TRANSACTIONS

OF THE

LEEDS NATURALISTS' CLUB

AND

SCIENTIFIC ASSOCIATION.

1886.

PRICE 2s. 6d.

LEEDS:
PRINTED BY McCORQUODALE & CO. LIMITED.
1886.

The Leeds Naturalists' Club,
and Scientific Association,
40 Greenmount Place, Beeston Hill

Leeds, August 15th 1887

Dear Sir,

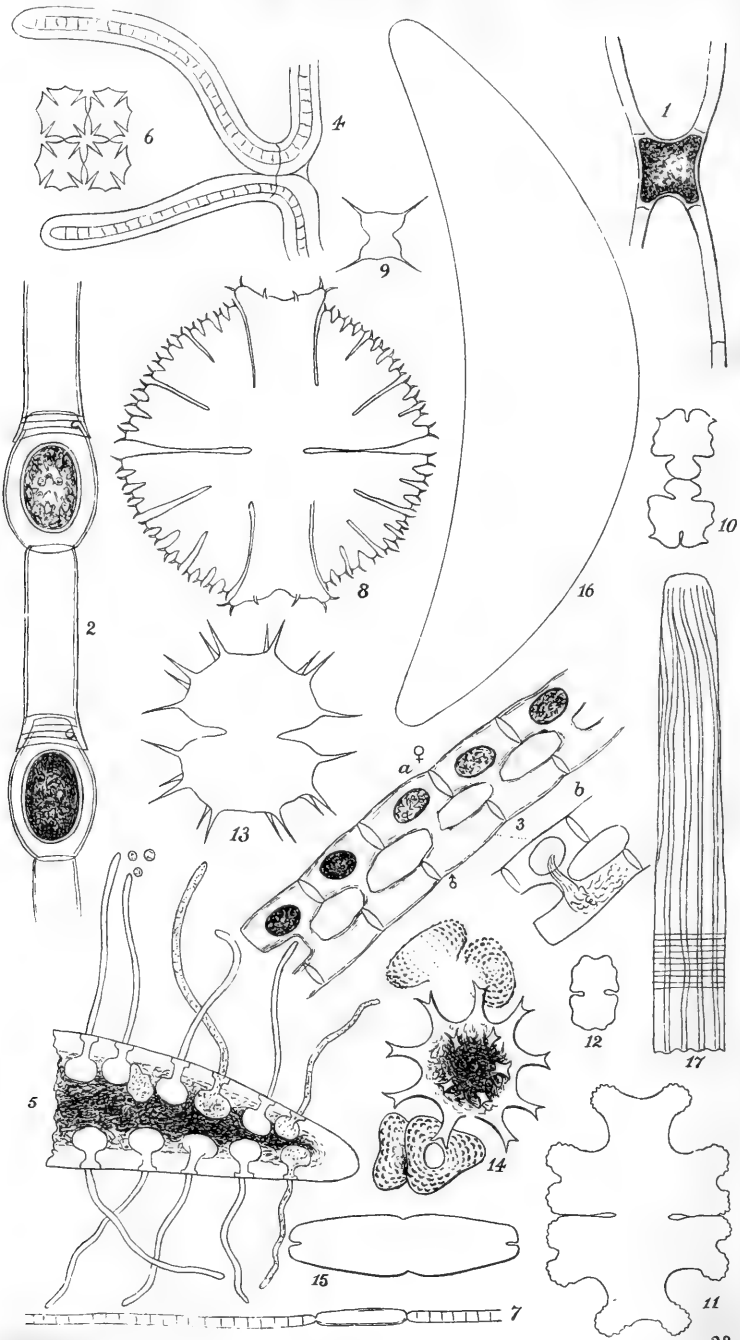
I must apologise for the long delay in replying to your letter of the 15th ult., which appears to have been delivered at my house the day after I left for the vacation. I have great pleasure in forwarding herewith a copy of our Proceedings for 1885 — the latest as yet published — and I will send a copy of ~~the~~ last year's Proceedings as soon as ready.

I am
Yours faithfully
Thos. W. Cox
Hon. Sec.

B. B. Woodward Esq.
British Museum


BRITISH MUSEUM
NATURAL HISTORY.

FRESH WATER ALGÆ.



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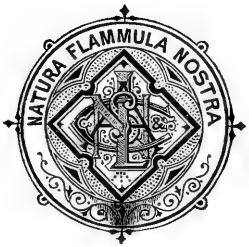

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CONTENTS.

LEEDS NATURALISTS' CLUB AND SCIENTIFIC ASSOCIATION.

RETROSPECT, 1878 TO 1884.

A SPACE of seven years having elapsed since the last annual publication of the Club, the Council recently resolved that an abstract of the more noticeable events of this period should be included in these proceedings.

1878.—During this year the membership of the Club was 167. The local collection received considerable attention, and the Herbarium, the oldest work of the Club, was enriched by the addition of thirty-eight species. Nine species were added to the Conchological collection, twenty-two to the Lepidoptera, and five to the Coleoptera. A marked feature of this period of the Club's existence, was the activity shown by the sections, as follows:—Botanical, Entomological, Zoological, and Microscopical. The special attention given by the Microscopical section to the Algæ of the district resulted in the identification of a large number of local species, many of which will be found recorded in the lists given in this volume. During the year, the rule relating to excursions, which stipulated that not less than six should be held annually for the investigation of the natural history of the West Riding, was rescinded, and a resolution, limiting the excursions to those of the Yorkshire Naturalists' Union, was adopted.

1879.—The Tenth Annual Report showed continued efficiency in sectional work, and many additions to the Library. In connection with the Microscopical section may be mentioned the publication of Mr. Turner's Catalogue of the Freshwater Algæ of the district. The Entomological section was busily employed in preparing their

material for publication. The approaching issue of "The Birds of Yorkshire," by Mr. W. E. Clarke, M.B.O.U., a member of the Club, was noted in the President's Address.

1880.—It is of interest to note that during this year a distinct advance was made in the direction of one of the Societies' principal objects—viz., the compiling of a Fauna and a Flora of the district. For nine years this had appeared on the syllabus, without any material progress. The Annual Report, as recorded in the Minute Book, states that all available information had been diligently collected from every source. It had also been intended to publish the lists for a portion of the area during the year, but when the manuscript was completed it was found that so many more species had been recorded than had been expected, that it was decided to defer its publication in order to allow time to prepare the lists for other portions of the area on a similar plan, with the view of issuing the whole together.

1881.—The most important event of this year was the holding of a successful Conversazione, a leading feature of which was the exhibition of objects under about fifty microscopes, by members of the Club and their friends, and a most interesting collection of Natural History exhibits, which were much admired. The activity of the various sections continued to add much information to that already compiled for the projected Fauna and Flora. Mr. Roebuck having vacated the office of Secretary, after a long and successful term of office, Mr. H. Pollard was appointed his successor; and a testimonial presented to Mr. Roebuck, evidenced the Club's appreciation of his labours on its behalf.

1882.—During this year the publication of a Diary of Natural History observations was commenced in the columns of the local weekly papers, with the view of increasing the interest of the general public in the special work of the Club. The Club definitely pledged itself, by issuing a printed circular, to undertake the early publication of the Fauna of Leeds and district. This circular was well responded to, and a considerable list of subscribers to the work was obtained. Another section of the Club, the Photographic, was formed, which attached to it about fifty amateur photographers, and increased the number of members to 225, the highest up to that time recorded.

1883.—The meetings of the various sections, with the exception of the Photographic, was discontinued this year, and the sections were merged into the general meetings of the Club. A very successful

social and scientific gathering commemorated the 500th meeting of the Club. Addresses were given by members and their friends on scientific and allied subjects, and many objects of interest were shown. Although it was not possible to publish the Fauna during this year, progress was made with the work; and the Honorary Treasurer reported that the sum of £10 had been expended in connection with the proposed work, during that and the preceding year. Towards the end of the session, the Photographic section deemed it advisable to resuscitate the former Leeds Photographic Society, one of the earliest in the kingdom, and applied to the Council with that object through its representatives, and eventually a separate society was formed on an independent basis.

1884.—During the earlier part of this year a change was made in the place of meeting of the Club; the room occupied at the Leeds Mechanics' Institute, the use of which had long been granted on liberal terms, not being suitable for all the requirements of the Club, especially lectures, the Library at the Philosophical Hall for meetings, and the Theatre for lectures, were therefore secured. The Rules of the Club were revised, one of the alterations being that the area for the Society's work, which had previously been defined as the West Riding of Yorkshire, was restricted to certain districts—viz., Leeds Borough, Leeds outer-ring, Permian Limestone tract, Nidderdale, Upper Wharfedale, Washburn, and Middle Wharfedale. The Botanical and Zoological collections of the Club, in consequence of the want of proper cases and the necessary space, were handed over to the Philosophical Society absolutely.

Sixteenth Annual Report of the Council.

It is with much pleasure that the Council is able to congratulate the members on the progress, and consequent usefulness, of the Club.

Membership.

In respect of membership, a notable increase has taken place, attributable partly to the special effort made by the Council early in the year to bring the objects of the Club prominently before the public, and enlist their sympathy and co-operation, and also to the increased interest shown by the members personally, in the welfare of the Club. During the year, 43 new members have been admitted, making the number at present on roll 175, of whom 19 are honorary members.

Location of the Club.

One of the clauses in the agreement made with the Philosophical and Literary Society—viz., that which makes the engagement of the Library and Lecture Hall by the Naturalists' Club subject to any other engagement of the Philosophical Society—has been found in practice to work very much to the detriment of the Club, and the Council have, on many occasions, been obliged to hire rooms elsewhere. This has entailed extra expense and inconvenience to the members, the books and apparatus of the Club not being available at these altered meetings. The Library and Lecture Hall, when available, have met the requirements of the Club most admirably, and the Council desire to place on record their thanks to the Philosophical and Literary Society for the uniform kindness the Club has received.

A suggestion that the Club should endeavour to obtain a suitable room from the Leeds Corporation, was warmly supported by the Council, with the result that the President and Messrs. Addyman, Branson, and Stubbins were appointed a committee to confer with the Corporate authorities. The Corporate Buildings Committee, with a cordial appreciation of the aims of the Club, met our proposals in a most kind and generous way, and granted a suitable room in close proximity to the Public Reference Library, and the consequent increase in the resources of the Club will in future be available for meeting the expense of printing the various proposed publications.

During the negotiations, the Council have undertaken, on the part of the Club, to commence the formation of a local collection, to illustrate the natural history of the district and the publications of the Club. With this further object in view, the Council hope that the number of specimens exhibited at meetings of the Club will be largely increased, and typical specimens presented to the Museum.

Publications.

It is proposed to print, early in the year, the present Annual Report, with an abstract of the reports for the years 1879 to 1884 inclusive; also lists of books and members, as well as the rules and transactions of the present year; several original papers by members of the Club will also appear. The Council hope to be able shortly to make a definite statement as to the publication of the Fauna, which has long received the attention of the Club, and to the production of which a distinct pledge has been given.

The following gentlemen have promised their valuable assistance in the preparation of this work, viz.:—Messrs. W. E. Clarke, M.B.O.U., F.L.S., J. Grassham, B. Holgate, F.G.S., W. Nelson, W. D. Roebuck, F.L.S., J. W. Taylor, W. H. Taylor, B.A., and W. Barwell Turner, F.R.M.S. In addition to the Fauna, the Council has, during the year, initiated a Flora for West Yorkshire. Considerable progress has already been made with the work, and the help of a number of Natural History Societies within the area has been obtained, together with the assistance of Messrs. J. Abbott, F. W. Branson, F.C.S., G. Hainsworth, W. Kirkby, G. Paul, F.G.S., J. Stubbins, F.G.S., F.R.M.S., W. Barwell Turner, F.C.S., F.R.M.S., and W. West.

Meetings.

At the beginning of the year the Council arranged that the first meeting in each month should be of a special character, and should be devoted to the exhibition of a variety of specimens by the members, a special syllabus being issued; that the third meeting in the month should be devoted to sectional work for a portion of the evening; and that the intermediate meetings should be of an informal conversational character. The Council, however, subsequently modified the scheme, by arranging for a series of short papers on various subjects, on the evenings set apart for intermediate meetings. These papers have proved eminently successful, and the reports of them, which have appeared in the *Leeds Mercury Weekly Supplement*, have contributed not a little towards attracting new members and keeping the existence of the Club prominently before the public.

The following papers have been read :—

"A Visit to Canada."	By	Mr. H. Marsh, F.R.C.I.
"Sunspots and Coronæ."	,,	,, J. W. Addyman, B.A.
"Desmids."	,,	,, W. Barwell Turner, F.C.S., F.R.M.S.
"Limax maximus."	,,	,, W. Denison Roebuck, F.L.S.
"Foraminifera."	,,	,, J. Stubbins, F.G.S., F.R.M.S.
"Bacteria."	,,	,, F. W. Branson, F.C.S.
"Fertilization of Flowers."	,,	,, G. Paul, F.G.S., &c.
"Electric discharges in rarefied Gases."	,,	,, T. Fairley, F.R S.E., F.C.S., F.I.C.
"Results of Explorations of East Yorkshire Kitchen-middens."	,,	,, H. Bendelack Hewetson, M.R.C.S.
"Occurrence of Echinococcus in Yorkshire."	,,	,, F. W. Greenhalgh, M.R.C.V.S.
"Microtomes."	,,	,, F. W. Branson, F.C.S.
"Notes on the Flora of Leeds and District."	,,	,, J. Abbott.
"Points of Comparison between Limestone Flints and Iron-stone Nodules."	,,	,, B. Holgate, F.G.S.
"The Chrysanthemum."	,,	,, G. Paul, F.G.S., &c.
"Scraps of Nature from Norway."	,,	,, J. W. Addyman, B.A.
"Egyptian Zoology and pre-historic Archæology of the Sahara."	,,	,, H. Myddelton Gavey, M.R.C.S.
"Section Cutting."	,,	,, J. Stubbins, F.G.S., F.R.M.S.

With regard to the character of the papers read, the Council did not desire anything of a very formal or elaborate nature, but only such a popular introduction of the subject as should lead to a profitable and instructive conversation. All the papers, however, have been most carefully prepared, and the Club has on each occasion expressed its cordial appreciation of the efforts of the above-named gentlemen. A lecture was also delivered, in the spring session, by the Rev. E. P. Knubley, M.A., of Staveley, on his "Visit to Canada in connection with the meeting of the British Association at Montreal," illustrated by drawings from the pencil of Mrs. Knubley, and many interesting specimens of Indian weapons and work.

Library.

The additions to the Library have been the usual serial publications—"Science Gossip," "The Naturalist," "Illustrations of British Fungi," "Quarterly Journal of the Postal Microscopical Society," &c.; and at the beginning of the year a number of valuable books were purchased of Mr. J. R. Murdoch, an old and

valued member whose failing health obliged him to seek a more genial climate in Australia. The following Reports and Transactions of various Natural History Societies have also been received during the year, viz.:—

"Report of Botanical Record Club."
"Annual Report of Brighton and Sussex Natural History Society.
"Transactions of the Eastbourne Natural History Society."
"Transactions of the Edinburgh Botanical Society."

A proposal to entrust the Club's Library to the care of the Library Committee of the Corporation as part of the Reference Library has been favourably received, and if carried out will enable the members to borrow the books of the Club at any hour of the day as freely as any part of the Corporation Lending Library, while the Club will be relieved of the duty of the custody and issue of the books.

Excursions.

Besides the excursions of the Yorkshire Naturalists' Union, which have been very well attended by members of the Leeds Naturalists' Club, there have been excursions to Pateley Bridge on May 16th, to Adel Bog on October 10th, and to Mr. Ruskin's Museum at Sheffield on October 24th. This last excursion was much appreciated by the large number of members (over 40) who took part in it, and will long be remembered for the exceptional interest of the exhibition, and for the kindly manner in which the members were received by the Curator (Mr. Henry Swann) and his family. The Club also had the advantage of the presence of Dr. Clifton Sorby, F.R.S., who took considerable pains in describing the various objects of interest. The Museum was again reverted to at the following monthly meeting of the Club, when Mr. Washington Teasdale gave an interesting address on the "True Spirit of the Ruskin Museum," and read extracts from Mr. Ruskin's works.

Social Gathering.

As usual the new year was inaugurated by a social gathering, held in Powolny's Rooms on January 31st, when the President gave an opening address, and a testimonial was presented to the late Hon. Secretary, Mr. H. Pollard, as an expression of the Club's appreciation of his services during the previous four years.

It is proposed to commence the session of 1886, and inaugurate the opening of the new room, by a conversazione, in which it is hoped that several other Societies, both in Leeds and the County, will take part.

H. BENDELACK HEWETSON,
President.

December 11th, 1885.

Abstracts of Papers and other Proceedings

OF THE

LEEDS NATURALISTS' CLUB AND SCIENTIFIC ASSOCIATION.

FEBRUARY 20TH, 1885.

EXHIBITS.

W. Denison Roebuck, F.L.S., exhibited two adult and one immature specimen of the true sand lizard (*Lacerta agilis*) from Southport, and sent to him by Mr. G. T. Porritt. The locality named is perhaps as far north as the species ranges in England. W. D. Roebuck has on different occasions had various "sand lizards" forwarded to him, but except in the present instance, all have proved to be the common lizard. On behalf of John Wood there was exhibited a fine collection of Hellebores in bloom, from his garden at Kirkstall. Amongst many others were specimens of *Helleborus niger*, *H. maximus*, *H. atrovirens*, *H. Olympicus*, *H. orientalis*, *H. abchasicus*, *H. dumetorum*, *H. purpureus*, *H. argutifolius*, and *H. fœtidus*. There was also shown on his behalf, a number of other winter plants in flower, including *Galanthus nivalis*, *G. imperati*, *Cyclamen coum*, *Eranthis hyemalis*, *Petasites vulgaris* var. *fragrans*, *Crocus imperati*, *Hepatica angulosa*, *H. triloba*, and *Saxifraga burseriana*. Chas. Smethurst exhibited examples of green-veined white, and dark green fritillary butterflies from Ledsham Park; the Northern Swift, Purple Bar Carpet, Red Twin Spot Carpet, Dark-barred Twin Spot Carpet, Barred Yellow, Sallow, Pink-barred Sallow, and scarce Silver Y. moths, from Ilkley Moor; the Buff Ermine and the Grey Chi moths, from Leeds; the Oak Eggar moth, from Adel Moor; the lesser Swallow prominent moth, from Bramley; *Nonagria fulva*, from Sherburn; *Ephyra trilinearia*, from Ledsham; and *Hypsipetes elutata*, from Seacroft. Insects, including the High Brown Fritillary; the large Tortoise-shell, from Adel Moor; and the Camberwell Beauty, from Whin Moor, were also shown on behalf of John Grassham. H. Pollard brought several specimens of the Pearl Mussel (*Unio margaritifera*), from the river Esk, near Whitby. These were compared with examples of the same species, belonging to John W. Taylor, from the river Conway, at Llanrwst. On behalf of the latter, were exhibited the variety *Sinuata* of the mussel from Bordeaux, West Sutherland, and the river Dhoo, in the Isle of Man; and *Unio arcuatus*, from Barnes. W. Nelson showed specimens of *Planorbis glaber*, from a pond at Ackworth; and Walter Raine, the nest and eggs of the Bearded Tit, from Norfolk; also eggs of the Cetti's Warbler.

FEBRUARY 27TH, 1885.

THE REV. E. P. KNUBLEY, M.A., ON "CANADA."

The paper was illustrated by a number of very effective sketches, made *en route* by Mrs. Knubley, and also by a large collection of Indian stone weapons (arrow heads, &c.), and some beautiful specimens of Indian work in birch bark, ornamented with porcupine quills, consisting of models of canoes, toboggans, snow shoes, and a variety of other articles. He also exhibited a number of skins of Canadian birds. The lecturer described, in a popular manner, his journey through Canada to the Rocky mountains, giving much information respecting the geology, natural history, climate, and productions of the Far West. A vote of thanks was most heartily accorded to the Rev. lecturer and Mrs. Knubley.

MARCH 13TH, 1885.

EXHIBITS.

