	9	19	69·1	5	[illegible]2·2	30
HEREFORDSHIRE.									
Whitfield	W. Wheatley, Esq.	4·69	1·06	9	20			26·0	30
Stoke Bliss	Rev. G. E. Alexander	4·21	·70	9	20	68·0	5	31·0	29
WORCESTERSHIRE.									
Orleton, Tenbury	T. H. Davis, Esq	4·26	·70	9	22	71·2	5	30·5	31
West Malvern	A. H. Hartland, Esq.	4·64	·77	23	22	72·0	5	29·	29
Pedmore	E. B. Marten, Esq.	4·42	·79	9	19	68·0	5	[illegible]0·0	29, 30, 31
Stourbridge	Mr. J. Jeffries	4·01	·67	9	17	70·0	5 & 6	26·0	30 & 31
St. John's, Worcester	G. B. Wetheral, Esq.	3·60	·60	23	18	66·0	6	30·0	31
STAFFORDSHIRE.									
Thorganby Villa, Wolverhmtn	G. J. C. Broom, Esq.	3·20	·50	9	21				
Barlaston	W. Scott, Esq.	3·64	·58	21	18	68·8	5	23·6	29
Amblecote	Mr. J. Robins	3·59	·59	9	17				
Dudley	Mr. J. Fisher	3·24	·46	9	20	70·0	6	30·0	29
Sedgley	Mr. C. Beale	2·9[illegible]	·54	9	21	65·0	5	[illegible]2·0	31
Kinver	Rev. W. H. Bolton	4·17	·78	19	21	66·0	5 & 6	30·0	29 & 30
Walsall	Mr. N. E. Best	3·14	·58	9	19	68·0	5	[illegible]2·0	29 & 31
Grammar School, Burton	C. U. Tripp, Esq.	2·90	·54	24	20	73·0	5	[illegible]0·0	30
Patshull Gardens	Mr. T. W. Dell	3·10	·55	10	15	[illegible]4·0	6	28·0	31
Weston-under-Lyziard R'tory	Hon. and Rev. J. Bridgeman	3·65	·61	21	25	68·5	6	[illegible]1·5	31
Wrottesley	E. Simpson, Esq.	3·10	·55	9	15	68·5	6	29·4	3[illegible]
Tamworth	W. Arnold, Esq.	3·01	·67	24	19				
Tean Vicarage, near Cheadle	Rev. G. T. Ryves	3·71			21	6[illegible]·2	6	28·0	30
Heath House, Cheadle	J. G. Philips, Esq.	3·3[illegible]	·54	25	18	67·0	5	29·0	[illegible]0
Alstonfield Vicarage	Rev. W. H. Purchas	4·19	·73	25	15	64·6	5	24·5	29
WARWICKSHIRE.									
Coundon, Coventry	Lieut.-Col. R. Caldicott	2·93	·5	23	22	[illegible]6·0	5	33·0	29 & 30
Coventry	J. Gulson, Esq.	2·59	·49	23	20	66·0		32·0	[illegible]0 & 31
Bickenhill Vicarage	J. Ward, Esq.	3·[illegible]7	·59	23	21	72·0		[illegible]8·0	
St. Mary's College, Oscott	Rev. S. J. Whitty	3·17	·47	21	20	71·6	5	30·8	30
Henley-in-Arden	T. H. G. Newton, Esq.	3·46	·59	24	20	71·0	5	30·0	31
Rugby School	Rev. T. N. Hutchinson	2·64	·59	21	16	73·0	5	30·0	30
DERBYSHIRE.									
Buxton	E. J. Sykes, Esq.	6·32	·91	10	20	67·8	5	27·0	2 & 29
Stoney Middleton	Rev. U. Smith	4·09	·84	24	14	64·0	5, 6, 7	30.0	29
Brampton St. Thomas	Rev. J. M. Mello	3·49	·90	24	13	70·0	5	29·0	2 & 30