R. W. Rusby exhibited a light-coloured variety of the large Heath butterfly, taken near Harwich, together with other Lepidoptera. Some peculiarities in the marking, colour, and shape of these insects, led to an interesting conversation on the causes of melanic variation in Lepidoptera. W. D. Roebuck, F.L.S., stated that Lord Walsingham had recently spoken on the same subject, in his presidential address to the Yorkshire Naturalists' Union, at Doncaster; and that in his opinion, as the Lepidoptera in high latitudes were generally of such colours as would most readily absorb the warmth of the sun's rays, so in manufacturing districts, where this tendency had been most observed, the insects had taken darker colours for the purpose of absorbing more of the scant warmth of the sun so greatly interfered with, and diminished, by the dense smoke of factories and forges. This view of the subject was generally concurred in by the other speakers, and C. Smethurst promised to show, at the next meeting, some specimens of Lepidoptera taken twenty years ago, and compare them with recent specimens of the same insects. C. D. Hardcastle showed several cases of stuffed birds from Natal, and a Flying Fox, said to have been taken about 200 miles from Durban. As this bat has not previously been noticed as occurring on the continent of Africa, but was found plentifully in Madagascar and adjacent islands, W. D. Roebuck thought that the statement would need verification. W. Nelson showed specimens of *Planorbis parvus*, from Oregon, North China, and other places. W. D. Roebuck exhibited a dissected specimen of *Testacella haliotidea* var. *scutulum*, the dissection showing muscles attaching the body to the skin. It was noticed that the muscles were chiefly on the left side. W. Booth brought a living specimen of the Kestrel *(Falco tinnunculus)*, which had been taken from the nest when very young, and had become quite tame during the three years it had been in his possession.

March 20th, 1885.

EXHIBITS.

On behalf of Wm. Storey, of Pateley Bridge, was shown a specimen of the Black-headed Gull *(Larus ridibundus)*, in winter plumage, which had been taken at Brimham, out of a flock of seven; and a couple of male specimens of the Great Water-beetle *(Dyticus marginalis)*, from Pateley Bridge. W. Booth showed eggs of the Kingfisher, and of four species of Shrike. C. Smethurst brought a number of Chrysalides of Lepidoptera, from Burley, Leeds, including the Puss Moth *(Dicranura vinula)*, in their well-known bark cocoons; he showed also cocoons of microgaster, the familiar parasite on the common large Cabbage White Butterfly; pupæ, from Selby, of *Notodonta ziczac*, and *N. dictæa;* male and female specimens of *Phigalia pilosaria*, and males of *Hyberia progemmaria*, taken near Horsforth. F. Emsley exhibited slides of *diatoms* and *rotifers*, and of *Euglena viridis*, from Beeston.

March 27th, 1885.

EXHIBITS.

W. Barwell Turner, F.R.M.S., brought some valuable illustrated works on Algæ, viz., Perty's *Kleinster Lebensformen*, Nägeli's *Algen*, and Wood's *United States Algæ*. On behalf of Jas. Walker, Esq., J.P., was exhibited a very old microscope, a fine example of 18th century work. The objectives were all single lenses, and the instrument was accompanied by curious objects, which were mounted dry between talc plates. F. W. Branson, F.C.S., exhibited a parasite taken from the dorsal fin of a roach.

April 10th, 1885.

EXHIBITS.

The President exhibited a number of Lepidoptera recently received from Ohio; and Washington Teasdale, F.R.M.S., brought a number of very beautiful micro-drawings, executed by the late Mr. G. F. Chantrell, of Liverpool.

April 25th, 1885.

H. MARSH on "THE NORTH-WEST OF CANADA."

It was an account of an excursion made under the auspices of the British Association during their meeting in Montreal in 1884. The route, which was over the Canadian Pacific Railway, via Toronto, Lake Superior, Winnipeg, and Calgary, to the Rocky Mountains, was described, and the various events of the journey touched upon. Attention was then drawn to the geographical aspect of the country, and the general characteristics of some of the tribes of Indians, whom the members of the party had an opportunity of observing; the form of government was also explained.

The lecturer next dwelt upon the productions of the soil, and the richness of the North-West in the departments of Botany, Geology, Entomology, and Ornithology.

An account was given of Lakes Huron and Superior, on the shores of which lakes the flora is of a sub-Arctic type, the physical conditions of a large body of cold water, with a low temperature and moist atmosphere, somewhat resembling those on the shores of the Gulf of St. Lawrence. Inland, however, the flora is of the ordinary Canadian type, more Asiatic than European. Two forms of mirage, seen on Lake Superior and on the prairies, were described.

In passing some small lakes on the prairies a few pelicans were seen, and the manner in which these birds feed is very interesting. Having congregated in a sufficient number on the edge of a small lake, they formed into a line and walked into the water. Packed very closely in this way, they drive the fish all into one corner, and a few more birds follow behind the line. One or two then step out of the line, while those behind take their places to prevent the fish escaping, and having filled their pouches, walk out of the water and round again to keep the line intact until their brethren are satisfied, or have caught all the fish.

The prairies are wonderfully rich ornithologically, especially in ducks and geese, which are to be found on all the small sheets of water in myriads. The hawks, too, are remarkably plentiful and in very large variety. The mammals seen were the moose and cariboo deer, prairie dog, chip-munk, many species of foxes, and hares; wild sheep and goats on the mountains; and in the Kicking-horse Pass were pointed out prints in the freshly fallen snow said to be those of the grizzly bear, which is plentiful there still. No buffalo were seen, and there is every reason to fear that this noble animal is already extinct in Canada.

A number of entomological and other specimens, collected by the lecturer, were exhibited, and the paper was followed by an interesting discussion.

MAY 8TH, 1885.

MISCELLANEOUS EXHIBITS.

The first exhibit taken was that of the President, who showed the emerald bird of paradise, which is confined to the island of Aru, and of which the nest and eggs are still unknown. It was supposed, when first described, to have no feet, and was accordingly named *Paradisea apoda*. C. D. Hardcastle showed a most valuable and interesting series of volcanic rock specimens both ancient and modern, including the following:—Specimens 1-6.—Volcanic bomb, varieties of lapilli, ashes, and sand. Bomb lump of lava shot from volcano, rounded by rotating through the air; outward envelope of solid lava, surrounding vesicular ball, filled originally with steam, and which by expansion bursts, and in some cases shatters the bomb, producing lapilli and ashes. Specimen 6. Bomb 5½ lbs., outer shell ¾ in. to

1 in. thick, diameter of inner ball 3 in., diameter of outer shell 5 in. 8. Fine specimen of native sulphur, with geodi lined with crystals. 7. Nepheline, a silicate of alumina and soda from the centre of lava from Monte Somma, with geode lined with beautiful crystals of glassy felspar. 14. Augitic and leucitic lava from the eruption of 1631; upper surface covered with atacamite—native copper. Lavas representing eruptions of various dates. Ancient rocks were shown corresponding in composition with the lavas, but altered by pressure and the absorption of other mineral matter. Mr. Hardcastle's explanation of the projection and formation of volcanic bombs, lapilli, &c., was the same in substance as the following passage from Professor Judd's "Volcanoes" (London, 1881), pp. 69-70:—"Various names have been given by geologists to the fragments ejected from volcanic vents, which, as we have seen, differ greatly in their dimensions and other characters. Sometimes masses of more or less fluid lava are flung bodily to a great height in the atmosphere. During their rise and fall these masses are caused to rotate, and in consequence assume a globular or spheroidal form. The water imprisoned in these masses during their passage through the atmosphere tends to expand into steam, and they become more or less completely distended with bubbles. Such masses, which sometimes assume very regular and striking forms, are known as 'volcanic bombs.' Many volcanic bombs have a solid nucleus of refractory materials. The large, rough, angular, cindery looking fragments are termed scoriæ. When reduced to the dimensions of a marble or pea they are usually called by the Italian name of 'lapilli.' The still finer materials are known as volcanic sand and dust." And the following passage from Professor Phillips's "Vesuvius, 1869:"—"The showers of lapilli, ashes, and dust, which make so large a portion of the mass of Vesuvius, may be regarded as disintegrated lava—crystalline grains or dust separated by the deveilent force of the explosion—the force of steam—pervading some parts, perhaps every part of the fluid mass." Another interesting exhibit was that brought by John T. Beer, F.R.S.Lit., who showed bones and teeth of the hyena, cave bear, woolly rhinoceros, horse, &c., and a specimen of breccia from the Cresswell Caves, near Welbeck. Some of the bones showed the marks of having been crushed by the hyena's teeth. He also showed teeth of the mammoth and of sharks from the marl cliffs of Whitstable, Kent, and a number of small marine shells from a boring made to a depth of fifty feet beneath the Goodwin Sands. Dr. Crowther, of Wakefield, exhibited specimens of two crabs—*Galathea squamifera* and *G. strigosa*—from Cornwall, which had been preserved in a manner that retained the natural colours of the animals. F. W. Branson, F.C.S., showed some interesting abnormal formations of the sweet orange, in which the seeds were of the same fleshy consistence as the remainder of the fruit. J. W. Addyman, B.A., showed some soundings from the North Atlantic, from a depth of 2,150 fathoms, and made in north latitude 34 deg. 23 min. 30 sec., and west longitude 14 deg. 13 min. 0 sec., and a series of mounted slides of the forms contained.

MAY 16TH, 1885.

J. W. ADDYMAN, ON "SUN-SPOTS AND CORONÆ."

J. W. Addyman, B.A. Lond., in the course of his address, gave a brief account of a mode of observing the sun with ordinary telescopes by projecting the image on a paper screen. The general appearance of the surface of the sun was stated to be that of a brilliant white disc, covered with faculæ, which were patches of greater luminous intensity, and gave the surface a flocculent appearance under low powers. Dark spots also appeared on the surface, mainly in two belts lying between 10 deg. and 30 deg. north and south respectively of the sun's equator. The appearance of these spots, and their history, their periodicity, and their connection with magnetic storms and variations, were described, and the theories of Faye and Secchi alluded to. This part of the subject was illustrated on the screen by a reproduction of Professor Langley's drawing of a typical sun-spot. The light-giving surface of the sun—that is, the photosphere—the red layer, called the chromosphere, in which the red prominences or flames are observed, and the corona, or halo of pearly light observed during total eclipses, were successively described. The theories as to the corona, the proofs of its solar origin, and of its constituents as ascertained by the spectroscope, were also discussed, and illustrated by lantern pictures of the corona as observed in various eclipses, and of the red prominences.

The exhibits included an abnormal growth of the common mushroom, consisting of a group of nine of about equal size from the same base, which was found growing on a heap of sawdust. This was brought by W. Barwell Turner, F.C.S., F.R.M.S. W. E. Collinge brought *Clausilia rugosa* var. *dubia*, a white form of *Helix virgata*, and living examples of the Zebra Mussel (*Dreissena polymorpha*). W. J. Fletcher showed living specimens of *Paludina vivipara*, and examples of *Helix pomatia* (the edible Snail) and of *Planorbis contortus*. J. W. Dixon and F. Emsley showed microscopic objects, the former contributing deep-sea organisms, and the latter *Uromyces ficariæ*, the fungus of the pilewort.

MAY 22ND, 1885.

W. B. TURNER, F.C.S., F.R.M.S., ON "DESMIDS."

These are a family of the algæ or waterweeds, microscopic, very minute in size. Their form is very curious; and presents the appearance of rosettes, circles with radiating spikes, lunettes, crosses, and other fantastic and beautiful shapes. The outer coat or membrane of these tiny organisms consists of hardened cellulose, and is in many prettily ornamented with spots, dots, raised bead-like markings, or often scattered over with warts or tiny spines. The membrane contains the "cell-contents" (chlorophyll), of

a brilliant green. With respect to size, a very large specimen is just comfortably visible to the naked eye, the British species ranging from 1-40th of an inch down to 1-2,400th. To make the latter measurement apparent, it may be added that when magnified "500 diameters" or 250,000 times, the length of the specimen will then only appear equal to 21-100ths of an inch. They are formed always in clear water, foul or muddy water knows them not; they prefer open moorland pools and slow, bright streams, in which they are seen in masses adherent to the water plants, stones, or the sandy or peaty bottom, the masses looking like filmy pale green clouds.

These plants are thoroughly cosmopolitan, many of the species being known to exist in the Temperate, Torrid, and Arctic zones alike, apparently being unaffected by extremes of heat or cold.

In the Yorkshire district, Goole, Adel, Cullingworth, Strensall, and Scarborough Mere are well-known haunts of the tribe. Like low forms of algæ, the Desmids multiply and increase by "cell-division"; a strictly vegetative process, in which the semi-cells divide and each throws out a new segment, which rapidly (often in four to six hours) grows like the old one, thus constituting new fronds; but the true reproduction of the family is by "zygospores," which are each formed by the fusion of the contents of two cells, these (like the fronds) are curiously diverse in form, being globular, oval, angular, smooth, with plain or forked spines, &c. These spores remain under water for at least one winter season (probably two), and then burst, the contents growing into fronds or cells like the original ones. In illustration of the species numerous forms were shown (which had been photographed and were exhibited as lantern slides) from the original and most exquisite drawings made by the lecturer. In conclusion, the lecturer begged the members present to study these interesting little plants, as there is much work to be done, and is needed with respect to the British species.

As regards the preservation and preparation of these (and other fresh-water algæ) for micro-examination, the most successful mode of "mounting" seems to be in shallow tin cells, not over $\frac{1}{100}$th inch thick, cemented to the slide with shellac dissolved in *cold*, strong alcohol. Many preservative fluids have been proposed, which all agree in being more or less ineffective; indeed it seems hopeless to attempt to keep Desmids in their pristine beauty, as the brilliant emerald of the chlorophyll soon becomes more or less dulled in time, and should a fluid of heavier specific gravity that 1·1 (water being unity) be applied, the cell-contents contract into shapeless masses. A weak solution of glycerine is useful for many species, but it is hardly a "safe" medium, as glycerine cells have a bad habit of leaking without apparent cause. A useful fluid is—distilled water 70 parts, camphor water 20 parts, saturated solution of acetate of alumina 10 parts. For the red or brown algæ, leave out the camphor water and add three drops per ounce of acetic acid. As Desmids mostly occur in peaty water, the material should be washed repeatedly with clean water,

and, after the addition of each supply of water, allowed to settle; when moderately clean, they may be separated from the filamentous algæ, sphagnum and myriophyllum leaves, &c., among which they exist, by washing and squeezing through coarse "cheese-cloth," a kind of canvas having 22 to 24 threads per inch; by this means a dark, flocculent mass is obtained, rich in these organisms. A little of this may be placed in the cell with some of the fluid, and well stirred, when the Desmids will sink through the supernatant *débris*, which may be skimmed off by a few rapid and gentle touches with a *small* pipette tube. A clean cover glass is then taken, the under-side breathed upon to make it "take" the fluid, excess of which exudes, and is absorbed by a little blotting-paper. The cell is then closed with shellac varnish, two or three *thin* coats of which are applied, and the slide is then ready for finishing. This is effected by a varnish possessing plenty of "body," three coats being applied over the shellac. It is needless to say that the varnish must have no action on the shellac. Unless the mounter is very expert, he should avoid the too-frequently recommended gold-size as either a cement or varnish, as it is rarely good in quality, and when not good is unsafe. Zinc white and dammar is a favourite finishing varnish, but the best one is asphalte-black varnish mixed with a little (10 to 15 per cent.) of India-rubber dissolved in turpentine. Finishing varnishes should be strained through a finely-woven, clean, and dry piece of linen, before use. With care, slides thus prepared will last for many years; *e.g.*, Mr. Turner now possesses slides, in good condition, mounted by the late Henry Webb, of Birmingham, so far back as 1850. Most micro-students seem to avoid fluid mounts; but they will, on trial, be found easy of production, and with a little care will last a lifetime. If the study of these organisms is undertaken, a few dozen cells of different sizes (those taking $\frac{9}{16}$ and $\frac{5}{8}$ inch covers are the most useful), should be kept in readiness for use as required.

At the close of W. B. Turner's lecture, the President (H. Bendelack Hewetson, M.R.C.S.), expressed the gratification which he and other members present had experienced in listening to it; and there was a discussion, in which several members took part.

Several specimens were then shown. J. W. Addyman showed a caterpillar of the Goat Moth (*Cossus cossus*), which had been sent to him from Wimbledon, where a poplar tree infested with these destructive creatures had recently been felled. J. W. Dixon showed various marine shells from Margate, the most noticeable of which was the European cowry (*Cypræa europæa*), the only British representative of a family, whose genera and species abound in tropical and sub-tropical seas. W. J. Fletcher had local specimens of shells, including *Cochlicopa lubrica*, from Woodhouse Hill, Hunslet; *Zonites nitidulus*, &c.; and W. E. Collinge a specimen of *Anodonta anatina*, from Brentford, Middlesex.

MAY 29TH, 1885.

W. DENISON ROEBUCK, F.L.S., ON "LIMAX MAXIMUS."

The exhibits included parasite of Black-headed Gull, shown by G. Hainsworth; section of poplar, showing galleries excavated by larva of Goat Moth (*Cossus cossus*), and three larvæ in cocoon, sent by G. A Hobson, of Wimbledon.

Mr. Roebuck, in his address, stated that he approached the subject from the point of view of the species, as showing how much there was worthy of consideration in connection with even a single organism. *L. maximus* is a slug, the largest of the British species, and one which is well distributed over the British Isles. It ranges over the whole European continent as well, stopping short of the Scandinavian peninsula, and giving place in Eastern Europe to such species as *Limax Schwabi* and *Limax Transylvanicus*. In Italy and Southern Europe its variation is great, and its allies not only numerous, but of large size and brilliant colouration. The systematic position of this animal among its allies was indicated, and hints given as to how best to distinguish the British species. The jaws and lingual ribbons were described, and numerous specimens shown under the microscope. The internal anatomy was merely mentioned in passing, although it was pointed out that the reproductive organs were of great value in fixing the limits of species among these animals. In its habitats this slug was noted as frequenting more especially the immediate vicinity of human habitations, and not so much the open country, like the black and the field slugs. In respect of food, it is omnivorous, its teeth being adapted to a herbivorous and refuse diet. The important subject of variation was then dealt with, it being pointed out that slugs in general, having their specific limits well defined by structural and anatomical characters, offer a wide field for the study of colour-variation. In respect of size it is difficult, without dissection, to know when a slug is adult, and eight inches was mentioned as the greatest length to which this species attains. In respect of colour-variation, it is to be noted that this is normally an animal which has a ground-colour of light brownish ash grey, with superposed markings—spots and stripes—of a much deeper shade, and also with black markings. There is not much variation of ground-colour recorded, except one of a lilac colour, clear and transparent, and an albino. The case is different with the markings, which vary to a considerable extent and degree, both by suffusion or coalescence and by suppression. The typical form of *L. maximus* has spots on the shield and four longitudinal stripes down the body. If these stripes are sinuous instead of being straight, we have the var. *serpentina*. If they are broken in their continuity, they are var. *cellaria*. If still further interrupted, thereby producing a series of four rows of spots instead of four continuous stripes, the var. is *ferussaci*. If both shield and body have irregular spots here and there, we get var. *maculata*. If the two inner bands are complete,

and the two outer ones reduced to a row of dots, we have var. *Johnstoni*. The dark markings may become so prominent as to give the animal the appearance of having five light stripes; this is var. *fasciata*. If the dark markings entirely coalesce, so that the ground colour is entirely obliterated, the animal appears unicolorous, and is var. *obscura*. There are various other varieties, but these are quite sufficient for mention. It will have been seen that the stripes of the body may be broken up into spots; but there has never been an instance known in which the spots of the shield have merged into stripes; the only way these vary is by being confused into marblings. In this way *L. maximus*, even very young ones, may always be distinguished from *Limax arborum*, which at all ages has always a dark stripe down each side of its shield. It was pointed out that not much importance is attached to the numerous colour-variations spoken of, although it was necessary—for clearness and precision—to give them names. In the present state of biological science the study of variation is all-important, and the most trivial ones are by no means to be neglected. Passing to other parts of the subject, it was stated that fossil forms are not known, and that this species does not extend its range so high up the mountains as *L. arborum* or *Arion ater* do. In the English vernacular this species has been called the great slug, from its size, and the leopard slug, from its often being spotted. In conclusion, he stated that he would be glad to receive specimens of slugs in general from all parts of the country, especially Scotland and Ireland, as he and J. W. Taylor were studying their distribution and variation, a task for which a liberal supply of material is indispensable. His remarks were illustrated by many drawings and living and preserved specimens, and numerous microscopic slides of the palates of mollusca.

JUNE 5TH, 1886.

J. STUBBINS, F.G.S., F.R.M.S., ON "FORAMINIFERA."

The literature on this subject is so voluminous that a historical summary is simply impracticable, but one interesting fact is that all the observers in this field of research, between the first English record, that of Hooke in 1665, to 1826, when D'Orbigny appeared, fell into one common error, viz., that they placed the Foraminifera among the mollusca, from a resemblance in some of the forms to the Nautili, until Dujardin in 1835 asserted their affinity to the *Reticularian rhizopoda*.

Modern writers have by common consent classified them, in conformity with characters derived from their shells, into three sections—two calcareous and one arenaceous. The first division, the Imperforata, have shells of an "opaque calcareous substance, having a porcellaneous aspect," and exhibit a brown or amber hue by transmitted light. Some Miliolæ, from soundings 4½ miles in depth, dredged during the Challenger expedition and described by Brady, have a "delicate homogeneous silicious investment," which suggests an affinity to the *Polycystina*.

The second group, the Perforata, are of a "hyaline or vitreous type," and are perforated in nearly every direction by minute holes (*Foramina*), through which the animal passes long filaments, the so-called Pseudopodia. The texture of these shells is firmer than those of the first group, approaching inferior forms of dentine.

The third group is the Arenaceous, the test being partially or wholly formed from sand, varied by the introduction of sponge spicules, or smaller foraminiferous shells, fixed by an animal cement insoluble in caustic potash, suggesting a composition analogous to the chitinous integuments of insects. The tests of this division contain 60 per cent. of silica, and the foreign bodies are incorporated by a layer containing Ferric Oxide and Carbonate of Lime, in variable proportions, the oxide being usually in excess.

These three variations are not confined to particular forms of the shells, for similar contours present themselves in all of them.

In the first division, Imperforata, there are one or two openings, from which the animal protrudes and retracts on the approach of danger, and the animal being within the test, the test is an *exoskeleton;* but in the Perforata, the substance of the shell is traversed by delicate canals *(Foramina)*, which allow the extrusion of the body of the animal in numerous protoplasmic filaments coalescing covering, and enclosing the shell or test, thus having the nature of an *endo skeleton.* Curious to find the two great types of the animal kingdom indicated in such lowly forms.

The simplest adult form is a cell-like shell, "Squamalia," or a discoidal spiral tube, "Cornuspira." The spherical "Orbulina" and flask-shaped "Lagena" are also simple forms, and possessing one chamber are called "Monothalamous," and are the embryonic starting points of all the types. The hard casing covering the animal, once formed, cannot be enlarged to accommodate the growing requirements. This can only be accomplished by additional chambers added to the original one, and thus the Monothalamous forms pass into the Polythalamous. When, with additional chambers, a lineal series results, they are *nodosaria*; if curved, *cornuspira*; if in segments, *rotalia*; or wound round a long axis, *miliola*. If they are irregularly aggregated they are *globigerina*, or the chambers may overlap as in *nummulites.* These calcareous and arenaceous shells are similar to the skeletons of sponges and corals.

It is usual to assign to Haeckel the establishment of a new kingdom, at the base of the Zoological scheme. He certainly, about 20 years ago, proposed his hypothesis, that there existed a third kingdom in addition to the animal and vegetable—a borderland, which he named "Protista"; but as early as 1859, Owen introduced a kingdom, "Protozoa," to occupy the lowest position, and was immediately followed by John Hogg, with his "Protoctista," which included both "Protozoa" and "Protophyta."

Haeckel describes the lowest division of his "Protista," the "Monera," as "not only the simplest, but the simplest conceivable organism, originated by spontaneous generation at the beginning of life upon the earth. They

one and all present us with nothing but a simple lump of an albuminous combination of carbon, each individual particle of which their bodies are composed has been proved, by refined chemical and optical tests, to be an exact counterpart of every other particle composing it." To this class he consigns the Foraminifera. Huxley places the "Monera" in his S.K. "Protozoa," and Pascoe gives S.K. "Protozoa." Class 1.—"Monera," without a shell. Class 2.—"Foraminifera," with a shell, no *ectosarc* nor *endosarc*, no mouth, no structural elements definable, no nucleus or indistinctly nucleated! A bundle of negations. To this must be added the statement, that they are without nerves or a nervous system, although possessing an inherent self-acting power: an impossible condition, unless Bowerbank's hypothesis is accepted, "that the whole mass is a diffused form of nervous matter." Should the opinion of the specially gifted leader of the German biologists and his followers be accepted, then the Foraminifera must have arisen by spontaneous generation—or, as Dr. Dawson ironically puts it, "The first molecules that took upon themselves the responsibility of living;" that they are organisms without organs—undifferentiated and homogeneous, without a nucleus, or indistinctly nucleated, and no contractile vesicle or nervous system, and yet they perform the functions of life as if possessing all these qualities, which the writers referred to deny them, and not the least of the powers which they do possess is that of selection. Immersed in sea water, they abstract from it the Lime and Silica required for the construction of their tests, and redeposit these materials in a variety of exquisite forms; and the Arenaceous series exhibit an intelligent power in the selection of the materials required for their tests, whether it is sand, sponge spicules, or the smaller shells of their own species; adapting the materials to the requirements, and putting them together with a smoothness in some instances, and a beauty in all, that prevents the acceptance of the definition that they are only a bundle of negations with one positive quality, *adherence*.

D'Orbigny considered the Amœba to represent the animal which in a higher stage evolved into a Foraminifer, but Haeckel and his school place the Foraminifera at a lower level than the Amœba, because the Amœba possesses an *ectosarc* and *endosarc*, a nucleus and contractile vesicle, which they assert are absent in the Foraminifera; but Huxley, in describing his class "Monera," in which he places Foraminifera, writes: "The entire body consists of a particle of gelatinous protoplasm, in which no nucleus contractile vesicle or other definite structure is visible, and which at the most presents a separation into an outer, more clear and denser layer or *ectosarc*, and an inner, more granular *endosarc*"—if not so well defined as in Amœba. The explanation is, that inhabitants of shells do not require an *ectosarc* so structurally perfect as the naked forms possess. The later researches of Hertwig, Lesser, Schulze, Gruber, and Bütschli prove the presence of nuclei in several forms, and in reply to the dogmatic assertion of the leader of the German school, respecting the homogeneity of the animal substance of the Foraminifera, Allen Thomson, as early as 1871,

wrote: "I am inclined to regard protoplasm, whether vegetable or animal, as in *no instance* entirely amorphous or homogeneous, but rather as always presenting some minute molecular structure"; and Carter, in his paper on the Foraminifer *(Haliphysema Tumanowiczii)*, says the protoplasm "has the appearance of being built up by a meshwork of fibrillæ, or of a denser substance honey-combed by very small vacuoles, or spaces of a less dense substance." Among the larger members of the various groups of organisms classed as Foraminifera, as high a structural differentiation will possibly be found as is exhibited by any of the naked fresh-water forms of Rhizopoda. Possibly, when measures are taken to overcome the difficulties of observation presented by their opaque and resisting shells, the larger Foraminifera may prove to be as highly organised as the Radiolaria. This and other forms from the Gulf of Manaar, appear to show a transition from the Amœba to the higher forms of Foraminifera through Lobosa, Gromia, &c. The position of Haeckel and his following, with regard to their lowly forms, is no longer tenable.

Their geographical range is almost everywhere, but in the sea they are confined to a zone extending about 55 deg. north and south of the Equator. They consist largely of the *globigerina*, and are found at all depths to about 2,400 fathoms. To the geologist they are especially interesting, for existing forms are mainly direct lineal descendants of those of very ancient geological periods. One species of *fusilina* has formed deposits of enormous thickness in Russia during the carboniferous period. The cretaceous system is crowded with them, and in the tertiary, the weald, the lias, they are even more abundant, *e.g.*, in the nummulitic limestones, called "coinstones," of which the largest Pyramid is built. They occur in the tertiaries of Europe, Asia, and Africa, and are nowhere more abundant than in the calcareous deposits of Paris. It may be said that Paris is built of these forms. They extend from the shores and the depths of the sea to the mountain tops, and even to the foundation of the geological system, the Laurentian, if *Eozoon Canadense* be accepted as one of them. There are 4,000 recognisable but different forms "which," Hooker says, "a superficial observer can separate by words and a name," and these vary in size from the larger *nummulites* and *orbitolites*, which occasionally attain to two inches and even three inches in diameter, to those of microscopic size, and which require the use of high powers for their determination, *e.g.*, some of the globigerina and other forms; and yet these atoms of creation are not only their own architects and builders, but have, shell upon shell, raised some of the mightiest of the rock masses constituting our mountains. Wherever a limestone, a chalk, or even a clay formation with its accompanying shales are found, these Foraminifera will be there, and often in abundance. They are the mightiest builders on the earth, although so small that 58,000 were found in one cubic inch of the *Calcaires grossiers* of the Paris basin, which is about 3,000,000,000 in one cubic yard. How many in a mountain chain?

The paper was illustrated by drawings and microscopical preparations.

JUNE 12TH, 1885.

EXHIBITS.

R. W. Rusby contributed the following lepidoptera, bred from pupæ taken at Hambleton, viz. :—Poplar Hawk Moth (*Smerinthus populi*), Puss Moth (*Dicranura vinula*), Swallow Prominent Moth (*Notodonta dictæa*), Buff Ermine Moth (*N. subricipeda*), and Swallow-tail Butterfly (*Papilio machaon*) ; also cocoons of Puss Moth. W. Nelson and W. D. Roebuck showed specimens of *Limnæa glabra* and other shells ; and H. Pollard brought examples of *Bulimus obscurus* and its variety *alba* ; the latter, of rare occurrence, was taken during the summer of 1879 at Whitby, being the second record for Yorkshire. In the first instance it was found at Grimbald Crag, near Knaresborough, in the year 1866. There was thus an interval of thirteen years between the two records.

G. Paul exhibited specimens of leaf variegation from the several families or genera of *begonia, euonymus, fuchsia, gazania, geranium, graminaceæ, iresine, lamium, polemonium, saxifraga, spiræa, thymus, veronica, vinca, vitis,* and several others. The markings on all these specimens were exquisitely beautiful in colour and shade. The exhibitor described the minute anatomy of leaves, and then put the query—What is the cause of leaf variegation ? This question has never been authoritatively solved ; and is one, therefore, that affords ground for original research. It is not the same thing as etiolation, pure and simple, for etiolation is the result of mere exclusion of light, whereas the most brilliant forms of variegation are obtained in strong light ; and, as is well known, perfect light is indispensable in the production of chlorophyll—the green colouring matter of plants. There is an apparent contradiction in these two facts, but the exhibitor suggested that the absence of green colouring matter in variegated leaves may be more apparent than real, as the chlorophyll may be attenuated only, and not entirely absent, in those parts of the leaves which are not green ; but further investigation of the question is much needed.

J. Wood, of Kirkstall, sent a number of not very common flowers, cultivated in the open garden, amongst which were the following :—*Phlox pondosa, Pæonia montana, Andromeda tetragona, Linaria alpina, Mertensia paniculata, Lithospermum prostratum, Veronica Hulkiana, Ranunculus Asiaticus, Iberis* (garden var.), *Saxifraga McNabiana, Meconopis cambrica, Viola puticosa, Ranunculus Cabulicus, Geranium phlæum, Papaver cuprifragum, Trollius napellifolius, Saxifraga Andrewsii, Trientalis Europæa Anthericum liliastrum, Asarum Europæum, Dodecatheon media, Papaver Alpinum, Saxifraga marginata, Cypripedium calceolus, Antirrhinum asarina, Helianthemum,* and several others. J. E. Bedford exhibited portions of antlers of the red deer, which had been found in the gravel of the Airedale valley between Leeds and Kirkstall, at a point about 150 yards from the present bed of the river. The excavation showed two feet of alluvial soil, below which were three or four feet of clay, and underlying this was

the gravel, consisting of pebbles of grit from the coal measures. Mr. Bedford also showed ice-scratched blocks of chalk and limestone, the former from the glacial drift of the Yorkshire coast, near Bridlington (derived, no doubt, from the Chalk Wolds to the north-west), and the latter from Menston, near Guiseley. H. Bendelack Hewetson also sent specimens of ice-marked stones, and an ice-scratched Mammoth tooth, in which the dentine of the tooth was still remaining. These also were found in the glacial drift of Holderness. J. E. Bedford exhibited also specimens of plumbago or graphite from the Buckingham Mines, near Ottawa, Canada; and he explained at some length the appearance of the veins in the Laurentian gneiss and crystalline limestone of that district, in which the substance is found.

Other exhibits consisted of a series of microscopical slides of jaws and lingual ribbons of mollusca, prepared by J. D. Butterell, and shown with polarised light.

JUNE 19TH, 1885.

F. W. BRANSON, F.C.S., ON "BACTERIA."

The paper opened with references to the able and eventful researches of Pasteur, to whose labours may be indirectly traced the system of antiseptic surgery initiated by Sir Joseph Lister. From the fact that organic substances remain unchanged for any length of time in perfectly pure air, *i.e.*, air free from germs, whereas putrefactive changes soon commence if the same substance is exposed to ordinary atmospheric conditions which allow the access of germs, it may safely be assumed that the changes are due to micro-organisms, which, indeed, appear in great numbers, Bacteria being the most numerous and important, the first organism which usually appears being *Bacterium termo*, the smallest of the Bacteria, the one-hundredth part of a cubic inch being equal to 50,000,000 of these organisms. At this stage a series of slides, showing the appearance of a fish infusion at stated intervals, were exhibited on the screen. The question, What is a Bacterium? was then considered, the general characters and affinities of these universally distributed organisms being described in detail, as were likewise the *spore* and *zooglea* forms of the Bacteria. The classification of Cohn was adopted by the speaker with some reservation, being based, he considered, too much on morphological characters, *e.g.*, the knowledge of the division *Micrococci*, in which the spore formation is unknown, being evidently incomplete. Cohn's system must, therefore, be regarded as partly provisional. Classification from a chemical point of view was then noticed, and the following well-defined groups described:—Septic or putrefactive bacteria, zymogenic bacteria, and pathogenic bacteria. *Bacterium termo* is a type of the first group, and is always to be found in putrescible liquid, the function of the organism being to break down complex organic molecules with the concurrent formation of simpler

molecules, one of the final products being ammonia. *Bacterium lactis* was described as typical of the zymogenic bacteria. In this group food of a definite and well-known constitution is consumed, and definite chemical products are formed, *e.g.*, *B. lactis* consumes sugar of milk, one of the products being lactic acid. The anthrax of woolsorters' disease was taken as a type of the pathogenic bacteria for two reasons—its local occurrence, and also because the entire life-history of this organism is well known. It was stated that as regards this group pathologists are generally agreed that a pathogenic bacterium may be regarded as the specific virus of a contagious disease. Notwithstanding the large amount of patient research given to the study of Bacteria by Koch, Klein, and many other workers, it is yet a disputed fact as to whether they should be placed in the animal or vegetable kingdom. Bauman and Salkowski have, however, thrown much light upon the chemical functions of the Bacteria, the remarkable proposition of the first named, that the action of Bacteria produce antiseptic substances (such as phenol, &c.) which are fatal to their existence, being now supported by direct and independent analytical evidence. With regard to the action of antiseptics, the following facts were related, namely :—that although a prolonged immersion in a 1 per cent. solution of perchloride of mercury will not kill the spores of some Bacteria, yet a solution as weak as 1 in 300,000 will prevent for an indefinite period the germination of the spore. The power of germination, is, however, only suspended, as on removal to a nutritive medium, growth normally occurs as if no retardation had taken place.

The action of heat and cold on Bacteria and their spores then claimed attention, and an explanation of the reason why the spores of some Bacteria can withstand the action of boiling water for some time was stated to be due to the fact that the spore coat is double, and is endowed with non-conducting properties, as regards heat, of a very special kind.

In conclusion, slides illustrative of the paper, including *Bacterium termo*, *Bacillus tuberculosis*, *Bacillus anthracis*, Koch's *Cholera bacillus*, and various spore forms of Bacteria, were shown and described.

At the close of the meeting the following lepidoptera were exhibited by J. W. Addyman, on behalf of Henry Oliver, Junr., of Harrogate, viz. :—*Papilio machaon*, *Argynis Euphrosyne*, *Vanessa Io*, *V. Antiopa*, *Nemiophila plantaginis*, *Chærocampa elpenor*, *Ch. porcellus*, *Thyatira batis*, *Plusia chrysitis*, *P. iota*, *Amphidasis betularia*, and *Macroglossa stellatarum*.

JUNE 26TH, 1885.

G. PAUL, F.G.S., F.R.Met.S., ON "THE FERTILISATION OF FLOWERS."

The lecturer furnished illustrations of the various forms of the sexual organs by means of fifty or sixty species of flowers, including a group of lovely orchid blooms (*Cattleyas*), besides which he exhibited some excellent models of characteristic inflorescence, made on a

large scale, and capable of dissection, which were lent for use by the courtesy of the Leeds School Board. The lecturer also displayed some diagrams on a very large scale, and exhibited a number of microscopic slides, all of which he had prepared expressly for this lecture. He began by drawing attention to the anatomical form of the stamens and pistil in a typical flower, showing that the stamen was made up of two members—the filament or stalk, and the anther or cap—which two members are attached the one to the other in modes exactly suitable to the circumstances in which they are naturally situated, in the most exquisitely perfect adaptation. The anatomical form of the anther was then described, and the manner in which the anther opens on maturity—either by suture or pore—and discharges the pollen ready for fecundation. In like manner the members of the pistil were pointed out—the stem or style, and summit or stigma—together with the modifications to which each is subject, and the variations of the stigmatic surface according to what is needed in the conditions by which the respective plant is surrounded. The form, the nature, and the object of the pollen was then described, together with the exact mode in which the pollen fertilises the future embryo seated in the ovary, at the same time pointing out the varying positions of the ovule in different species of plants. In this difficult part of the subject the models, diagrams, and microscopical slides were of great utility, and the conclusion arrived at was that the actual means by which fertilisation is effected must be accepted as one of the most enchanting illustrations of Divine wisdom. The physiology of the orchid was next entered on, and the deeply interesting manner in which fertilisation was brought about in this family of plants was described practically. At this point the lecturer observed that to almost every physical question there is a metaphysical side, and the metaphysical aspect of this question is found in the means by which the effective dispersion of pollen is brought about. Assuming, as a hypothetical premiss, that it is undesirable in nature that self-fertilisation should take place, we then see the *raison d'être* of the numerous contrivances by which self-fertilisation is prevented. In one set of cases the male flowers are found on one plant, and the corresponding female flowers on another (dicœcious), and even in those cases where both sexes of flowers are found on the same plant (moncœcious) there is still a hindrance in the way of self-fertilisation in the fact that either the male flowers are mature before the female flowers on the same plant, or *vice-versa*. The most difficult case, however, in which to prevent self-fertilisation, as far as appearances are concerned, must evidently be that in which both male and female organs are situated on the same flower (hermaphrodite); but even here self-fertilisation is equally prevented by the arrangement which secures that the male organs shall be ripe first (protandrous), or else the female organs (protogynous), but not mature both together on the same flower. Then, again, on some plants that are hermaphrodite, there are two, and even three different forms of the flower, all calculated to render difficult direct self-fertilisation. Another interesting feature of the subject was the

mechanical means by which the pollen is conveyed from one flower to another, some plants having the pollen wind-borne (anemophilous), others having it conveyed by insects (entomophilous). These facts involve a variation in the form of the pollen grains themselves, and in the quantity of pollen to be produced by the respective genus or species. Reference was also made to the labours of Darwin, Lubbock, and others in this absorbing subject.