Fernslope, Belper	J. G. Jackson, Esq.	3·54	·53	24	21	68·0	5	29·0	30
Linacre Reservoir, Ches'fi'ld	C. E. Jones, Esq.	3·84	·66	8	19				
Willesley Gardens, Cromford.	J. Tissington, Esq.	3·71			15				
Spondon	J. T. Barber, Esq.	2·43	·72	24	15			20·0	27
YORKSHIRE.									
Hesley Hall	B. J. Whitaker, Esq.	2·32	·36	25	18	71·0	6	32·0	31
NOTTINGHAMSHIRE.									
Highfield House, Nottingh'm	E. J. Lowe, Esq.	3·07	·70	21		73·6	5	26·7	30
Hodsock Priory, Worksop	H. Mellish, Esq.	2·50	·66	24	19	70·5	5	27·0	30
Park Hill, Nottingham	H. F. Johnson, Esq.	3·2[illegible]	·74	24	18	68·5	5	31·5	
LEICESTERSHIRE.									29
Loughborough	W. Berridge, Esq.	2·46	·65	24	20	74·7	5	29·5	
Ashby Magna	Rev. E. Willes	2·54	·70	24	21	68·0	5	32·0	27
Market Harborough	S. W. Cox, Esq.	2·53	·50	21	17	68·0	5	27·0	30 & 31
Kibworth	T. Macauley, Esq.	2·64	·48	23	19				29
Town Museum, Leicester	W. J. Harrison, Esq.	2·57	·40	24	[illegible]0	71·9	5	31·2	29 & 30
Belmont Villas, Leicester	H. Billson, Esq.	2·51	·43	23	20	70·8	5	30·0	30
Syston	J. Hames, jun., Esq.	2·52	·80	24	18	72·0	6	29·0	31
Waltham-le-Wold	E. Ball, Esq.	2·5[illegible]	·54	24	16	67·0	5	28·0	29
Little Dalby Hall	G. Jones, Esq.	2·50	·44	29	17	70·0	5	26·0	30
Coston Rectory, Melton	Rev. A. M. Rendell	2·36	·56	24	17	69·[illegible]	5	25·0	30
NORTHAMPTONSHIRE.									
Towcester Brewery	J. Webb, Esq.	2·[illegible]3	·47	21 & 23	12	68·0			
Castle Ashby	R. G. Scriven, Esq.	2·32	·50	24	16	74·0	5	33·0	29
Pitsford	C. A. Markham, Esq.	2·32	·50	22	21	67·0	6	[illegible]0·0	30
Kettering	J. Wallis, Esq.	2·61	·58	24	20	66·0	7	[illegible]0·0	30
Althorpe	W. F. Jakeman, Esq.	2·50	·55	23	14	68·0	5 & 6	30.0	29 & 30
Northampton	H. Terry, Esq.	2·26	·44	9	14		5	31·0	29
RUTLAND.									
Burley-on-the-Hill	W. Temple, Esq.	2·57	·71	25	20	6[illegible]·0	8	25·0	30
West Deyne, Uppingham	Rev. G. H. Mullins	2·45	·50	29	20	70·8	5	29·0	30
Northfields, Stamford	W. Hayes, Esq.	2·27	·40	24	16	70·0	7	32·0	20
Radcliffe Observatory, Oxford	Mr. H. E. Bellamy	3.11	1·03	19	15	70·0	5	32·1	30
Spital Cemetery, Carlisle	T. Bell, Esq.	3·19	·75	21	17	70·7	5	25·3	31
Ventnor Hospital	H. Sagar, Esq.	3.01	·75	25	13	73·8	5	34·2	30
Altarnun Vicarage	Rev. G. Tripp	8.6[illegible]	1·32	28	19	71·0	6	34·0	12