JULY 3RD, 1885.

T. FAIRLEY, F.R.S.E., ON "THE ELECTRIC DISCHARGE IN AIR AND OTHER GASES."

After defining the meaning of some of the terms used, the speaker showed that when a conductor is charged with electricity of high tension, a limit at length occurs when the electricity forces its way through the air or other dielectric medium to the nearest conductor.

If this takes place rapidly with air at ordinary pressures a spark is produced, as in ordinary lightning. This spark discharge is modified by the form of the conductor, and by the currents of air set up, into a brush which may be most readily obtained from a positively charged obtusely pointed conductor, or into a glow best shown by the luminous air-current from a negative conductor.

In air when the pressure is diminished up to a certain limit the discharge takes place more readily, and at greater intervals between the poles. In the extreme case Morgan showed 100 years ago that no spark passes in the Toricellian vacuum. Under increased pressures above that of the atmosphere the electric discharge takes place with greater difficulty, so that the striking distance becomes greatly diminished.

The *spark discharge* is shown as a thin streak of light, straight in short sparks, zigzag in larger sparks. Its duration by one mode of testing is 1-24,000th part of a second. Its colour varies with the poles, and the medium through which it passes; thus, in air it has a bluish tint; in nitrogen, purple; oxygen, whiter than nitrogen; hydrogen, crimson; carbonic acid, green; and coal gas, red or green.

The *brush or broom discharge* occurs most readily when one conductor is projecting, but not pointed, and the other is a plate or larger surface. It is intermittent, and attended by a hissing noise.

The glow, convective or silent discharge is continuous and without noise. The glow is best seen near to the negative conductor, and less on the positive, with a dark interval between. Recently, Professor O. Lodge has shown that this glow discharge has a wonderful power in condensing and precipitating vapours, or any finely divided particles in suspension. The glow is no doubt a visible manifestation of what takes place when the surfaces are larger, and show no glow. When the glow takes place in ordinary smoke, the air currents produced by the discharge are well shown,

resembling a whirlwind in miniature, and ending with the complete precipitation of the smoke.

When the discharge takes place in Geissler tubes from which the air or other gas has been partially exhausted between electrodes of platinum or, better, aluminium, very beautiful effects are obtained in an almost endless variety, according to the forms of the tubes and the gases present in them.

July 10th, 1886.

EXHIBITS.

The concluding meeting of the session was devoted to the examination of a varied collection of natural history specimens and microscopical objects. W. D. Roebuck exhibited living examples of *Limax cinereo-niger*, *L. maximus*, *Arion ater* var. *rufa*, found on the east side of Lindley Wood Reservoir, Washburndale; and very fine and characteristic specimens of *Limax maximus* from Leicestershire, Derbyshire, and West Yorkshire, which showed the normal type of colour and markings. The *Limax cinereo-niger* is an extremely rare slug, and one which the exhibitor was the means of introducing definitely into the British list. It is true that one was taken in Ireland about forty years ago, and another in North Somersetshire about twenty years ago; but the naturalists who recorded them, though giving recognisable descriptions, took them to be abnormal examples of one common species, *L. maximus*. The two species are very different from each other, and can never be confounded on careful scrutiny. The rarity can be judged from the fact that this is but the ninth British example, six of which have passed through his hands. In its European distribution it is a species which affects countries with a high average rainfall, so far as is at present ascertained. Other exhibits were a number of Lepidoptera from Pateley Bridge, sent by W. Storey, including the female of the Ghost Moth (*Hepialus humuli*), the white Ermine Moth (*Arctia menthastri*), the ruby Tiger Moth (*Phragmatobia fuliginosa*), the Burying Beetle, and others. Miss F. A. Penistone exhibited a very good example of the Tarantula, from Los Angeles, California, and a leaf of the *Ficus elastica*. W. E. Collinge brought a collection of freshwater shells, taken this season from the canal at Newlay, among which were *Anodonta cygnea*, *A. anatina*, *Unio pictorum*, *U. p.* var. *curvirostris*, *U. tumidus*, *Dreissena polymorpha*, *Paludina vivipara*, *Bythinia tentaculata*, *Planorbis vortex*, *Limnæa peregra*, *L. auricularia*, *Ancylus fluviatilis*, and *Neritina fluviatilis*. Chadwick showed eggs of Tree Sparrow, from Arthington, white House Sparrow, Chiffchaff, Reed Warbler, and very small Sedge Warbler; and J. W. Dixon and F. Emsley brought a collection of microscopical slides, including specimens of ripe eggs of Goby (*Gobius niger*) and young Starlet (*Asterina gibbosa*).

AUTUMN SESSION.

SEPTEMBER 11TH, 1885.

EXHIBITS.

The specimens exhibited included a very fine collection of plants, contributed by Percy H. Grimshaw, amongst which were *Lamium maculatum*, *Teesdalia nudicaulis*, *Trollius Europæus*, *Aquilegia vulgaris*, *Silene maritima*, *Alchemilla alpina*, and others gathered in the Lake District; and *Polygonum dumitorum*, *Thalictrum flexuosum*, *Agrimonia odorata*, *Doronicum pardalianches*, *Crepis paludosa*, and *Angelica sylvestris*, found at Burley-in-Wharfedale. He also brought from Burley-in-Wharfedale a specimen of *Plantago major*, in which the fruits had been transformed into true leaves. On behalf of Mr. Muff was shown a specimen of the Wait-a-bit thorn (a truly formidable object which fully justified its name), which had been imported from Australia in a bag of wool. Several Beetles, taken in the neighbourhood of Leeds, including *Carabus violaceus* and its variety *exasperatus*, were shown by W. E. Collinge; and a series of microscopical slides of Diatoms and Desmids, among which was the very rare and beautiful *Micrasterias brachyptera*, was exhibited by W. Barwell Turner and F. Emsley. H. B. Wilson brought a number of very fine specimens of teeth of Saurians, found at Ipswich.

In the conversation which ensued, reference was made to the very barbarous and useless destruction of sea birds, which had as usual taken place during the present season on the Yorkshire coast, and several members reported what they had themselves witnessed at Bridlington and other places. The Club heard with much regret that a nobleman, with a number of his friends, had lately been engaged in this cruel kind of "sport," and that the destruction of life they had effected was most pitiable. In view of such facts as were reported, it was felt that further legislation was urgently necessary to ensure the adequate protection of wild birds, and especially sea birds; and on the motion of the President, seconded by W. Barwell Turner, the following resolution was unanimously adopted:—"That concerted action of the Naturalists' Societies of Great Britain be invited, with a view to obtaining Parliamentary assistance in extending the close time for sea birds, which extension is urgently called for."

SEPTEMBER 18TH, 1885.

H. BENDELACK HEWETSON, M.R.C.S., ON "RESULTS OF EXPLORATIONS OF EAST YORKSHIRE KITCHEN MIDDENS."

The lecturer commenced by stating that some years ago whilst walking on the shore near Easington, in Holderness, he had observed, in the low-lying cliffs of diluvial clay, that there were thick layers of oyster shells

being laid bare by each tide, which, at that part of the coast, is quickly washing away the soil. On examination, then and at many other times during the last few years, it was found that these oyster shells, each of which was chipped by being opened by some rude implement, were associated with rude pottery, implements of flint, early barbaric pottery in the lower strata, and pottery of a decided Roman type as the strata of the midden approached the surface of the soil. An invariable rule in this midden at Easington, and others—in a low cliff on the Humber bank, near *Kilnsea*—is that the *lowest* layers contained the *rudest* pottery, mixed with oyster shells in profusion and many land shells, these latter being perforated by a small hole to extract the animal. Associated with the pottery and some burnt earth, were the bones of many animals, and possibly birds, several species of Deer, Wild Boars (whose tusks were found), Dogs or Wolves. The middens were evidently deep trenches cut in the glacial drift, the edges being sharply defined ; and these trenches had been used by the early Britons first, and then by their first conquerors, just as our middens are used at the present time for kitchen refuse. The lower layers giving evidence by the ruder character of their contents that they were the remains left by a people in a much lower grade of civilisation than the more superficial deposits, which gave evidence in the refinement of the pottery remains of a more cultivated people—probably Roman. In close proximity to a kitchen midden, Mr. Hewetson discovered a ground oven in the cliff, about 2 feet 10 inches deep and 18 inches in width ; the bottom was paved by three large stones which showed plainly the action of fire, and on these stones stood, crushed into twenty-eight fragments, an ancient and very rude *urn*, the whole of the circular excavation being filled by charcoal and burnt earth : this was evidently a cooking oven with the urn or pot *in situ*. In the various middens proper were secured (from time to time, as the lecturer visited them, as they were laid bare by the action of the sea) one fine flint arrow, discovered by Mr. Armistead in the lower layers, a bone arrow-head and awl, probably for marking the lines on pottery ; and the shafts of long bones of animals, all of which had been split to obtain the marrow. A few years ago a discovery of much interest was made, viz., the head of a human femur, which showed evidences of having been gnawed by Dogs or Hyenas, whose canine teeth had left deep marks on the extremely hard bone of the "head," the cancellous bone structure having been as easily crushed away. Mr. Hewetson, in conclusion, related how that occasional search for some years at last revealed, to his delight, the orbits of a human skull, whose frontal bone of low type was staring at him from amongst the culinary refuse in the lower layers of a midden at Kilnsea. These are believed to be the first records of the discovery of human remains in kitchen middens in England, certainly in Yorkshire, which go, it is feared, very far towards showing that our ancestors were, if not actually confirmed cannibals, at all events in times of war might occasionally make a meal of a vanquished foe.

OCTOBER 2ND, 1885.

EXHIBITS.

H. Marsh contributed the following lepidoptera, collected during the present year, viz. :—Yellow-horned (*C. flavicornis*), Knot Grass (*A. rumicis*), Vapourer (*O. antiqua*), Gold Tail (*L. auriflua*), Ermine (*A. menthrastri*) and other moths, and Ringlet (*S. hyperanthus*), Meadow-brown (*S. janira*), Orange-tipped (*A. cardamines*), and Common Skipper (*H. linea*) Butterflies. He also showed a specimen of *Unio pictorum* from the Tweed at Berwick, a locality very much further north than the species has hitherto been known to exist. W. Barwell Turner brought several specimens of moths, among which were *C. porcellus*, *A. psi*, and *E. lucifera*. H. Pollard's exhibits consisted of a number of specimens of *Cyclostoma elegans*, which he had collected some weeks ago on the Boxley Hills in Kent ; and several fossils, &c., illustrative of the Barnsley coal measures, including specimens of calamites, lepidodendra, ferns, microspores, and iron pyrites and slikensides. G. Paul, F.G.S., then exhibited and described the large and beautiful collection of samples of granitic mineralogy, which he had obtained in Aberdeen, and he explained at some length the characteristics of the various localities in which they were found. J. Wood, of Kirkstall, had forwarded a number of uncommon plants and flowers, nearly all of which had been grown out of doors, and these were next examined. The collection consisted of the following :—Autumn Anemones, varieties (*Anemone japonica*) ; Globe Thistle (*Echino retro*), N. Europe ; fruit of *Rosa rugosa*, Japan ; white form of *Gentiana asclepidea*, European Alps, rare ; *Hypericum empetrifolium*, from the East ; St. Dabeoc's Heath (*Menziesia polyfolia*) ; Gold Tree, in flower (*Diplopappus chrysosophilus*), allied to aster ; Goldilocks (*Linosyris vulgaris*) ; Bristly Pearl Shrub (*Margyricarpus setosus*), Peru ; New Holland Violet (*Erpetion reniformi*) ; *Amaryllis lutea ; Polygonum vaccinifolium*, mountains of N. India ; various sunflowers ; some British flowers, showing their disposition to bloom late under cultivation ; some late (or early) coloured primroses or hybrid polyanthuses ; *Acæna Novæ Zealandiæ*, showing fruit spines ; and *Stanhopa*, orchid from tropical South America, and *Lapageria rosea*, both of which had been cultivated under glass.

OCTOBER 9TH, 1885.

F. W. GREENHALGH, M.R.C.V.S., ON "ECHINOCOCCUS VETERINORUM."

This dangerous form of the Icelandic tape worm had been brought under his observation in an aged cow, which he had attended professionally at Armley, in the spring of this year. This cow had been in its owner's possession about six weeks prior to his first visit, but beyond the fact that it had come from the neighbourhood of Masham, nothing was known of its previous history. A few days after its arrival at

Armley, the cowman noticed certain signs of illness, which he could not account for, the animal having the same diet as the other cows; and this state of things gradually grew worse. The only abnormal appearance noticed was a bulging enlargement of the abdominal cavity, which became more observable as the animal lost her condition, but there were no symptoms to lead him to suspect that the liver was involved—a very strange fact indeed. Notwithstanding all the efforts of the surgeon, the animal became in less than a fortnight so extremely emaciated, that the owner consented to have her slaughtered, in order to have a post-mortem examination of the body. As soon as the abdominal muscles were divided, a huge sac was disclosed, which proved to be the liver, or what had been doing duty for that organ. It was attached to the abdominal wall and to the diaphragm by thick and tough fibrous cords and bands of white tissue. After it was detached it was placed on the scales, and turned them at the astounding weight of 157 lb., or 11 st. 3 lb. On examination, the organ was found to contain only a few pounds of real hepatic substance. He had submitted specimens of this abnormality to several other veterinary surgeons, and to Professor Williams, of the New Veterinary College, Edinburgh, who informed him that it was a most valuable specimen of the *Echinococcus veterinorum*, which gives rise to the small tape-worm of the dog, the *Tænia echinococcus*. Several microscopic slides, illustrative of various portions of this worm, had been prepared by B. Holgate, and were exhibited. On making a section through the organ, it was found to be almost entirely occupied by cysts or bladders of various sizes, filled with a clear straw-coloured liquid with little or no odour. All the larger cysts were evidently brood cysts, as in some instances they contained a multitude of secondary vesicles. The walls of the larger cavities were very dense, and from this fact Professor Williams was of opinion that the disease had been in existence for a long time, probably for years. A number of these small cysts were also found on the surface of the lungs, but their presence there was inexplicable. The lecturer then gave an outline of the life-history of this form of Tænia, which he stated was in its full-grown form very prevalent in both man and dogs in the far North—among the Icelanders and Esquimaux. Though the animal is so small—never exceeding one-sixteenth of an inch in length—it is, perhaps, the most dangerous of the whole tribe of Cestoda, either in its hydatid or matured form, to the host which bears them. The grave accounts received from Iceland, especially of the ravages of this parasite (nearly 30 per cent. of the deaths occurring there being directly attributable to it) make one hope that such a dreadful disease may never become common in this country.

The reading of the paper was followed by a discussion, in which the President, the lecturer, and Messrs. Paul, Prince, Russell, and others took part.

OCTOBER 16TH, 1885.

F. W. BRANSON, F.C.S., ON "MICROTOMES."

The word "microtome" is not to be found in most dictionaries; it is not, therefore, popularly understood. Like very many other scientific terms of recent origin, it is derived from the Greek. The first root in the word (*mikros*—small) goes to form the first part of several names of scientific instruments, as microscope, microphone, &c., and of scientific terms, as micrograph, microcosm, &c.; and the other part of the word (*tome*—section or cutting) is from the Greek root *tomos*. There is also a well-known Latin word, *tome*, which means a section, or part of an author's work, and which we freely render as a "volume," that is derived from the same Greek root. It is obvious from this that the object of a microtome is to produce small sections or slices of various substances. These sections are intended to be submitted to microscopical examination, and it is therefore indispensable that they should be very thin, and of equal thickness throughout. How thin they should be (within certain ranges) depends on what particular substance it is desired to examine, but the microtome is not uncommonly required to produce slices of no greater thickness than the five-thousandth part of an inch; or to put this in a practical way, supposing it is desired to examine throughout, in a transverse plane, the head of a blue-bottle fly, whose head has a longitudinal diameter of, say, one-eighth of an inch, then this head must furnish six hundred and twenty-five slices (625)! This illustration may furnish a key, roughly speaking, to the extreme interest attaching to machines that are required to produce such delicate results.

Some substances may be sliced by the microtome without previous preparation; but others, as animal substances in a mass, require to be frozen; and other substances, whether animal or vegetable, of a fragile character, need to be first hardened and then embedded in some matrix which will hold them in a true position, and, at the same time, relieve the cells from the crushing effect of the action of cutting. The microtomes of Weigert, and of Rivet, exhibited among others, are capable of adaptation to make sections under all three of these circumstances mentioned—*i.e.*, without previous preparation of the object, by freezing the object, or by imbedding the object in a foreign substance. Then the mode of freezing the object varies. By means of one of Williams's microtomes the object is frozen by an ether spray; in another of his instruments by a mixture of ice and salt. The ether spray is also employed for freezing in the two first-named instruments. But one instrument, the "Cambridge Rocking Microtome," absorbed a large share of attention. This instrument is so called in allusion to the motion of the limb which holds the object, imbedded in paraffin, and brings it down on the cutting edge of the razor; but the principal interest attaching to it arises from its producing the sections in a serial or riband form, the great advantage arising from which consists in its thus presenting the successive slices of the object in perfect

order of rotation, and depositing them in serial order upon microscope slides, when the sections are ready for examination under the microscope after clearing and covering them with glass slips.

OCTOBER 23RD, 1885.

JAS. ABBOTT, ON "THE FLORA OF LEEDS AND DISTRICT."

After giving an account of the Flora of the immediate neighbourhood, Mr. Abbott enumerated the plants which formerly occurred, but which are now missing. He mentioned, also, that many plants which have been found are not truly indigenous, but have been introduced, and are therefore not likely, in the majority of instances, to permanently establish themselves in the district.

Mr. Abbott's observations had also reference to the plants of the Nidd, Wharfe, and Aire valleys, and the results of his extended observations will be found in the Flora.

OCTOBER 31ST, 1885.

VISIT TO THE RUSKIN MUSEUM AT SHEFFIELD.

On reaching the Museum, situated at Upper Walkley, the President (H. Bendelack Hewetson) and the members of the Club were received by the Curator (Mr. Henry Swann) and Mrs. Swann, who had made unusual arrangements to enable the Club to view the treasures with the greatest possible facility, and to whose kind attention the Club were greatly indebted.

The original museum has long since proved too small to enable the valuable specimens to be properly displayed, and recently a larger gallery has been erected, which now contains the chief works of art and some of the larger illustrated works on Natural History subjects. The almost unique collection of minerals, and many of the smaller and more precious works of art, are retained in the original building. Still, however, many beautiful objects lie hidden for want of greater facilities for exposing them to public view, and large subscriptions are needed to assist Mr. Ruskin in further extending the area of the museum, which, after his great munificence, he cannot be expected to grant out of his private purse. The members of the Club were particularly struck by the splendour of the mineralogical collection, which contains numerous interesting and instructive specimens of agate-structure, and the various forms (some most fantastic) of chalcedony. One specimen is particularly like the droppings of candle grease set on agate. The various forms of agate are the fortification or mural agate, columnar agate, horizontal agate, brachiated agate, moss agate, and pipe agate. There is an agate from whose banded surface springs beautiful crystals of deep purple amethyst quartz. One specimen of

agate, which had been cut and polished, showed that at one time the stone had been broken up by some great force, and that in the broken state crystallisation had taken place between the scattered fragments, beautifully uniting them into an organised mass by interposed amethyst quartz crystals. In studying these varied formations, the members of the Club were greatly assisted by the kind demonstration of Thomas Fairley, F.R.S.E., and also by the remarks on these subjects made by Dr. Clifton Sorby, F.R.S., whose presence at the museum in response to an invitation by the Club was much appreciated. The collection of opals contains in a special casket the largest and most brilliant specimen of Australian opal, save one, which is in an Austrian museum. This opal is in its native matrix of deep brown rock, which shows off the brilliancy of its exquisite colouring to great advantage. Smaller specimens, of singular beauty, were observed from Mexico. A large Scotch jasper was noticed in its golden setting, containing 111 square inches. There was also a beautiful specimen of Labradorite felspar, of about the same size, which was softly banded with blue and grey iridescent colours when held in certain lights. Nearly all the known precious stones are to be seen in their natural rock, and uncut. The Club next inspected natural diamond crystals from Africa and Brazil, specimens of precious emerald and ruby, besides a magnificent specimen of topaz crystal about nine inches in length, and a particularly fine instance of blue topaz on a slab of rock matrix. A specimen of meteoric iron attracted particular attention, it being so extremely heavy in proportion to its bulk. A complete system of crystal models was shown, whereby the student of crystallography is enabled to complete his theoretical knowledge of the formation and growth of crystals. Specimens of blue and yellow sapphire were also noted, as well as beautiful beryl crystals in a group. The attention of the Club was also particularly drawn to the magnificent collection of rare and unique illustrated works on natural science, the most notable being the original drawings, in seven elephant-folio volumes, for Donovan's celebrated work on insects, shells, and reptiles. In obtaining this work Mr. Ruskin found it necessary to outbid the authorities at the British Museum, which he did in order to procure it for the benefit of the museum at Sheffield. This work has recently been arranged by the Rev. Dr. Dallinger, F.R.S., President of the Yorkshire Naturalists' Union, who much regretted his inability to meet the Club at the museum, which he had expressed his intention of doing. It is enough to say of these original drawings of Donovan's, that they are the work of a life-time, and that in fidelity, execution, and perspective they are unsurpassed in this line of art. The superb works of the late John Gould, F.R.S., called forth universal admiration, particularly the "Humming Birds," which are exquisitely vignetted in their natural surroundings of exotic flowers and foliage. Sharpe's "Kingfishers of the World" is a work of great beauty. The plates are drawn by Keulemans, a Dutchman by birth, who is still living and doing beautiful work in ornithological drawing. An illustrated work on "The Fishes of Great Britain," by Mrs. Bowditch, was

greatly admired by those members who "courted the gentle art." The plates were drawn with great fidelity; in some instances several fishes were sketched from to ensure that the artist copied only the fresh colours of the subject, and discarded the fish when it was faded. Mention must also be made of the drawing, by Mr. Ruskin himself, of a single feather from the breast of a peacock, which is executed in water-colours, and when examined with a powerful glass, appears merely a magnified reality, so exquisite is the delicacy of the workmanship. The chief object of botanical interest in the museum was an example of equisetum which had been treated by some acid, all vegetable substance proper being dissolved away, leaving a beautifully delicate network of the shape of the plant in pure silica. This was preserved in glycerine. It was the chief object of the Club to devote their attention to the natural science collections. The shortening day afforded but too little time for a thorough inspection of many of the objects which required a better light to be seen properly. The members were much interested in the numerous works of art with which the museum is filled, but it was with the object of better knowing Professor Ruskin as a naturalist that the excursion was undertaken, and not for the purpose of following him in his study of art, for which his study of nature has rendered him so masterly a critic.

A vote of thanks was proposed by the President to Mr. and Mrs. Swann and their family, and in the course of his remarks he explained what had been the object of Mr. Ruskin in founding his museum at Walkley, and gave a short sketch of Mr. Ruskin's work. The motion was seconded by J. Stubbins, and carried with great unanimity. Mr. Swann suitably responded, and pointed out that underlying all Mr. Ruskin's teaching was the principle that science and art are only useful as they tend to raise and ennoble society. Dr. Sorby spoke of the importance of scientific training for the artist, and described certain blemishes arising from a want of such training which he had noticed as marring, in his estimation, what was in other respects most excellent work. G. Paul, F.G.S., and Washington Teasdale, F.R.M.S., spoke of the pleasure the presence of Dr. Sorby gave them, Mr. Teasdale remarking that Dr. Sorby was, he believed, the one scientific man of the day whom Mr. Ruskin liked and sympathised with.

October 30th, 1885.

B. HOLGATE, F.G.S., on "SOME POINTS OF COMPARISON BETWEEN LIMESTONE FLINTS AND IRONSTONE NODULES AND COAL BALLS OF THE COAL MEASURES."

The lecturer observed that, scattered throughout the shales of the coal measures, and sometimes in the middle of the seams of coal themselves, are found substances which exhibit a tendency to assume a nodular form. Sometimes they are in isolated nodules, and sometimes in layers; but, even

when in continuous layers, it is easy to see that it is only by the union of a great number of nodules that they take the form of a continuous plate. These nodules appear to be formed by the hardening of the shales around a central organic object. The hardening and impregnating material being sometimes carbonate of iron, that produces clay iron stone nodules, sometimes carbonate of calcium, sometimes silica, and sometimes sulphide of iron, and these are generally associated together; the preponderance of one or other of these substances giving the nodule its characteristic name. The objects contained in these nodules are numerous: sometimes it is a leaf, or fern frond, or terminal bud, in which case the actual tissue is present, and the very finest lines visible. Sometimes it is a twig, stem, root, fruit, or may be a shell, in which case it may have been permeated with carbonate of iron, and carbonate of lime, or iron may have replaced the lime, but it often shows the finest lineaments, and also every cell of the structure. At other times we find organic objects scattered through the mass of the nodule. It is important to direct attention to the condition of these entombed objects. When woody matter is present, it is often crushed, and shows that it has been subjected to violence. It has been withered or dried, and has become dead wood, often bored by insects, and it almost invariably shows the rootlets, running through its mass, of other plants which have grown around and upon it after its fall. These facts go to show the time at which these substances became petrified, which must have been not long after they were laid down, and certainly the earlier portions of the concretions were formed before the change of woody matter into coal commenced, and before the coal measures became faulted, and the strata were subjected to the intense pressure which came into action when the coal measures were upheaved, for we find that the nodules have moved and slided in the shales and coals; for all of them in the neighbourhood of a fault are slickensided with their motion, and often the shales are seen to laminate concentrically with the nodule, showing that they have been laterally squeezed into another place. Mr. Holgate described the mode of agglomeration of iron stone nodules and coal balls, and stated that he believed their formation might be attributed to the presence of a water containing iron, lime, silica, and sulphur in a soluble state; that this water had flowed over this organic matter, probably after it had received a covering of mud, and had permeated through the mud, depositing the chemical matter in and around the organic substances. The action has probably gone on ever since, and is going on now, for we find that wherever there are layers of iron stone nodules, there is a slow passage of water through that horizon. For the origin of these chemicals we had not far to look, when we considered that volcanoes were in existence at Edinburgh, Keswick, and Charnley Forest, vomiting these substances, and that the movement of the water most probably was from one or other of these places. Mr. Holgate then took up the question of flints, and showed that their formation must have been of a similar character. They are of nodular form, the objects embedded in them are almost invariably damaged

or fragmentary. It has been said that flints are sponges, and to a certain extent this is true, but it is not generally so. The objects embedded are sponge spiculæ, the detached spines of sea urchins of various kinds, the crushed shells of sea urchins, fragments of the same shells, bivalve shells, pieces of wood, and sometimes even pebbles. They present precisely the same appearance as do the nodules of the coal measures; sometimes the silica has permeated through the object, and has left it free from a matrix, at other times it has partially embedded it, and again at other times the object is merely a central nucleus. The chemicals are the same as those which have formed the nodules in the coal measures—viz., iron, lime, silica, and sulphur, in different proportions; many flints contain a large amount of lime—*i.e.*, they are not thoroughly silicified; others contain iron, and we occasionally find sulphur along with them. On the whole, from an examination of a great number of specimens, many of which the lecturer exhibited in illustration of his paper, he had come to the conclusion that the nodules of the coal measures and the flints of the lime, whether chalk or oolite, had been formed in the same manner, and by the same chemical substances, the proportions of which had varied according to the substances originally in solution in the water, and the composition of the strata through which the water had passed.

NOVEMBER 20TH, 1885.

J. W. ADDYMAN, B.A., ON "A VISIT TO SOUTHERN NORWAY."

The lecturer illustrated his remarks by means of a large number of photographs, some of which were thrown on the screen by the oxyhydrogen lantern. After giving a general description of the route followed, pointing out the places on the map, he described the general physical characteristics of Norway, and exhibited views of Christiansand, Manflaa, Svindal, and other places. Much information was afforded respecting the primitive character of the people, their dwellings, and general mode of life; and attention was especially drawn to their kindly manners and great courtesy toward strangers, and the very general honesty of the people. In the conversation which followed, some information was given regarding some points in the natural history of Norway, and the great abundance of fish and aquatic birds on the coast and in the lakes and rivers was especially remarked upon, the comparatively high temperature of the sea being mentioned as one of the causes of this abundance.

NOVEMBER 21ST, 1885.

POND LIFE EXHIBITS.

A number of interesting specimens were exhibited and examined under the microscope. G. Hainsworth contributed a series of microscopic slides, showing various portions of *Dyticus marginalis* (anterior leg of

male, showing sucker plates, spiracles, mandibles, &c.) and a number of caddis cases; and F. W. Branson, F.C.S., exhibited a series of marine and fresh-water algæ, illustrative of various stages of growth.

NOVEMBER 27TH, 1885.

H. MYDDELTON GAVEY, M.R.C.S., ON "OBSERVATIONS ON EGYPTIAN ZOOLOGY, AND NOTES ON THE PRE-HISTORIC ARCHÆOLOGY OF THE SAHARA."

The observations on the Zoology of Egypt, which the lecturer brought before the members of the Club, published *in extenso* in the *Leeds Mercury* Weekly Supplement were, for the most part, personal observations collected during a stay of some months in that strange and historical land; and the archæological remarks bore upon remains found in the oases which, like islands in the ocean, lie scattered throughout the great Sahara.

Diary of Natural History Observations.

1885. BOTANICAL.

February 23rd.—Purple Dead Nettle (*Lamium purpureum*) in flower at Snaygill, near Skipton (C. C. Smith).

February 26th.—Dog Mercury (*Mercurialis perennis*) in flower at Bradley, near Skipton (C. C. S.).

March 11th.—Opposite-leaved Saxifrage (*Chrysosplenium oppositifolium*) in flower at Bradley (C. C. S.).

March 13th.—Lesser Celandine (*Ranunculus ficaria*) in flower at Bradley (C. C. S.).

March 18th.—Moschatel (*Adoxa moschatellina*) in flower at Bradley (C. C. S.).

March 19th.—Alternate-leaved Saxifrage (*Chrysosplenium alternifolium*) in flower at Bradley (C. C. S.).

March 20th.—Floral buds of Holly (*Ilex aquifolium*) noted at Bradley (C. C. S.).

March 21st.—Wild Strawberry (*Fragaria vesca*) in flower at Bradley (C. C. S.).

March 21st.—Wood Sorrel (*Oxalis acetosella*), and Fir Tree and Sallow in bloom (W. Storey).

March 28th.—Wood Anemone (*Anemone nemorosa*) in flower at Bradley (C. C. S.).

March 28th.—Dog Violet (*Viola canina*) in flower near Pateley (W. S.).

March 30th.—Ladies' Mantle (*Alchemilla arvensis*) in flower in Nidderdale (W. S.).

March 31st.—Butterbur (*Petasites vulgaris*) in flower at Bradley, near Skipton (C. C. S.).

April 3rd.—Wood Anemone (*Anemone nemorosa*), Moschatel (*Adoxa moschatellina*, and Speedwell (*Veronica* (?) species) in bloom at Masham (T. Carter).

April 7th.—Observed the Lesser Celandine (*Ranunculus ficaria*) in flower (W. H. H.).

April 8th.—Wood Crowfoot (*Ranunculus*) in bloom at Masham (T. C.).

April 10th.—Butterbur (*Petasites vulgaris*) in bloom at Masham (T. C.).

April 12th.—Marsh Marigold (*Caltha palustris*) in bloom at Masham (T. C.).

April 13th.—Wood Anemone (*Anemone nemorosa*) and Violet (*Viola odorata*) in flower in Nidderdale (W. Storey).

April 13th.—Elder (*Sambucus niger*) in leaf, Nidderdale (W. S.).

April 13th.—Dog Violet (*Viola canina*) in flower at Thorleby, near Skipton (C. C. S.).

April 14th.—Cowslip (*Primula veris*) in flower at Coniston, near Bell Busk (C. C. S.).

April 16th.—Blackthorn (*Prunus spinosa*) in flower at Bradley.

April 17th.—Marsh Marigold (*Caltha palustris*) in flower at Bradley (C. C. S.).

April 18th.—Field Woodrush (*Luzula campestris*) in flower at Bradley (C. C. S.). Woodsorrel (*Oxalis acetosella*) in flower at Thorleby (C. C. S.).

April 18th.—In flower—Sweet Violet (*Viola odorata*); Primrose (*Primula vulgaris*); Cowslip (*Primula veris*); Marsh Marigold (*Caltha palustris*); Larch (*Abies larix*); Butterbur (*Petasites vulgaris*); Wood Anemone (*Anemone nemorosa*); Ground Ivy (*Nepeta glechoma*), Coverdale (J. A. E. S.).

April 18th.—Wild Raspberry (*Rubus idæus*), Hawthorn (*Cratægus oxyacantha*), Sycamore *Acer pseudo-platanus*) all in leaf, Nidderdale (W. S.). Broom (*Sarothamnus scoparius*) in flower (W. S.).

April 18th.—Cowslip (*Primula veris*) in bloom, Masham (T. C.).

April 21st.—Wood Avens (*Geum rivale*) in flower at Bradley (C. C. S.).

April 22nd.—Marsh Marigold (*Caltha palustris*), Sloe (*Prunus spinosa*) in flower at Seven Arches (J. T.).

April 22nd.—Blackthorn (*Prunus spinosa*) in bloom, Masham (T. C.).

April 23rd.—Lady's Smock (*Cardamine pratensis*) in flower, Pateley Bridge (W. S.).

April 23rd.—Wood Sorrel (*Oxalis acetosella*), Forget-me-not (*Myosotis palustris* (?)), and Scurvy Grass in bloom at Masham (T. C.).

April 24th.—Ground Ivy (*Nepeta glechoma*) in bloom, Masham (T. C.).

April 25th.—Cuckoo Grass, Rib Grass, Yellow Violet (*Viola lutea*), White Deadnettle (*Lamium album*), all in flower, Pateley Bridge W. S.).

April 26th.—White Deadnettle (*Lamium album*) and Wild Cherry (*Prunus cerasus*) in bloom, Masham (T. C.).

April 29th.—*Bullace* and *Cardamine* (*pratensis?*), in bloom, Masham (T. C.).

April 30th.—Horse-tail (*Equisetum sylvaticum?*) in fruit, Nidderdale (W. S.); Birch (*Betula alba*) and Mountain Ash (*Pyrus aucuparia*) in leaf, Nidderdale (W. S.).

April 30th.—Hyacinth (*Hyacinthus nonscriptus*) and Broom (*Sarothamnus scoparius*) in bloom, Masham (T. C.).

May 2nd.—Forget-me-not (*Myosotis palustris*) and Water Avens (*Geum rivale*), in Lower, near Adel (P. R.).

May 2nd.—Great Toothwort (*Lathræa squamaria*) seen at Masham (T. C.).

May 2nd.—Purple Orchis (*Orchis mascula*) in flower, Ramsgill (W. S.); Woodruff (*Asperula odorata*), Holly (*Ilex aquifolium*), Box (*Buxus sempervirens*) in flower, in Nidderdale (W. S.); Currant (*Ribes hortensi*) and Pear Tree (*Pyrus communis*) in flower, Park Side, Dewsbury Road, Leeds (W. H. H.).

May 3rd.—Violet (*Viola odorata*) in flower, Seven Arches, Adel (W. H. H.).

May 9th.—Mountain Ash (*Pyrus aucuparia*) in flower, at Woodhouse (J. Scaife); White Dead Nettle (*Lamium album*) in flower, Park Side, Dewsbury Road, Leeds (W. H. H.).

May 9th.—Sweet Cicely (*Myrrhis odorata*) in bloom, at Masham (T. C.).

May 10th.—Water Avens (*Geum rivale*), Marsh Valerian (*Valeriana dioica*) and Holly (*Ilex aquifolium*) in flower, at Masham (T. C.).

May 10th.—Cherry Tree (*Prunus cerasus*) and Strawberry (*Fragaria vesca*) in flower, Currant Trees with young green fruit on them, Alwoodley, near Leeds (W. H. H.).

May 11th.—Red Lychnis (*Lychnis diurna*) found at Lowthorpe (L. B. Ross).

May 11th.—Dog's Violet (*Viola canina*) in flower, Park Side, Dewsbury Road (W. H. H.); and Forget-me-not (*Myosotis palustris*) in flower, near Pateley (W. S.).

May 12th.—Crab (*Pyrus malus*) in leaf, and Birch (*Betula alba*) in flower, in Nidderdale (W. S.); Hedge Parsley (*Torilis nodosa*) in flower, Park Side, Dewsbury Road (W. H. H.).

May 12th.—Common Vetch (*Vicia sativa*) in flower, at Bradley (C. C. S.).

May 13th.—Good King Henry (*Chenopodium Bonus-Henricus*) in flower, at Bradley (C. C. S.).

May 13th.—Moschatel (*Adoxa moschatellina*), Crosswort (*Gallium cruciatum*), Purple Dead Nettle (*Lamium purpureum*), Garlic Mustard (*Sisymbrium alliaria*), all in flower, near Pannal (J. H. Taylor).

May 14th.—Bird Cherry (*Prunus padus*), Lousewort (*Pedicularis sylvatica*), and herb Paris (*Paris quadrifolia*) in bloom, at Masham (T. C.).

May 14th.—Red Rattle in flower, Pateley Bridge (W. S.); Cuckoo Flower (*Cardamine pratensis*), Park Side, Dewsbury Road (W. H. H.).

May 15th.—Common Lady Fern (*Athyrium filix-fœmina*), Male Fern (*Lastræa filix-mas*), Common Polypody (*Polyodium vulgare*), Harts tongue (*Scolopendrium vulgare*), Wall Rue (*Asplenium ruta-muraria*), Common Maiden Hair (*Asplenium trichomanes*), Moonwort (*Botrychium lunaria*), Hard Fern (*Blechnum spicant*), Broad Buckler, Brittle Bladder Fern (*Cystopteris fragilis*), and Figwort (*Scrophularia nodosa*), collected near Pateley (W. S.).

May 15th.—Leopard's Bane (*Doronicum pardalianches*), Garlic (*Allium ursinum*), Creeping Bugle (*Ajuga reptans*) in flower, near Harrogate (J. H. T.).

May 16th.—Wood Sanicle (*Sanicula Europæa*) in flower, at Bradley; Garlic (*Allium ursinum*), also in flower (C. C. S.).

May 16th.—Spotted Dead Nettle (*Lamium maculatum*), Wood Stitchwort (*Stellaria nemorum*), Rue-leaved Saxifrage (*Saxifraga tridactylites*), Lady's Mantle (*Alchemilla vulgaris*), Bilberry (*Vaccinium myrtillus*), Great Woodrush (*Luzula sylvatica*), and Bitter Vetch (*Orobus tuberosus*) in flower, at Pateley (Percy Alexander).

May 16th.—Red Campion (*Lychnis diurna*) in flower (W. S.); Holly (*Ilex aquifolium*) in flower, and Petty Whin (*Genista Anglica*), and Large Stitchwort (*Stellaria holostea*), Adel Moor (W. H. H.).

May 17th.—Wild Hyacinth (*Scilla nutans*) and Milkwort (*Polygala vulgaris*) in flower, Park Side, Dewsbury Road, Leeds (W. H. H.).

May 18th.—Round-leaved Cranesbill (*Geranium rotundifolium*) in flower, near Skipton (C. C. S.).

May 18th.—Oak Tree (*Quercus robur*) in leaf, Cut-leafed Geranium (*G. dissectum*) in flower, in Nidderdale (W. S.).

May 18th.—Tormentil (*Potentilla tormentilla*), Bird's-foot Trefoil (*Lotus corniculatus*) in flower, in Nidderdale (W. S.).

May 19th.—Sycamore (*Acer pseudo-platanus*), Crab (*Pyrus malus*), Field Speedwell (*Veronica arvensis*), and Cowberry (*Vaccinium vitis-idæa*) in flower, in Nidderdale (W. S.).

May 19th.—Earth Nut (*Bunium flexuosum*) in flower, Dewsbury Road, Leeds (W. H. H.).