Microscopy.

A paper read by Mr. Thomas Bolton at a recent meeting of the Birmingham Natural History Society, "On the Examination of Rotifers and Infusoria under the Microscope," suggests a remark or two which may be useful as hints to some of our readers.

Most forms of compressorium are useless, all are expensive. Those who try the following will be surprised at the efficiency of the apparatus. Two pieces of thin glass are cemented on to a glass slip in the shape of the letter ⌊, but with the two strokes of the letter about equal in length, and another thinner and longer one is fixed longitudinally, thus ⌊—— The ⌊ serves to retain in position a square slip of cover glass placed, of course, not on the ⌊ but inside it; the horizontal piece, which should be ground to a bevel on its top edge before fixing it, serves to carry a fine needle, the point of which is inserted beneath the edge of the cover glass. This point being tapered, it is easy to increase or diminish the thickness of a film of water carried between the cover and the slip by pushing the needle further in or out, and so to form a cheap and effective compressorium.

Those who possess a Ross's four-tenths condenser will find the arrangement of stops marked O over B give the most perfect dark background illumination available, by unscrewing the top lens of the combination, for low powers.

The beauty of Rotifers and Infusoria seen by this illumination is immensely enhanced by feeding them with carmine, sparingly supplied to the water by drawing a camel-hair brush, charged with some of the pigment, along its surface. In a few minutes the stomachs of Rotifers and the cavities of Infusoria are painted with the most glowing colour, while the ciliary currents to and from the animals are traced out in equally brilliant lines.

The cases of all the thecated Rotifers are tinged with the colour upon which their tenants are fed. Hence evidently the material out of which they are constructed is a product elaborated from the food of the animal.

Microscopists will be glad to hear of a really good low priced revolving microscope table, which is accurately described in the maker's advertisement as "steady and substantial." The legs, which form a tripod, are handsomely cast in iron and bronzed: the top is made of a thick slab of slate. Without being inconveniently large it is large enough for all practical purposes. The microscope and lamp may be readily adjusted at one side of it, and then quietly moved round without readjustment to other students sitting round the table. There is room on the table for a compound microscope and lamp, a simple or dissecting microscope for preparing objects for the larger one, or for biological laboratory work, and for note-book and text-book, or other writing materials, either of which may be successively brought round to the student as it may be required, by the mere revolution of the table. The top being made of slate is very serviceable and easily cleaned. An ornamental cover over the slate top when the table is not in use for microscopical work will make it fit for a place in the drawing room. The table is also made with a solid mahogany top, the centre of which is inlaid with leather to meet the wishes of those who prefer a wood to a slate top. The manufacturers are Messrs. Hassall and Singleton, ironfounders, Birmingham, who have arranged with Mr. T. Bolton, 17, Ann Street, Birmingham to supply retail customers.

Correspondence.

Scientific Names.—With reference to Dr. Cobbold's appeal to me in the November number of the "Midland Naturalist," (p. 295,) it may be observed that we have the authority of the Greeks themselves for a departure from the usual plan in the formation of the words Distomum and Tristomum, these actual words, (with others of a like character,) occurring, of course in their Greek form, in that language. But these exceptions do not invalidate the general rule, which is as I have stated it, and it would be hard to say that we must not use such a word as Polystoma, while *polupous*, *polucheir*, &c., are good Greek. Another observation is that when Distomum is used, Distomidæ becomes correct; the error consists in using Distoma and Distomidæ concurrently. No one can say that it is unfitting to employ "complimentary" generic names, many of them, as Linnæa and Lobelia, being among the prettiest we have, and even Lyellii and Forsteri may be tolerated. But every one, who is not a professional nomenclator, regrets that the liberty is so often abused: the "compliment" has now become so common, that one scarcely cares to enquire, or even to wonder, who the *savant* is, who is supposed to be complimented.—W. B. Grove.

Fungi.—I should be much obliged if some of the readers of the "Midland Naturalist" would kindly inform me whether they have found the Chantarelle in Leicestershire. I have failed so far, though this locality is a fairly good one. I have found it in Warwickshire. Few people, I think, are aware how very good eating some of the quite common fungi are. *Hygrophorus virgineus* and *H. pratensis*, *Boletus edulis*, and the Maned Agaric are among the best. I have almost invariably found *B. edulis* under oak trees. Is this the usual experience? One other circumstance I should like to have corroborated, and, if it may be, explained. This autumn we buried, about 5ft. deep, a quantity of diseased potatos. About a fortnight ago I observed quite a large crop of *Peziza aurantia* growing over the spot, though I had never before observed it in the garden or its immediate neighbourhood. Was this merely a coincidence?—E. A. Green, Normanton Rectory, Ashby-de-la-Zouch.