May 20th.—Ash Tree (*Fraxinus excelsior*) in leaf, Brook Lime (*Veronica beccabunga*), White Clover (*Trifolium repens*), Yellow Clover (*Trifolium minus*) in flower, in Nidderdale (W. S.).

May 20th.—Herb Robert (*Geranium Robertianum*) and herb Paris (*Paris quadrifolia*) in flower, in Nidderdale (W. S.); Early Orchis (*Orchis mascula*) and Lousewort (*Pedicularis sylvatica*) gathered at Burton Agnes (L. B. R.).

May 21st.—Wild Pansy (*Viola tricolor*) in flower, Woodhouse Hill, Leeds (W. H. H.).

May 23rd.—Yellow Dead Nettle (*Lamium galeobdolon*), White Dead Nettle (*L. album*), Red Campion (*Lychnis diurna*), Creeping Bugle (*Ajuga reptans*), Crab Apple (*Pyrus malus*), Sycamore (*Acer pseudo-platanus*), Germander Speedwell (*Veronica chamædrys*), Wood Forget-me-not (*Myosotis sylvatica*) in flower, in the Washburn Valley (P. A.).

May 25th.—Ivy-leaved Speedwell (*Veronica hederifolia*), Thyme-leaved Speedwell (*V. serpyllifolia*) and Sweet Cicely (*Myrrhis odorata*) in flower, at Roundhay (P.A.); Marsh Marigold (*Caltha palustris*), Herb Robert (*Geranium Robertianum*), Stitchwort (*Stellaria holostea*), Dog Violet (*Viola canina*), Forget-me-not (*Myosotis palustris*) in flower, and Edible Mushroom (*Agaricus campestris*) found on Speeton Cliff, Driffield (Geo. T. and L. B. R.).

May 25th.—In flower, Slender Vetch (*Vicia tetrasperma*), Burdock (*Arctium lappa*) Water Crowfoot (*Ranunculus aquatilis*), Water Violet (*Hottonia palustris*), Bird Cherry (*Prunus padus*), Common Bugle (*Ajuga reptans*), Ground Ivy (*Nepeta glechoma*), Dogwood (*Cornus sanguinea*), Spotted Orchis (*Orchis mascula*), Oxlip (*Primula elatior*), at Copgrove and Riggmoor; Wild Garlic (*Allium ampeloprasum?*), Borage (*Borago officinalis*), Adder's Tongue (*Ophioglossum vulgatum*), Forget-me-not (*Myosotis palustris*), Lily of the Valley (*Convallaria majalis*), and Wild Pansy (*Viola tricolor*). The above noted in Copgrove Park (W. H. H.).

May 25th.—Bird's-eye Primrose (*Primula farinosa*) and Marsh Violet (*Viola palustris*) in bloom, at Masham (T. C.).

May 25th.—Herb Paris (*Paris quadrifolia*) in flower, at Skipton (C. C. S.).

May 26th.—White Meadow Saxifrage (*Saxifraga granulata*), two forms of *Valeriana dioica* (*a* pistil absent, *b* anthers rudimentary, and corolla small), Green-winged Orchis (*Orchis Morio*), Lousewort (*Pedicularis sylvatica*), Yellow Pimpernel (*Lysimachia nemorum*), Milkwort (*Polygala vulgaris*), Stitchwort (*Stellaria holostea*), and Wood Stitchwort (*S. nemorum*), all in flower, near Harrogate (J. H. T.).

May 28th.—Hop Trefoil (*Trifolium procumbens*) in flower, at Bradley; Juniper (*Juniperus communis*) in flower, at Malham (C. C. S.).

May 30th.—Tormentil (*Potentilla tormentilla*), in flower, at Ilkley (C. C. S.).

May 30th.—Flax (*Linum usitatissimum*) and London Pride (*Saxifraga umbrosa*) in flower, on Greenhow Hill (W. Storey).

May 30th.—Holly Fern, Soft Prickly Shield Fern, Common Prickly Shield Fern, collected at Howstean; Royal Fern (*Osmunda regalis*) noted at Brimham Rocks; Yellow Vetch (*Vicia lutia*) (W. S.).

May 30th.—Globe Flower (*Trollius Europæus*), Barberry (*Berberis vulgaris*), Hawthorn (*Cratægus oxyacantha*) in flower, at Tanfield; Toothwort (*Lathræa squamaria*), Shining Geranium (*Geranium lucidum*), Bird Cherry (*Prunus padus*), Crosswort (*Galium cruciatum*), and Wood Sanicle (*Sanicula Europæa*) in flower at Hackfall, Masham (J. A.).

May 31st.—Wood Sanicle (*Sanicula Europæa*), Earth Nut (*Bunium flexuosum*), and Lesser Burnet (*Poterium sanguisorba*) in flower, at Masham (T. C.).

June 2nd.—Hawthorn (*Cratægus oxyacantha*) Dwarf Orchis (*Orchis ustulata*), and Globe Flower (*Trollius Europæus*) in bloom, at Masham (T. C.).

June 3rd.—Greater Celandine (*Chelidonium majus*) in flower, at Skipton (C. C. S.).

June 4th.—Brooklime (*Veronica beccabunga*), Earth Nut (*Bunium flexuosum*) in flower, at Skipton (C. C. S.).

June 5th.—Bird's-foot Trefoil (*Lotus corniculatus*), Twayblade (*Listera ovata*), and Silverweed (*Potentilla anserina*) in flower, at Skipton (C. C. S.).

June 5th.—Butterwort (*Pinguicula vulgaris*), Wood Crane's-bill (*Geranium sylvaticum*), Bistort (*Polygonum bistorta*), Cow Wheat (*Melampyrum sylvaticum*), Herb Christopher (*Actea spicata*), Yellow Goat's-beard (*Tragopogon pratensis*), and Hoary Plantain (*Plantago media*) in bloom, at Masham (T. C.).

June 6th.—Mountain Speedwell (*Veronica montana*), Procumbent Speedwell (*Veronica agrestis*), Spindle Tree (*Euonymus Europæus*), Corn Poppy (*Papaver rhœas*), Sun Spurge (*Euphorbia helioscopia*), Scarlet Pimpernel (*Anagallis arvensis*), Common Fumitory (*Fumaria officinalis*), Long-stalked Crane's-bill (*Geranium columbinum*), Dove's-foot Crane's-bill (*Geranium molle*), Field Scorpion-grass (*Myosotis arvensis*), Wild Mignonette (*Reseda lutea*), Columbine (*Aquilegia vulgaris*), Silverweed (*Potentilla anserina*), Creeping Cinquefoil (*Potentilla reptans*), Salad Burnet (*Poterium sanguisorba*), Water Avens (*Geum rivale*), Lesser Clover (*Trifolium procumbens*), Hairy Violet (*Viola hirta*), Bush Vetch (*Vicia sepium*), Ox-eye (*Chrysanthemum leucanthemum*), Lady's Fingers (*Anthyllis vulneraria*) in flower, at Wothersome; Yellow Water Lily (*Nuphar lutea*), Marsh Valerian (*Valeriana dioica*), Twayblade (*Listera ovata*), Rock Rose (*Helianthemum vulgare*) in flower, in Bramham Park (P. Alexander).

June 8th.—Limestone Polypody (*Polypodium calcareum*) and Parsley Fern (*Allosorus crispus*) collected on Greenhow Hill (W. S.).

June 9th.—Yellow Rattle (*Rhinanthus crista-galli*) in flower, at Pateley (W. S.).

June 11th.—St. John's Wort (*Hypericum perforatum*) and Avens Eye-bright (*Euphrasia officinalis*) in flower, in Nidderdale (W. S.).

June 12th.—Figwort (*Scrophlularia aquatica*) in flower, Pateley (W. S.).

June 14th.—Buckbean (*Menyanthes trifoliata*) collected on Pateley Moor (W. S.).

June 14th.—Honeysuckle (*Lonicera periclymenum*) and Scurvy-grass (*Cochlearia officinalis*) in flower, at Garforth; Buck-bean (*Menyanthes trifoliata*) and Woody Nightshade (*Solanum dulcamara*) in flower, in Parlington Park (W. H. H.).

June 15th.—Lesser St. John's Wort (*Hypericum pulchrum*), Wood Betony (*Stachys betonia*), and Globe Flower (*Trollius Europæus*) seen in Fellbeck Woods (W. S.).

June 17th.—Wild Raspberry (*Rubus idæus*), Cow-wheat (*Melampyrum sylvaticum*) in flower, in Nidderdale (W. S.).

June 18th.—Wall-pepper (*Sedum acre*) and White Campion (*Lychnis vespertina*) in flower, at Barnsley (J. H.).

June 19th.—Bladder Campion (*Silene inflata*) in Bloom, at Barnsley (J. H.).

June 19th.—Dog Rose (*Rosa canina*), Ragwort (*Senecio Jacobæa*), Butterfly Orchis (*Habenaria bifolia*) in flower, at Pateley (W. S.).

June 20th.—Mouse-ear Hawkweed (*Hieracium pilosella*), Long-rooted Cat's-ear (*Hypochæris radicata*), Frog Orchis (*Habenaria viridis*), Butterfly Orchis (*Habenaria bifolia*) in flower, on Harlow Hill, Harrogate (J. H. T.).

June 20th.—Dogwood (*Cornus sanguinea*) and Ox-eye (*Chrysanthemum leucanthemum*) in flower, at Park Side, Dewsbury Road (W. H. H.).

June 21st.—Wood Betony (*Stachys betonica*), five-leaved Heath (*Erica cinerea*), and Buckbean (*Menyanthes trifoliata*) in flower, in Nidderdale (W. S.).

June 21st.—Long-stalked Crane's-bill (*Geranium columbinum*), Lesser Butterfly Orchis (*Habenaria bifolia*), Buckthorn (*Rhamnus catharticus*), Black Bryony (*Tamus communis*), Foxglove (*Digitalis purpurea*), Traveller's Joy (*Clematis vitalba*), Dog Rose (*Rosa canina*), Villous Rose (*Rosa mollis*), in flower, at Grange (J. A.).

June 22nd.—Cow Wheat (*Melampyrum pratense*), Thrift (*Armeria maritima*), Sea Plaintain (*Plantago maritima*), Field Madder (*Sherardia arvensis*), Yellow Rattle (*Rhinanthus crista-galli*) in flower, at Grange (J. A.); Meadow Vetch (*Lathyrus pratensis*) in flower, at Barnsley (J. H.).

June 22nd.—Snake-weed (*Polygonum bistorta*), Small-flowered Willow Herb (*Epilobium rivulare*), Cross-leaved Heath (*Erica tetralix*) in flower, near Harrogate (J. H. T.).

June 23rd.—Lesser St. John's Wort (*Hypericum pulchrum*), Foxglove (*Digitalis purpurea*), Soapwort (*Saponaria officinalis*), Meadow Sweet (*Spiræa ulmosa*) in flower, in Nidderdale (W. S.).

June 23rd.—Herb Paris (*Paris quadrifolia*), Deadly Nightshade (*Atropa belladonna*), Pale Willow Herb (*Epilobium montanum*), Celery-leaved Crowfoot (*Ranunculus sceleratus*), Marsh Orchis (*Orchis latifolia*), Variegated Horsetail (*Equisetum variegatum*), Rampant Fumitory (*Fumaria capreolata* and *F. pallidiflora*) in flower, at Grange (J. A.); Dog Rose (*Rosa canina*) in bloom, at Barnsley (J. H.).

June 24th.—Self-heal (*Prunella vulgaris*) in flower, at Monk Bretton (J. H.).

June 25th.—Field Knautia (*Knautia arvensis*), Wild Thyme (*Thymus serpyllum*), Wild Barley (*Hordeum sylvaticum*), Ivy-leaved Toad-flax (*Linaria cymbalaria*), Columbine (*Aquilegia vulgaris*) in flower, at Grange (J. A.).

June 25th.—Butterwort (*Pinguicula vulgaris*) in flower, in Nidderdale (W. S.).

June 26th.—Great Valerian (*Valeriana officinalis*), Bloody Crane's-bill (*Geranium sanguineum*), Large Butterfly Orchis (*Habenaria chlorantha*), Cathartic Flax (*Linum catharticum*), Lesser Burnet (*Poterium sanguisorba*), Burnet Rose (*Rosa spinosissima*), Sea Campion (*Silene maritima*), Bladder Campion (*S. inflata*) in flower, at Grange (J. A.); Common Mallow (*Malva sylvestris*) in bloom, at Barnsley (J. H.).

June 26th.—White Campion (*Lychnis vespertina*), Marsh Orchis (*Orchis latifolia*), Dogwood (*Cornus sanguinea*), Wood Betony (*Stachys betonica*), Field Scabious (*Knautia arvensis*), Hedge Woundwort (*Stachys sylvatica*) in flower, near Harrogate (J. H. T.).

June 27th.—Golden-rod (*Solidago virgaurea*), Hemp-agrimony (*Eupatorium cannabinum*), Saw-wort (*Serratula tinctoria*), Guelder Rose (*Viburnum opulus*), Wood Betony (*Stachys betonica*), Wild Thyme (*Thymus serpyllum*), Small Scabious (*Scabiosa columbaria*), Wild Marjoram (*Origanum vulgare*), Horse-shoe Vetch (*Hippocrepis comosa*), Wall-rue Spleenwort (*Asplenium ruta-muraria*) and *Hieracium cæsium*, found at Aysgarth Force; Wood Crane's-bill (*Geranium sylvaticum*), Cut-leaved Crane's-bill (*G. dissectum*), Mountain Scurvy-grass (*Cochlearia alpina*), Sweet-scented Orchis (*Gymnadenia conopsea*), Great Bell-flower (*Campanula latifolia*), Prickly Buckler Fern (*Lastræa spinulosa*), and Bladder Fern (*Cystopteris fragilis*) found at Gale Dale, Wensleydale (J. A. E. S.).

June 27th.—Foxglove (*Digitalis purpurea*), Scentless Mayweed (*Matricaria inodora*) in bloom, at Middleton Wood (W. H. H.).

June 27th.—Dewberry (*Rubus cæsius*) in bloom, near Barnsley (J. H.); Eyebright (*Euphrasia officinalis*), Quaking-grass (*Briza media*), False Oat-grass (*Arrhenatherum avenaceum*), Cock's-foot Grass (*Dactylis glomerata*) in flower, at Grange; Mountain Polypody (*Polypodium calcareum*) gathered near Grange (J. A.).

June 28th.—Nipplewort (*Lapsana communis*), Great Celandine (*Chelidonium majus*), Self-heal (*Prunella vulgaris*), Yellow Flag (*Iris pseudacorus*), Wood Melic-grass (*Melica uniflora*), and Mountain Melic-grass (*Melica nutans*) in flower, at Grange J. and P. A.).

June 29th.—Alder Buckthorn (*Rhamnus frangula*), Bog Myrtle (*Myrica gale*), Cranberry (*Vaccinium oxycoccos*), Marsh Andromeda (*Andromeda polifolia*), Cross-leaved Heath (*Erica tetralix*), Fly Orchis (*Ophrys muscifera*), Sea Milk-wort (*Glaux maritima*), Scurvy-grass (*Cochlearia officinalis*), Honeysuckle (*Lonicera periclymenum*), Creeping Fescue-grass (*Festuca rubra*), Yellow Sedge (*Carex œderi*), Round-fruited Rush (*Juncus compressus*), Red Valerian (*Centranthus ruber*), Sea Spurry (*Spergularia marina*), Hare's-tail Cotton-grass (*Eriophorum vaginatum*), and Prickly Shield-fern (*Polystichum lobatum*) found at Grange (J. and P. A.); Hedge Stachys (*Stachys sylvatica*) in flower, near Barnsley (J. H.).

June 30th.—Rest-Harrow (*Ononis arvensis*), Ragged-robin (*Lychnis flos-cuculi*), Dwarf Mallow (*Malva rotundifolia*), Sweet-scented Orchis (*Gymnadenia conopsea*), and Moonwort (*Botrychium lunaria*) found at Grange (J. and P. A.).

July 1st.—Sharp-fringed Sow Thistle (*Sonchus oleraceus*) in bloom, near Barnsley (J. H.).

July 2nd.—Scentless May Weed (*Matricaria inodora*) in bloom near Barnsley (J. H.).

July 2nd.—Welsh Poppy (*Meconopsis Cambrica*) and Deadly Nightshade (*Atropa belladonna*) found in Nidderdale (W. S.).

July 3rd.—Feverfew (*Matricaria parthenium*), Cranberry (*Vaccinium oxycoccos*), and Viper's Bugloss (*Echium vulgare*) (W. S.)

July 3rd.—Traveller's Joy (*Clematis vitalba*), White Water-lily (*Nymphæa alba*), Wood Crane's-bill (*Geranium sylvaticum*), and Welsh Poppy (*Meconopsis Cambrica*) in flower at Rydal (J. and P. A.); Black Knap-weed (*Centaurea nigra*) in bloom near Barnsley (J. H.).

July 4th.—Feverfew *Matricaria parthenium*), Yarrow (*Achillea millefolium*) in bloom near Barnsley (J. H.).

July 4th.—Foxglove (white variety) (*Digitalis purpurea*), Goldenrod (*Solidago virgaurea*), and Guelder-rose (*Viburnum opulus*) in flower in Nidderdale (W. S.).

July 7th.—Wild Marjoram (*Origanum vulgare*), Black Knapweed (*Centaurea nigra*), and Great Knapweed (*C. scabiosa*) in flower near Pateley (W. S.).

July 9th.—Agrimony (*Agrimonia eupatoria*), Square-stalked St. John's Wort (*Hypericum quadrangulum*), Large Butterfly Orchis (*Habenaria chlorantha*), Fragrant Orchis (*Gymnadenia conopsea*), Wood Crane's-bill (*Geranium sylvaticum*), Cut-leaved Crane's-bill (*Geranium dissectum*), Eyebright (*Euphrasia officinalis*), Meadow Vetch (*Lathyrus pratensis*) in flower at Gargrave (Miss Tranter).

July 11th.—Great Bell-flower (*Campanula latifolia*) and Viper's Bugloss (*Echium vulgare*) in flower; and Elder (*Sambucus niger*), Hawthorn (*Cratægus oxyacantha*), and Crab-apple (*Pyrus malus*) in fruit near Pateley (W. S.).

July 14th.—Butterfly Orchis (*Habenaria bifolia*), Common Filago (*Filago Germanica*), Field Filago (*Filago minima*), Enchanter's Nightshade (*Circea lutetiana*), Woody Nightshade (*Solanum dulcamara*) found at Folifoot (Miss Milner).

July 18th.—Ragwort (*Senecio Jacobæa*), Black Knapweed (*Centaurea nigra*), Common Flax (*Linum usitatissimum*), and Musk Mallow (*Malva moschata*) in flower near Bardsey (Percy Alexander).

July 20th.—Bee Orchis (*Ophrys apifera*) and Common St. John's Wort (*Hypericum perforatum*) found near Wetherby (Miss Milner).

July 22nd.—Large-flowered Hemp Nettle (*Galeopsis versicolor*) and Common Toad-flax (*Linaria vulgaris*) in flower at Potternewton (P. A.).

July 25th.—Common Melilot (*Melilotus officinalis*), Creeping Soft-grass (*Holcus mollis*), Common Fox-tail Grass (*Alopecurus pratensis*), Rye Grass (*Lolium perenne*), Rough Meadow Grass (*Poa trivialis*), Dog's-tail Grass (*Cynosurus cristatus*), and Floating Meadow Grass (*Glyceria fluitans*) in flower near Pateley (W. S.).

July 31st.—Great Bell Flower (*Campanula latifolia*) and Bog Asphodel (*Narthecium ossifragum*) in flower at Eccup (W. L. Leach).

August 1st.—Comfrey (*Symphytum officinale*), Agrimony (*Agrimonia eupatoria*), Ling (*Calluna vulgaris*), and a white variety of Meadow Crane's Bill (*Geranium pratense*), in flower, near Otley (P. A.).

August 6th.—White variety of Cross-leaved Heath (*Erica tetralix*) found on Thorne Waste, near Doncaster (A. P. B. Ellis).

August 8th.—Common St. John's Wort (*Hypericum perforatum*), Yellow Bed Straw (*Galium verum*), Great Knapweed (*Centaurea scabiosa*), Hoary Plantain (*Plantago media*), Perfoliate Yellow Wort (*Chlora perfoliata*), Hemlock (*Conium maculatum*), Red Bartsia (*Bartsia odontites*), Wild Marjoram (*Origanum vulgare*), Centaury (*Erythræa centaurium*), Basil (*Calamintha clinopodium*), and Grass of Parnassus (*Parnassia palustris*), in flower, near Wothersome and Bardsey (P. A.).

August 10th.—Bog Asphodel (*Narthecium ossifragum*), collected on Pateley Moor (W. S.).

August 12th.—Tansy (*Tanacetum vulgare*), Willow-leaved Spiræa (*Spiræa salicifolia*) in bloom, in Nidderdale (W. S.).

August 13th.—Grass of Parnassus (*Parnassia palustris*) in flower, at Pateley (W. S.).

ZOOLOGICAL.

February 8th.—Pied Wagtail (*Motacilla lugubris*) observed at Broadley, near Skipton (C. C. S.).

February 20th.—Yellow Hammer (*Emberiza citrinella*) in song at Skipton (C. C. S.).

February 27th.—Grey Wagtail (*Motacilla sulphurea*), observed at Broadley, near Skipton (C. C. S.).

March 2nd.—Nest of Starling (*Sturnus vulgaris*), and also nest of Robin (*Erithacus rubecula*), noted in course of construction near Skipton (C. C. S.).

March 7th.—Arrival of Curlew (*Numenius arquatus*), noted at Eavestone, near Ripon (J. Ingleby).

March 10th.—Water Debber or Dipper (*Cinclus aquaticus*) observed near Bradley; Kingfisher (*Alcedo ispida*) observed on the river Aire, near Bradley (C. C. S.).

March 20th.—Several Larks seen on Woodhouse Moor (C. T. Hope).

March 21st.—Twenty Curlews (*Numenius arquatus*) seen feeding in fields at Gowthwarth Hall; also several noted in a field at Ramsgill; and about 150 Golden Plovers (*Charadrius pluvialis*) observed in fields near Howstean (W. T. and A. W. Philipps). Common Bunting (*Emberiza miliaria*) in song (W. S.).

March 21st.—Nest of Magpie (*Pica caudata*) noted in course of construction near Skipton (C. C. S.).

March 21st.—Ring-Ouzel (*Turdus torquatus*) seen in Nidderdale (W. S.).

March 21st.—A pair of Sand Martins seen flying in a northerly direction at Crossgates (W. L. C.).

March 23rd.—Whiskered Bat (*Vespertilio mystacinus*) caught during the day while flying about (W. Thackrey). This Bat is common about here (W. S.).

March 23rd.—Wheatear (*Saxicola œnanthe*) seen on Pateley Moor (W. S.); Halifax (C. L. Hanson).

March 25th.—Stone Chat and Water Wagtail seen on Woodhouse Moor (C. T. H.).

March 28th.—Several Hooded Crows (*Corvus cornix*) noted flying about a dead sheep on Pateley Moor; Green Woodpecker (*Gecinus viridis*) heard, and Ringdove (*Columba palumbus*) heard cooing near Pateley; also nest of Song Thrush (*Turdus musicus*) noted containing two eggs; Snipe (*Scolopax media*) heard drumming on Hayshaw Moor; nest of Missel Thrush (*Turdus viscivorus*), containing one egg, near Pateley Bridge (W. S.).

March 29th.—Greenfinch (*Coccothraustes chloris*) and Tit Lark in song in Nidderdale (W. S.).

April 1st.—Pair of Teal Ducks (*Querquedula crecca*) seen on a small stream, and several Fieldfares (*Turdus pilaris*) and Red Wings (*T. iliacus*) seen collecting; also two nests of Lapwings (*Vanellus cristatus*) containing one and two eggs respectively, Pateley Moor (W. S.).

April 2nd.—Wheatear (*Saxicola œnanthe*) observed at Bradley, near Skipton (C. C. Smith). Nest of Lapwing (*Vanellus cristatus*) noted at Bradley, containing eggs (C. C. S.).

April 3rd.—Arrival of Chiffchaff (*Phylloscopus collybita*) at Masham. Woodcock (*Scolopax rusticola*) last seen at Masham. Meadow Pipit (*Anthus pratensis*) in full song, Masham; Water-hen (*Gallinula chloropus*) building at Masham; Cabbage Butterfly and Humble-bee seen at Masham (T. Carter).

April 3rd.—Gold-crested Wren (*Regulus cristatus*) heard chirping, and nest of Dipper (*Cinclus aquaticus*) noted containing three eggs, Glasshouses (W. S.).

April 4th.—Noted some of the Rooks (*Corvus frugilegus*) have eggs in their nests at Middleton Wood (W. H. Hutton).

April 4th.—Tree Sparrows (*Passer montanus*) building under Rooks' nests at Masham (T. C.).

April 4th.—Numerous nests of Song Thrush (*Turdus musicus*) and of Missel Thrush (*T. viscivorus*) noted, containing eggs (C. C. S.).

April 5th.—Wheatear (*Saxicola œnanthe*) arrived at Flamborough (M. B.).

April 6th.—Ring Ouzel (*Turdus torquatus*) noted at Bradley (C. C. S.).

April 6th.—The Cuckoo heard at Pool (W. L. C.).

April 7th.—Flock of 20 Golden Plovers (*Charadrius pluvialus*) seen flying over Harlow Moor, Harrogate (W. S.).

April 7th.—Heard Goldfinches singing, Osmondthorp (W. H. Hutton).

April 11th.—Nest of Blackbird (*Turdus merula*) with three eggs, Masham; Starling (*Sturnus vulgaris*) building, Masham (T. C.).

April 11th.—Nest of Robin (*Erithacus rubecula*), with three eggs, near Pateley (W.S.); young Rooks noted and several nests of Starlings (*Sturnus vulgaris*) containing eggs, in Nidderdale (W. S.).

April 13th.—Hooded Crow (*Corvus cornix*) seen at Flamborough (M.B.).

April 13th.—Young House Sparrow (*Passer domesticus*) noted in nest, Pateley (W.S.).

April 13th.—Nest of Wren (*Troglodytes parvulus*) with one egg, at Glasshouses (W.S.).

April 13th.—Hedge Sparrow (*Accentor modularis*) building at Masham (T. C.).

April 14th.—Coot (*Fulica atra*) building at Masham (T. C.).

April 14th.—Ray's Wagtail (*Motacilla Raii*) arrived near Halifax (C. C. H.).

April 15th.—Nest of Rook (*Corvus frugilegus*) containing four eggs, noted near Skipton (C. C. S.).

April 15th.—Swallow and Sand Martin at Tadcaster (B. B. Thompson).

April 16th.—Sandpiper (*Acitis hypoleucos*) arrived, Masham; two Black-headed Gulls (*Larus ridibundus*) seen at Masham (T. C.).

April 17th.—Wood Pigeon (*Columba palumbus*) building, Masham.

April 17th.—A flock of seven Swallows (*Hirundo rustica*) noted at Bradley (C. C. S.).

April 17th.—Three Swallows seen on river Cover, Wensleydale (J. A. Erskine Stuart).

April 17th.—Three Swallows (*Hirundo rustica*) seen at Adel Rectory (Alfred Greenwood).

April 17th.—Swallow (*Hirundo rustica*) arrived at Salterhebble (C.C.H.).

April 17th.—A pair of common Gulls (*Larus canus*) flying eastward over Potternewton (James Taylor).

April 17th.—Several Swallows (*Hirundo rustica*), Sand Martins (*Cotile riparia*) arrived; also Willow Wren (*Phylloscopus trochilus*) heard and seen in Nidderdale (W. S.).

April 18th.—Red Admiral Butterfly (*Vanessa Atalanta*) seen in Coverdale (J. A. E. Stuart).

April 18th.—Nest of Missel Thrush (*Turdus viscivorus*), containing four young ones; also that of Hedge Sparrow (*Accentor modularis*), with three eggs; Yellow Bunting (*Emberiza citrinella*) and Wheatear (*Saxicola œnanthe*) noted building near Pateley (W.S.).

April 18th.—Several Swallows (*Hirundo rustica*) seen near Ripley (C. E. Avignon); young Hedgehogs (*Erinaceus Europæus*) noted in Guy's Cliff, Nidderdale (Robert Young); Sandpipers (*Acitis hypoleucos*) arrived in Nidderdale, Grey (*Motacilla sulphurea*) and Pied Wagtails (*M. lugubris*) noted building, nest of Snipe (*Gallinago media*) containing four eggs, several nests of Red Grouse (*Lagopus scoticus*) noted, containing from five to ten eggs each, on the moors, all in Nidderdale (W. S.); Cuckoo (*Cuculus canorus*) arrived at Luddendenfoot (F. D. Clayton); Swallow (*Hirundo rustica*) on the wing at Potternewton, Leeds (J. T.).

April 18th.—Willow Wren (*Phylloscopus trochilus*), Sand Martin (*Hirundo riparia*), and Swallow (*Hirundo rustica*) first noted at Masham, and young Thrushes (*Turdus musicus*) seen there; Sparrows (*Passer domesticus*) building there (T. C.); Swallow (*Hirundo rustica*) first seen at Eaveston, near Ripon (James Ingleby).

April 18th.—Chiffchaff at Harrogate (B. B. T.).

April 19th.—Willow Wren and Tree Pipit at Harrogate (B. B. T.).

April 19th.—Hooded Crow (*Corvus cornix*) last seen, Masham (T. C.).

April 19th.—Cuckoo (*Cuculus canorus*) heard near Ripley (C. E. A.); Willow Wren (*Phylloscopus trochilus*) and Chiffchaff (*P. collybita*) arrived, Elland Park Wood (C. C. H.); Yellow Wagtail (*Motacilla Raii*) arrived at Luddendenfoot (F. D. C.); lesser Tortoise-shell Butterfly (*Vanessa urticæ*) and Cabbage Butterfly (*Pieris brassicæ*) on the wing at Potternewton; several Swallows (*Hirundo rustica*) on the wing at Potternewton; Blackbird (*Turdus merula*) sitting on four eggs, Potternewton (J. T.).

April 20th.—Nests of Song Thrush (*Turdus musicus*) seen at Flosby, near Skipton, containing young (C. C. S.).

April 20th.—Two Swallows seen at Ulleskelf (Florence Baines); Swallow in York Road, Leeds; three Swallows in company with five House Martins (*Hirundo urbica*), at Killingbeck; three Swallows at Seacroft, one at Bramham; Willow Wren (*Phylloscopus trochilus*) and Chiffchaff (*P. collybita*) seen and heard at Bramham (H. B. Hewetson).

April 20th.—Dor Beetles observed flying about during the evening at Pateley (W. S.); Willow Wren (*Phylloscopus trochilus*) arrived at Luddendenfoot (F. D. C.).

April 20th.—Chaffinch (*Fringilla cælebs*) building, and Fieldfares (*Turdus pilaris*) last seen, at Masham (T. C.).

April 21st.—Sand Martins (*Hirundo riparia*) and a Swallow flying over Meanwood Beck (H. Kirkby).

April 21st.—Arrival of Wheatear (*Saxicola œnanthe*), Tree Pipit (*Anthus trivialis*), House Martin (*Hirundo urbica*), and Yellow Wagtail (*Motacilla Raii*), and nest with two eggs of Hedge Sparrow (*Accentor modularis*) noted at Masham (T. C.).

April 21st.—Three Swallows (*Hirundo rustica*), and two Martins (*Hirundo urbica*), and House Martin (*Hirundo urbica*) arrived in Nidderdale (W. S.).

April 22nd.—Large Bat (*Vesperugo noctula*) caught at Glasshouses (Edward Knowles).

April 22nd.—Nightingale at Harrogate (B. B. T.).

April 22nd.—Appearance of Hedgehog (*Erinaceus Europæus*), and nest with two eggs of Grey Wagtail (*Motacilla melanope*) noted, Masham (T. C.).

April 23rd.—Cuckoo (*Cuculus canorus*) heard near Pateley (David Storey); young Lapwings (*Vanellus cristatus*) noted, and young Song Thrush (*Turdus musicus*) on wing, Redstart (*Ruticilla phœnicurus*) arrived (this bird is rather common here, and is locally called "Renny Red-tail" or "Fire-tail"); Ring Ouzels (*Turdus torquatus*) observed building (this bird is very common in Nidderdale) (W. S.).

April 23rd.—Arrival of Wheatear (*Saxicola œnanthe*) noted at Eaveston, Ripon (J. Ingleby); young Missel Thrushes (*Turdus viscivorus*) seen, nest of Jackdaw (*Corvus monedula*) with three eggs noted, and Pied Wagtail (*Motacilla lugubris*) observed building, Masham (T. C.).

April 24th.—Arrival of Blackcap (*Sylvia atricapilla*), and nest with one egg of starling (*Sturnus vulgaris*) noted at Masham (T. C.).

April 24th.—Tree Pipit (*Anthus trivialis*) heard and seen at Potternewton (James Taylor).

April 25th.—Cuckoo (*Cuculus canorus*) in a wood near Halifax (C. C. H.); Yellow Wagtail (*Motacilla Raii*), Common Whitethroat (*Sylvia rufa*), Tree Pipit (*Anthus trivialis*), seen in Nidderdale (W. S.).

April 25th.—Arrival of Redstart (*Ruticilla phœnicurus*), noted at Masham (T. C.). Cuckoo (*Cuculus canorus*) first heard at Eaveston, Ripon (J. I.).

April 25th.—Yellow Wagtail and Cuckoo at Harrogate (B. B. T.).

April 26th.—Cuckoo (*Cuculus canorus*) heard first time this year (L. B. Ross, Driffield).

April 26th.—Arrival of Whinchat (*Pratincola rubetra*) and Lesser Whitethroat (*Sylvia curruca*) noted, Masham (T. C.).

April 26th.—Cuckoo (*Cuculus canorus*) heard near Alwoodley Crags; also Black-headed Bunting (*Emberiza melanocephala*) seen at Alwoodley Moss (J. T.).

April 27th.—Arrival of Cuckoo (*Cuculus canorus*) and Sedge Warbler (*Acrocephalus schœnobœnus*), and nest with one egg of Waterhen (*Gallinula chloropus*) noted at Masham (T. C.).

April 27th.—Landrail, Swift, and Sandpiper at Tadcaster (B. B. T.).

April 27th.—Sedge Warbler (*Acrocephalus schœnobœnus*) arrived at Luddendenfoot (F. D. Clayton); Martin (*Hirundo urbica*) seen at Victoria Bridge, Leeds (J. T.).

April 28th.—Whinchat (*Pratincola rubetra*) arrived in Nidderdale; nest of Dipper (*Cinclus aquaticus*), with five eggs; nest of Magpie (*Pica caudata*), with two eggs, at Felbeck (W. S.).

April 28th.—Found larva Oak Eggar Moth (*Bombyx quercus*) (L. B. R.).

April 28th.—Arrival of Landrail (*Crex pratensis*), and Garden Warbler (*Sylvia hortensis*) noted at Masham (T. C.); arrival of House Martin (*Hirundo urbica*) and Redstart (*Ruticilla phœnicurus*) noted at Eaveston (J. I.).

April 29th.—Young Water Ouzels (*Cinclus aquaticus*) seen, and arrival of Wood Wren (*Phylloscopus sibilatrix*) and Whitethroat (*Sylvia rufa*) noted, Masham (T. C.).

April 29th.—Wood Wren (*Phylloscopus sibilatrix*) and Corncrake (*Crex pratensis*) arrived; nest of Ring Ouzel (*Turdus torquatus*), with five eggs in, at Pateley Moor (W. S.).

April 30th.—Nest of Chaffinch (*Fringilla cœlebs*), with four eggs; Grey Wagtail (*Motacilla sulphurea*), five eggs; Pied Wagtail (*Motacilla lugubris*), with four eggs, at Glasshouses; Swifts (*Cypselus apus*) arrived in Nidderdale (W. S.).

April 30th.—Arrival of Swift (*Cypselus apus*), and nest with one egg of Pied Wagtail (*Motacilla lugubris*) noted, Masham (T. C.).

May 1st.—Nest of Chaffinch (*Fringilla cœlebs*), one egg.

May 2nd.—Grasshopper Warbler (*Acrocephalus nævius*) arrives; Sand Martin (*Hirundo riparia*) builds.

May 2nd.—Cuckoo (*Cuculus canorus*) and Corncrake (*Crex pratensis*) heard, and Whitethroat (*Sylvia rufa*) seen near Adel (P. Robinson).

May 2nd.—Pied Flycatcher (*Muscicapa atricapilla*) arrived (W. S.); Shells collected (*Helix hortensis* and *Helix arbustorum*); Several nests of Chaffinch (*Fringilla cœlebs*), and one of Greenfinch (*Coccothraustes chloris*), noted at Ramsgill (W. S. and A. W. Phillips); nest of Wheatear (*Saxicola œnanthe*), with two eggs, Pateley Moor (W. S.).

May 3rd.—A large flock of Swallows (*Hirundo rustica*) on the trees and about the beck near Meanwood Church (W. H. H.).

May 3rd.—Pied Flycatcher (*Muscicapa atricapella*) arrives; nest of Wood Pigeon (*Columba palumbus*), two eggs; nest of Partridge (*Perdix cinerea*), one egg; and nest of House Sparrow (*Passer domesticus*), two eggs.

May 4th.—Spotted Flycatcher (*Muscicapa grisola*) and Garden Warbler (*Sylvia hortensis*) noted; young Hedge Sparrows (*Accentor modularis*) on wing in Nidderdale (W.S.).

May 5th.—Found larva of Currant Moth (*Abraxas grossulariata*) at Driffield (L. B. R.).

May 5th.—Young Missel Thrushes (*Turdus viscivorus*) fledge.

May 6th.—Young Starlings (*Sturnus vulgaris*) on Wing and Brimstone Moth (*Rumia cratægata*) taken at Bewerley Gardens (W. S.).

May 6th.—Heard Corncrake (*Crex pratensis*), Park Side, Dewsbury Road (W. H. H.).

May 8th.—Sedge Warbler (*Acrocephalus schœnobœnus*) noted, nest of Greenfinch *Coccothraustes chloris*) containing three eggs, young Robins (*Erythacus rubecula*) on wing, young Snipe (*Gallinago medias*) seen near Pateley (W. S.).

May 9th.—Several nests of Skylarks (*Alauda arvensis*) with four eggs each, Pateley Moor; also Titlark (*Anthus pratensis*) nest, with four eggs; Redstart (*Ruticilla phœnicurus*) nest, with one egg; and that of Great Tit (*Parus major*), with four eggs, near Pateley (W. S.).

May 9th.—Willow Wren (*Phylloscopus trochilus*) builds; Spotted Flycatcher (*Muscicapa grisola*) arrives; young Hedge Sparrows (*Accentor modularis*) seen.

May 10th.—Heard Night Jar (*Caprimulgus Europæus*), also Corncrake (*Crex pratensis*), and notes Skylark's (*Alauda arvensis*) nest with three eggs, which were near hatching; also a Thrush's (*Turdus musicus*) nest, with four young ones almost ready to leave the nest, Alwoodley, near Leeds (W. H. H.).

May 11th.—Four Gulls seen; young Peewits (*Vanellus cristatus*) found; and Lesser Redpole (*Linota linaria*) builds.

May 11th.—Young Ring Ouzels (*Turdus torquatus*) noted near Pateley (W. S.).

May 12th.—Nest of Jay (*Garrulus glandarius*), with three eggs, Summer Bridge; nest of Wheatear (*Saxicola œnanthe*), with four eggs; young Grouse (*Lagopus scoticus*), Pateley Moor; Night Jar (*Caprimulgus Europæus*) observed, Pateley (W. S.); Whitethroat (*Sylvia rufa*) and Pied Flycatcher (*Muscicapa atricapilla*) seen Park Side, Dewsbury Road, Leeds (W. H. H.).