Miller's Dale Flora.—I was rather surprised to notice Mr. G. Robson (an old correspondent of mine) recording the botany of Miller's Dale as "rather disappointing." Its botany pleased me as much as the perusal of Mr. Robson's really fine description of a Derbyshire thunder-storm. In addition to the ferns he mentions I have found many other uncommon plants within about half an hour's walk from the station, such as:—*Thalictrum flavum*, *Trollius europæus*, *Helleborus viridis*, *Draba incana*, *Silene nutans*, *Hypericum montanum*, *Geranium sanguineum*, *G. pratense*, *G. columbinum*, *Rhamnus catharticus*, *Prunus Padus*, *Sanguisorba officinalis*, *Poterium Sanguisorba*, *Potentilla verna*, *Rubus cæsius*, *R. saxatilis*, *Geum intermedium*, *Rosa tomentosa*, *R. arvensis*, *Pyrus Aria*, *P. rupicola*, *Ribes Grossularia*, *R. alpinum*, *R. rubrum*, *Sedum Telephium*, *Saxifraga granulata*, *S. hypnoides*, *Parnassia palustris*, *Pimpinella magna*, *Cornus sanguinea*, *Galium sylvestre*, *Scabiosa Columbaria*, *Carduus nutans*, *C. crispus*, *C. heterophyllus*, *Carlina vulgaris*, *Serratula tinctoria*, *Lactuca muralis*, *Campanula Trachelium*, *C. latifolia*, *Ligustrum vulgare*, (not in or near hedges,) *Gentiana Amarella*, *Calamintha Acinos*, *Myosotis collina*, *Polygonum Bistorta*, *Taxus baccata*, *Blysmus compressus*, *Phleum nodosum*, *Avena pubescens*, *Kœleria cristata*, *Melica nutans*, *Poa nemoralis*, *Aspidium lobatum*, *Botrychium Lunaria*, and many other good plants. I have found a few miles further up Chee Dale, towards Buxton, *Hutchinsia petræa*, *Cardamine impatiens*, *Polemonium cœruleum*, *Draba muralis*, *Mimulus luteus*, &c. I have only paid flying visits to the neighbourhood alone, and therefore do not pretend to know all the rare plants.—Wm. West, Bradford.

A Hybrid Fern.—In the February number of "The Midland Naturalist," (p. 52,) an account was given of a supposed hybrid fern, which had produced spores. These spores, after being sown, appeared to produce prothallia, but it has since turned out that the latter had sprung from other spores accidentally introduced, as often happens to fern-growers.—W. B. G.

Signs of Early Winter.—A flock of fieldfares, (*Turdus pilaris,*) the first I saw this season, numbering about twenty, flew over Handsworth Parish Church about nine o'clock on Tuesday morning, 28th October last. The temperature fell during the day, and in the evening, at half-past nine o'clock, there was a heavy snow storm.—W. R. H., Handsworth Wood, 21st November, 1878.

Gleanings.

The British Association.—The meeting at Sheffield next year will begin on August 20th, and not on the earlier day previously announced.

"The Art of Scientific Discovery" is the title of an important new book (648 pp.) by Mr. G. Gore, LL.D., F.R.S., of Birmingham, just published by Messrs. Longmans and Co.

The Sphagnaceæ, or Peat Mosses of Europe and North America, by Dr. Braithwaite, an octavo volume, illustrated with twenty-nine plates, is announced by Messrs. Hardwicke and Bogue.

Mr. Charles R. Thatcher, the well-known conchological collector, started a few months ago on an extended foreign collecting tour. He was attacked suddenly by fever, and died a few days after his arrival at Shanghai.

The Rev. M. J. Berkeley, M.A., F.L.S.—A portrait of this eminent fungologist, painted by Mr. Peele, at the instance of a number of Mr. Berkeley's friends, was recently presented on their behalf to the Linnean Society by Sir Joseph Hooker.

Do Leaves absorb Water?—The Rev. Geo. Henslow read a paper on this subject at the Linnean Society on the 7th November, in which he replied to the question affirmatively, and detailed the experiments he had made. He pointed out that the practical issue of what he proved is that syringing is not merely beneficial to plants in that it cleanses them and cools the air about them, but that the water is actually absorbed by the leaves.

The Royal Society Medals for the present year have been awarded as under:—The Copley Medal to M. Jean Baptiste Boussingault, for his long-continued and important researches and discoveries in Agricultural Chemistry; a Royal Medal to Mr. John Allan Broun, F.R.S., for his investigations in Magnetism and Meteorology, and for his improvements in methods of observation; a Royal Medal to Dr. Albert Günther, F.R.S., for his contribution to the Zoology and Anatomy of Fishes and Reptiles; the Rumford Medal to M. Alfred Cornu, for various optical researches, and especially for his recent re-determination of the velocity of propagation of light; and the Davy Medal to MM. Louis Paul Cailletet and Raoul Pictet, for their researches, conducted independently but contemporaneously, on the condensation of the so-called permanent gases.

Hybridisation.—From the "Herefordshire Pomona" we glean the following interesting facts as to the results of some of the fertilisation experiments made by Thos. Andrew Knight. From pips or seeds of the Orange pippin apple fertilised by pollen of the Golden pippin he obtained the Grange pippin (1802,) Downton pippin (1804,) Red Ingestrie (1800,) and Yellow Ingestrie (1800.) The two last-named apples were not only derived from the same parentage, but actually sprang from two pips which occupied the same cell in the same apple. From pips of the Siberian crab, fertilised by pollen from the Orange pippin, were produced the Yellow Siberian (1805,) the Siberian pippin (1806,) and the Foxley apple (1808.)

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—Geological Section.—October 22nd. Some specimens of rocks from Malvern, sent by the Rev. W. S. Symonds were exhibited, and the thanks of the section were ordered to be sent to that gentleman. The section determined to take part in the scheme for the united examination of the glacial deposits of the midland counties, as proposed by Mr. W. J. Harrison, and appointed the Rev. H. W. Crosskey as secretary of the committee, to whom all communications may be addressed. Mr. C. J. Watson exhibited specimens from the carboniferous limestone of Yorkshire. Mr. Wilkinson showed some beautiful fungi from Malvern. Mr. T. H. Waller read some notes on specimens of rocks from Shetland and Orkney, and showed specimens and microscopic sections of them.—General Meeting.—November 5th. Mr. Montagu Browne exhibited two beautiful butterflies *(Morpho Cypris)* from Brazil. Mr. J. Bagnall exhibited microscopic slides, illustrating free cell formation and cell formation by merismatic division of protoplasm; he also exhibited one of the Hepaticæ, *Riccia glauca*, new to the district; *Mnium cuspidatum*, in fruit, from Sutton Park; and a number of rare plants, amongst which were the following: *Euphorbia Peplis*, *Corrigiola littoralis*, *Frankenia lævis*, *Lysimachia thyrsiflora*, *Ophioglossum ambiguum*, &c. Six beautiful slides were exhibited and presented to the society, together with a full description of the way in which they had been mounted, from Mr. F. W. Sharpus, of London. They consisted of the following: *Bugula flabellata*, *B. plumosa*, *Vanessa Urticæ*, Pedicellariæ of *Uraster glacialis*, *Bombyx mori*, and Palate of *Buccinum*. A cordial vote of thanks was passed to Mr. Sharpus.—Biological Section.—November 12th. Mr. J. E. Bagnall read "Notes on Plants Collected this Season," with special reference to their distribution—first, in Warwickshire; second, in Great Britain; and third, over the general surface of the globe. He also reviewed the several hypotheses which have been advanced to account for plant-distribution, summarising the theories proposed respectively by Linnæus, E. Forbes, Hooker, and Darwin. The paper was illustrated by a large and beautifully mounted collection of rare plants, collected during the past season in new Warwickshire stations, such as *Potamogeton zosterifolius*, *Vicia gracilis*, *Agrimonia odorata*, *Centunculus minimus*, and many others of equal rarity. Mr. T. Bolton gave "Notes on the Examination of Rotifers and Infusoria under the Microscope," in which he dealt with the manipulations necessary in isolating and observing the motile and fixed forms of these organisms severally, the use of various kinds of live-troughs, compressoria, and other contrivances for facilitating their investigation under the microscope, &c., illustrating his remarks by the selection and exhibition of a variety of such animals, *e. g.*, *Stephanoceros Eichhornii*, *Stentor Mülleri*, *Limnias ceratophylli*, *Vorticellæ*, *Philodina roseola*, &c., &c. Both the papers of the evening elicited considerable discussion.

BIRMINGHAM AND MIDLAND INSTITUTE SCIENTIFIC SOCIETY.—October 30th. Mr. J. Levick read a paper on Microscopical Apparatus. In the course of it the purchase of cheap binocular instruments was deprecated, as they generally proved unsatisfactory, so that unless a considerable outlay could be made it was better to buy a monocular. One common source of mischief was pointed out, namely, that the two eyepieces, although meant for a pair, are frequently of different focal power, and thus produce images of different sizes; so that the eyes in trying to combine these two images suffer more harm than from a monocular The paraboloid and other adjuncts were described, and their uses illustrated.—November 13th. Mr. A. Cresswell described a new method of Automatic Railway Signalling invented by himself. In this method, which is worked entirely by electricity, there is required a metallic conductor electrically insulated, running along the whole length of the railway, with which, by means of a metallic brush or friction wheel, the engine makes connection. This conductor is divided into sections of convenient length—such as a mile—and wires connect each of these segments with the automatic signalling instrument at the nearest convenient station. When a current passes through a segment and the engine on it, an all-right signal is exhibited on the engine to the driver; but the action of the current passing is also by means of an electro-magnet in the station instrument made to break the electrical circuit in the segment behind the train; and, therefore, on an engine entering this segment, its indicator will fly to danger. The breakage of a conductor or failure of a battery will also put the indicator to danger, and thus, though it may delay the train, will render a collision impossible. The position of any train on the line can at any time be ascertained by simply inspecting the station instrument, although the instrument itself requires no one to attend to it. The details were fully explained by Mr. Cresswell, by the aid of a working diagram; and he also promised that a working model should shortly be exhibited to the public.

BURTON NATURAL HISTORY AND ARCHÆOLOGICAL SOCIETY. —The Winter Session was opened on the 22nd October by a Conversazione, which was held at St. George's Hall. There was a large number of exhibits, biological, geological, archæological, and scientific. A very pleasant evening was spent, to which the singing of the Burton Glee Club agreeably contributed.

EVESHAM FIELD NATURALISTS' CLUB.--The Annual Meeting was held on the 30th October, the Rev. J. C. Odgers in the chair. The Hon. Secretary (Mr. G. New) read the annual report, by which it appears the number of members has decreased to twenty-eight, compared with thirty-two last year. During the past season there were excursions to Tiddesley Wood, Dovedale, Buckland Woods, the Abbey Manor Grounds, and to Worcester Natural History Museum. The evening meetings were held once a month throughout the winter. The financial position of the Club is reported to be satisfactory. Mr. John Gibbs was re-elected president, and Mr. J. S. Slater treasurer. Mr. E. B. Martin was elected hon. secretary, and a vote of thanks was accorded to Mr. Geoffrey New for his services during the past two years. The Rev. J. C. Odgers, Mrs. Martin, and Messrs. A. H. Martin and T. E. Doeg were elected to form the committee. On the secretary reporting the receipt of papers from the Hon. Secretary of the Midland Union of Natural History Societies on the subject of the examination of the glacial deposits of the Midland Counties, he was instructed to send a copy to Mr. Winnington Ingram and Mr. Gibbs, with a request that Mr. Ingram would represent the club.

NOTTINGHAM LITERARY AND PHILOSOPHICAL SOCIETY.— NATURAL SCIENCE SECTION.—October 18th. Mr. A. Bush read a paper on the "Morphology and Physiology of a Freshwater Mussel." November 8th.—Mr. E. Smith, M.A., read a paper on "Infusoria," illustrated by photographic and other lantern slides. This paper is printed in the "Midland Naturalist" for November and December. November 15th.—Microscopical meeting; subject: "Fresh-water Life."

NOTTINGHAM NATURALISTS' SOCIETY.—The following meetings have been held:—October 16, Lecture on Coal, by C. T. Musson; November 6, Lecture on the Phonograph, by Mr. A. H. Simpson; November 13, Special General Meeting, at which "The position of the Society with regard to other Nottingham Societies" was the subject of discussion.

RUGBY SCHOOL NATURAL HISTORY SOCIETY.—October 19th.—The President announced that "Tree No. 10," in the School Close, had ceased to exist, and exhibited fragments from the inside of it. The holiday collections of Lepidoptera, the prize for which was gained by E. Solly, (A,) were also exhibited. The Rev. T. N. Hutchinson read a most interesting paper, illustrated by sketches made on the spot, of the "erratics" on "Norber," an outlying spur of Ingleborough, Yorkshire. He exhibited a fine *Septaria* stone from the shales of Penyghent. J. M. Wilson, Esq., read a letter from Mr. H. V. Ellis, once head of his XI., now headmaster of a young Rugby in Natal. Mr. Ellis said he should be very glad to exchange specimens, &c., with Rugby, and Mr. Wilson proposed to send him a collection of views of his old school. G. Jones (M.) gave a short account of a curious formation discovered by T. B. Oldham and himself in a brook below Shawell Church (Leicestershire) It is probably a recent formation, though Jones thought it pre-glacial. L. Cumming, Esq., exhibited a rare orchis from Gloucestershire, *Cephalanthera rubra*, and a curious monstrosity. He then read a most interesting paper on the appearance and disappearance of some flowers. The President compared the case of the erratic appearances of some butterflies. M. H. Bloxam, Esq., exhibited a plant of the *Eucalyptus globulus*, some fragments of church tiles discovered in the parish church, also some from his own collection, and some coins and counters, one from Nuremburg, from the Church.—November 2nd. The President made various exhibitions. Mr. Percy Smith read a very interesting paper describing sugar making from first to last. Mr. Bloxam said Lawrence Sherriffe (founder of Rugby) presented Queen Elizabeth with a sugar-loaf as a new year's gift. H. J. Elsee (M.) read a paper on "Cromlechs," describing some remains he visited near Barmouth, N W. C. E. Sayle (A.) read a paper describing a curious building he visited in the holidays near Oulton Broad, Suffolk; he also described Blunderton Church, made so famous by Dickens. J. Lea (M.) read an interesting paper on "Attractions for Moths." The President discussed the paper and the subject of "Moth Traps." Mr. Bloxam exhibited an Irish pike, 1798; improvised Hungarian swords; Joseph Addison's sword; and made some remarks on the subject.—November 16th. The President read a note from H. W. Trott (C.) on the flora of Napton-on-the-Hill; also a note from the Uppingham Natural History Society relative to a joint excursion of the two societies. The Rev. T. N. Hutchinson exhibited and explained a Jablochkoff's electric candle; also some photographs of Vesuvius in eruption. Mr. Cumming read a note on a curious growth of shoots from a tree recently cut down in the Hillmorton Road. L. F. Carleton read a practical paper on "Aquariums," discussing how to make, decorate, and stock them. The best form is an oblong, about five feet in length and 1 foot 6 inches across, with one side only of glass and the rest slate. He described the seven best fish for an aquarium, viz., stickleback, gudgeon, minnow, perch, roach, carp, pike. Mr. Hutchinson said he had kept a marine aquarium for eighteen years now, and gave some account of it. C. E. Sayle (A.) remarked on the effect music has on the fish in the Society's aquarium. Mr. Bloxam exhibited a fragment of a Roman mortarium, from Cave's Hill, with the stamp of Moricam. This is unique. Also some Shakespeare relics. He gave a description of the way MSS. were prepared for the press. He then exhibited a bag of Roman coins, some of which he distributed to the Society *passim*. The next meeting was fixed for November 30th. No more excursions will take place till spring.

STROUD NATURAL HISTORY AND PHILOSOPHICAL SOCIETY.—November 12th.—The "Ammonia System" of water analysis was exhibited and demonstrated by Dr. Partridge, and the "Decomposition of Water by Electrolysis," by Mr. Paul Smith.

EXCHANGE.

Collections of Land and Freshwater Shells (up to seventy species,) chiefly Nottinghamshire, are offered for Natural History Text Books. Want Turton's British L. and F.W. Shells and Geological Books principally.—C. T. MUSSON, 68, Goldsmith Street, Nottingham.

Wanted to Exchange, good Tertiary Fossils, in splendid preservation, for good specimens found in the Silurian and Carboniferous formations.—J. MARRIOTT, Fleckney, Market Harborough.