May 13th.—Nest of Sandpiper (*Actitis hypoleucos*), four eggs; young Starlings (*Sturnus vulgaris*) seen; and nest of Tree Sparrow (*Passer montanus*), three eggs.

May 14th.—Nest of Great Tit (*Parus major*), five eggs; nest of Redstart (*Ruticilla phœnicurus*), two eggs.

May 14th.—Nest of Willow Wren (*Phylloscopus trochilus*), with one egg, and nest of Common Wood Pigeon (*Columba palumbus*), partly built; Tree Creeper's (*Certhia familiaris*) nest, with five eggs; young Pied Wagtails (*Motacilla lugubris*) observed; also young Skylarks (*Alauda arvensis*) noted, and nest of Starling (*Sturnus vulgaris*), with seven eggs, near Pateley (W. S.).

May 14th.—Wood Wren (*Phylloscopus sibilatrix*) seen, Middleton Wood (W. H. H.), and nest of Greenfinch (*Coccothraustes chloris*), with three eggs, Park Side, Dewsbury Road, Leeds (W. H. H.).

May 15th.—Young Tree Creepers (*Certhia familiaris*) seen; Blackcap (*Sylvia atricapilla* and Garden Warbler (*Sylvia hortensis*) build; young Water Ouzels (*Cinclus aquaticus*) fledge; and Pied Flycatcher (*Muscicapa atricapilla*) in full song.

May 16th.—Young Wrens (*Troglodytes parvulus*) found.

May 16th.—Nest of Wood Pigeon (*Columba palumbus*), containg two eggs, Harewell Woods (W. Storey); Nest of Pied Flycatcher (*Muscicapa atricapilla*), containing eggs, in an old tree, at Glasshouses (David Storey); (these birds are more numerous this year than on any previous year I ever remember, W. S.).

May 16th.—A number of Black-headed Buntings (*Emberiza melanocephala*) and Lapwing (*Vanellus cristatus*) on the Moor, Adel (W. H. H.); also observed a Magpie (*Pica caudata*) being mobbed by Blackbirds, in Meanwood Wood (W. H. H.).

May 17th.—Noted Tree Pipit (*Anthus trivialis*), Park Side, Dewsbury Road, Leeds (W. H. H.).

May 17th.—Nest of Lesser Redpole (*Linota linaria*), three eggs.

May 18th.—Noted nest of the Kestrel (*Falco tinnunculus*), near Leeds (W. H. H.).

May 18th.—Found larva of Tiger Moth (*Arctia caja*) (L. B. R.); young Wheatears (*Saxicola œnanthe*) noted; nest of Lesser Redpole (*Linota linaria*) with four eggs, and that of Marsh Tit (*Parus palustris*) with five eggs; Grasshopper Warbler heard (*Acrocephalus nœvius*); (this bird is rather rare in this district, W. S.).

May 19th.—Nest of Chiffchaff (*Phylloscopus collybita*) containing five eggs, nest of Sandpiper (*Actitis hypoleucos*) with four eggs, nest of Blue Tit (*Parus cæruleus*) with eight eggs and nest of Tree Sparrow (*Passer montanus*) with one egg, near Pateley (W. S.).

May 19th.—Lesser Whitethroat (*Sylvia curruca*) builds.

May 20th.—Sedge Warbler (*Acrocephalus schœnobœnus*) builds; nest of Blackcap (*Sylvia atricapilla*), two eggs; and nest of Garden Warbler (*Sylvia hortensis*), five eggs.

May 20th.—Two nests of Common Wasp (*Vespa vulgaris*), in Nidderdale (W. S.).

May 20th.—Nest of Swallow (*Hirundo rustica*) with two eggs; Natterer's Bat (*Vespertilio Nattereri*) secured near Pateley (W. S.).

May 21st.—Several Whiskered Bats (*Vespertilio mystacinus*) caught at Glasshouses (J. W. S.).

May 21st.—Hedge Sparrows (*Accentor modularis*) fledge; young Chaffinches (*Fringilla cœlebs*) seen; nest of Lesser Whitethroat (*Sylvia curruca*), five eggs; and nest of Willow Wren (*Phylloscopus trochilus*), five eggs.

May 21st.—Young Redstarts (*Ruticilla phœnicurus*); noted young Chaffinches (*Fringilla cœlebs*), on wing near Pateley (W. S.).

May 22nd.—Nest of Yellow Bunting (*Emberiza citrinella*), with four eggs; also Common Bunting (*Emberiza miliaria*), three eggs, Pateley (W. S.).

May 22nd.—Young Jackdaws (*Corvus monedula*) seen.

May 22nd.—Nest of Kestrel Hawk (*Falco tinnunculus*) containing three eggs, Brimham Rocks; nest of Tree Pipit (*Anthus trivialis*) with two eggs (W. S.).

May 23rd.—Emperor Moth (*Saturnia carpini*) caught at Bewerley Hall (W. Winsdale); Corncrake (*Crex pratensis*) heard at Driffield (L. B. R.).

May 23rd.—Nest of Spotted Flycatcher (*Muscicapa grisola*), partly built, Pateley (W. S.).

May 23rd.—Young Rooks (*Corvus frugilegus*), Middleton Wood, Dewsbury Road, Leeds (W. H. H.).

May 24th.—Tree Pipit's (*Anthus trivialis*) nest of four eggs, Grey Wagtails (*Motacilla sulphurea*) fledge, Greenfinch (*Coccothraustes chloris*) builds, Sand Martin's (*Hirundo riparia*) nest, five eggs; Brimstone Moth (*Rumia crataegata*) seen.

May 25th.—Moths, including the Brimstone Moth (*Rumia crataegata*), and Bees, including *Bombus muscorum*, taken in Harewell Woods (W. S.); Partridge nest with four eggs, *Clausilia rugosa*, *Pupa umbilicata*, *Helix rotundata*, *H. nemoralis*, *H. Arbustorum*, *H. virgata*, *H. ericetorum*, *H. sericea*, *Zonites nitidulus*, *Z. cellarius*, found on Speeton Cliff (Geo. T. and L. B. R.).

May 25th.—Birds noted at Lofthouse Hill, Riggmoor, and Copgrove Park: Magpie (*Pica caudata*), Blackbird (*Turdus merula*), Thrush (*Turdus musicus*), Tree Pipit

(*Anthus trivialis*), Chaffinch (*Fringilla cœlebs*), Yellow Hammer (*Emberiza citrinella*), Greater Redpole (*Fringilla linota*), Cuckoo (*Cuculus canorus*), Lapwing (*Vanellus cristatus*), Creeper (*Certhia familiaris*), Young Water Hens (*Gallinula chloropus*), Pheasant's Nest (*Phasianus Colchicus*). Copgrove Park: Chaffinch's Nest, with young (*Fringilla cœlebs*), Wood Pigeon (*Columba palumbus*), Coot (*Fulica atra*), nest of Dippers (*Cinclus aquaticus*). Staveley: House Martin (*Hirundo urbica*), Corn Crake (*Crex pratensis*), Cole Tit (*Parus ater*), Partridge (*Perdix cinerea*), Mallards (*Anas boschas*). Boroughbridge: Sand Martin (*Hirundo riparia*), Pied Wagtail (*Motacilla lugubris*). Collected the following fresh-water shells at Staveley: *Limnæa peregra;* and in a ditch by the railway station at Boroughbridge: *Limnæa glabra, Physa hypnorum,* and *Planorbis spirorbis;* land shells, *Helix nemoralis, H. hortensis,* &c. (W. H. H.).

May 26th.—Noted Grass Chat (Whinchat, *Pratincola rubetra*), Greater Whitethroat (*Sylvia rufa*), Cross Flats, Beeston, Leeds; Reed Warbler (*Acrocephalus streperus*), Blue Cap (*Parus cæruleus*), Lesser Redpole (*Linota linaria*), and two nests of the Linnet (*Linota cannabina*), one with two eggs and one with one egg, forsaken; observed men catching Lesser Redpoles, Park Side, Dewsbury Road, Leeds; noted large numbers of Tiger Moth Caterpillars (*Arctia caja*) Cross Flats, Beeston, Leeds (W. H. H.).

May 27th.—Dabchick's (*Podiceps minor*), nest, one egg; Sedge Warbler's (*Acrocephalus schœnobœnus*) nest, three eggs.

May 28th.—Reed Bunting's (*Emberiza schœniclus*) nest, five eggs; Wrens (*Troglodytes parvulus*) fledge (T. C.).

May 28th.—Noted young Starlings (*Sturnus vulgaris*) almost ready to leave the nest, at Dewsbury Road, Leeds (W. H. H.).

May 28th.—Young Ouzels (*Turdus torquatus*), Pateley Moor (W. S.).

May 30th.—Slow Worm (*Anguis fragilis*), enclosed alive, taken at Pateley (W. S.); also pair of Slow Worms, taken at Ginscliff (John Hall). Enclosed Bees (*Bombus lapidarius*) and Wagtail, taken at Pateley (W. S.).

May 30th.—Found pupæ of Tiger Moth (*Arctia caja*) at Cross Flats, Beeston (W. H. H.).

May 30th.—Long-eared Bat (*Plecotus auritus*) caught while flying about during the day, at Pateley (Orlanda Atkinson).

May 30th.—Greenfinch's (*Coccothraustes chloris*) nest, one egg; Wood Wren's (*Phylloscopus sibilatrix*) nest, four eggs.

May 31st.—Whitethroat's (*Sylvia rufa*) nest, five eggs; Young Sandpipers (*Actitis hypoleucos*) seen; young Water Hens (*Gallinula chloropus*) seen; Spotted Flycatcher (*Muscicapa grisola*) builds; Skylark's (*Alauda arvensis*) nest, three eggs.

June 1st.—Nightjar (*Caprimulgus Europœus*) arrives, young Snipe (*Gallinago media*) seen flying, young Carrion Crows (*Corvus cornix*) seen, young Ring Ouzels (*Turdus torquatus*) seen, Masham (J. C.).

June 1st.—Cabbage Butterfly (*Pieris brassicæ*), very abundant in Dewsbury Road; noted Skylark's (*Alanda arvensis*) nest, with young birds in, at Dewsbury Road, Leeds (W. H. H.).

June 2nd.—Emperor Moth (*Saturnia carpini*), Red Admiral Butterfly (*Vanessa Atalanta*), and Tiger Beetle (*Cicindela campestris*) taken, young Tit Larks (*Anthus pratensis*) noted, and young Skylarks (*Alauda arvensis*) on wing on Pateley Moor (W. S.).

June 3rd.—Large White Cabbage Butterfly (*Pieris brassicæ*) and larvæ of Northern Egger (*Bombyx callunæ*) taken on Pateley Moor (W. S.).

June 4th.—Young Blackcaps (*Sylvia atricapilla*) seen, young Garden Warblers (*Sylvia hortensis*) seen, Brimstone Butterfly (*Goneptery rhamni*) and Orange Tip (*Euchloë cardamines*).

June 5th.—Young Peewits (*Vanellus cristatus*) fly, Whinchat's (*Pratincola rubetra*) nest, five eggs; Swift's (*Cypselus apus*) nest, one egg; Yellow Hammer's (*Emberiza citrinella*) nest, one egg.

June 5th.—Several nests containing eggs of Spotted Flycatcher (*Muscicapa grisola*), Whitethroat (*Sylvia rufa*), Sedge Warbler (*Acrocephalus schœnobœnus*), and young Wood Pigeons (*Columba palumbus*) noted near Pateley (W. S.).

June 6th.—Young Magpies (*Pica caudata*) noted at Brimham (W. S.).

June 6th.—Spotted Flycatcher's (*Muscicapa grisola*) nest, four eggs; young Blue Tits (*Parus cæruleus*) seen, at Masham (T. C.).

June 8th.—Pair of Lesser Spotted Woodpeckers (*Picus minor*) noted nesting in an old tree in Guy's Cliff; this bird is extremely rare in Nidderdale; this is the only occurrence of its nesting I have ever been able to prove (W. S.). Nest of Grasshopper Warbler (*Acrocephalus nævius*) observed with eggs in Guy's Cliff (Mr. Swires). This bird is rather rare in this district; this is the second instance of its nesting with us (W. S.).

June 9th.—Several nests of Whinchats (*Pratincola rubetra*), Blue Tits (*Parus cæruleus*), Tree Pipits (*Anthus trivialis*), Common Buntings (*Emberiza miliaria*) and Yellow Buntings (*Emberiza citrinella*) noted near Pateley (W. S.).

June 10th.—Young Sandpipers (*Actitis hypoleucos*) observed, and Lesser Redpoles (*Linota linaria*), several nests of swallow (*Hirundo rustica*), Sand Martin (*Cotile riparia*), House Martin (*Hirundo urbica*), containing eggs, and nest of Swift (*Cypselus apus*) with two eggs, at Pateley (W. S.).

June 11th.—Young Redstarts (*Ruticilla phœnicurus*) noted on the wing, also several nests of Tree Pipit (*Anthus trivialis*), Greenfinch (*Coccothraustes chloris*), Yellow Bunting (*Emberiza citrinella*), Corn Bunting (*E. miliaria*), and Swallow (*Hirundo rustica*) containing young ones, at Pateley (W. S.).

June 12th.—Young Wheatears (*Saxicola œnanthe*) on wing, Pateley Moor (W. S.).

June 13th.—Young Grey Wagtails (*Motacilla sulphurea*), Pied Wagtails (*M. lugubris*) noted, and young Kingfishers (*Alcedo ispida*), near Pateley; nest of Kestrel Hawke (*Falco tinnunculus*), with four eggs in; young long-eared Owls (*Asio otus*), and Pied Flycatchers (*Muscicapa atricapilla*) seen in Sawley Woods (W. S.).

June 14th.—Lapwing (*Vanellus cristatus*) feeding young; *Helix nemoralis*, Garforth, near Leeds; noted nest of Bottle Tit (*Acredula caudata*) and Yellow Hammer (*Emberiza citrinella*), with eggs; also small Heath Butterfly (*Cœnonympha pamphilus*), in large numbers, Hook Moor, near Parlington Park; observed young Swifts (*Cypselus apus*) flying at Aberford; also nest of Chaffinch (*Fringilla cœlebs*) and Grey Linnet (*Linota cannabina*), with eggs in; and collected Snail Shells (*Zonites cellarius*), near Barwick (W. H. H.).

June 15th.—Young Tree Creepers (*Certhia familiaris*), Bullfinches (*Pyrrhula Europœa*), Sedge Warblers (*Acrocephalus schœnobœnus*), Brown Linnets (*Linota cannabina*), Whinchats (*Pratincola rubetra*) observed near Pateley (W. S.).

June 16th.—Oil Beetle (*Melœ, sp.*) taken, Pateley; small Heath Butterfly (*Cœnonympha pamphilus*), and larvæ of *Abraxas grossulariata* taken at Brimham (W. S.). Pair of live Slow Worms (*Anguis fragilis*) secured at Eagle Hall (John Hall); Cockchafer (*Melolontha vulgaris*) taken at Pateley (W. S.).

June 17th.—Young Squirrels (*Sciurus vulgaris*) observed, Sweep Moth (*Odezia chærophyllata*) and Lamprey (*Petromyzon fluviatilis*) taken near Pateley (W. S.).

June 18th.—Young Snipe (*Gallinago media*) seen on Pateley Moor; young Blue Tits (*Parus cæruleus*), Sparrow Hawks (*Accipiter nisus*) noted, near Pateley (W. S.).

June 20th.—Young Ringdoves (*Columba palumbus*) on wing, at Ramsgill; nest of Dunlin (*Tringa alpina*) containing four eggs, also the pair of birds seen; there are now three pairs of Dunlins on these (Ramsgill) Moors, and nests containing eggs have been observed for the past three summers (W. S.).

June 20th.—Noted Blue Tit (*Parus cæruleus*) and Grass Chat (*Pratincola rubetra*) feeding young, Park Side, Dewsbury Road; also young Robins (*Erithacus rubecula*) on wing, and noted Grey Wagtail at Belle Isle, Middleton (W. F. H.).

June 22nd.—Glowworms (*Lampyris noctiluca*) noted, and Adders (*Pelias verus*) caught, near Pateley (W. S.).

June 23rd.—Pair of Meadow Pipits (*Anthus pratensis*) observed feeding a young Cuckoo (*Cuculus canorus*), and nest of Landrail (*Crex pratensis*) containing five eggs, at Pateley (W. S.).

June 25th.—Young Whinchats (*Pratincola rubetra*), Grey (*Motacilla sulphurea*) and Pied Wagtails (*M. lugubris*), on wing; Meadow Brown Butterfly (*Hipparchia janira*) taken at Pateley (W. S.).

June 26th.—Young Spotted Flycatchers (*Muscicapa grisola*) on wing, and House Sparrow (*Passer domesticus*) seen feeding on Cockchafers (*Melolontha vulgaris*) in Bewerley Park (W. S.).

June 27th.—Noted Young Titlarks (*Anthus pratensis*) and young Small Straws (Lesser Flycatcher), near Middleton Wood, Hunslet (W. H. H.).

June 29th.—Nest of Yellow Wagtail (*Emberiza citrinella*), and that of Sedge Warbler (*Acrocephalus schœnobanus*) containing four young ones, at Auldfield, near Ripon (W. S.).

July 1st.—Young Landrails (*Crex pratensis*) noted, Green-veined White Butterfly (*Pieris napi*), Clouded Magpie Moth (*Abraxas ulmata*), Orange Tip Butterfly (*Euchloë cardamines*), caught at Pateley (W. S.).

July 4th.—Red Vole (*Arvicola glareolus*), Long-tailed Field Mouse (*Mus sylvaticus*), Short-tailed Field Vole (*Arvicola agrestis*), caught at Pateley (W. S.).

July 4th.—Silky Earth Mite (? *Trombidium holosericeum*) Common Shrew (*Sorex araneus*), Water Shrew (*Crossopus fodiens*), secured near Pateley (W. S.).

July 5th.—Young Sand Martins (*Hirundo riparia*) and Swallow (*Hirundo rustica*) on wing (W. S.).

July 6th.—Long-eared Owl (*Asio otus*) noted at Brimham (W. S.).

July 7th.—Dark Arches Moth (*Xylophasia polyodon*), large Cabbage White Butterfly (*Pieris brassicæ*) and other lepidoptera, taken in Guy's Cliff (W. S.); Young Cuckoo (*Cuculus canorus*) observed in a Meadow Pipit's (*Anthus pratensis*) nest on Pateley Moor (Alfred Sendy); young Swifts (*Cypselus apus*) and young Swallows (*Hirundo rustica*) on wing, in Nidderdale (W. S.).

July 8th.—Clegg (*Hæmatopota pluvialis*), Yellow Underwing (*Triphæna pronuba*), Ghost Moth (*Hepialus humuli*), Old Lady (*Mania maura*), taken at Pateley (W. S.).

July 10th.—Young Kingfishers (*Alcedo ispida*) observed on wing, at Glasshouses (W. S.).

July 11th.—Long-eared Owl (*Asio otus*) secured near Brimham, Crayfish (*Astacus fluviatilis*) taken in the Nidd, at Killinghall Mill (G. Kersey).

July 13th.—Large Bat (*Vesperugo noctula*) secured near Pateley (W. S.).

July 14th.—Dunlins (*Tringa alpina*) noted on Grimwith Moor, Wharfedale (J. W. Swires).

July 15th.—Several Garden Tiger Moths (*Arctia caja*) caught at Pateley (W. S.).

July 15th.—Cuckoo (*Cuculus canorus*) last heard in Nidderdale (W. S.).

July 16th.—Green Oak Moth, Dark Arches Moth (*Xylophasia polyodon*), Magpie Moth (*Abraxas grossulariata*), &c., taken at Glasshouses (W. S.).

July 18th.—Fox Moth (*Bombyx rubi*), larvæ of Emperor Moth, and Saw Fly, caught on Pateley Moor (W. S.); Pied variety of Blackbird (*Turdus merula*) noted at Brimham (Jos. Kirkley).

July 20th.—Merlin (*Falco æsalon*) and flock, six Golden Plovers (*Charadrius pluvialis*) observed at Pateley Moor (W. S.); Jays (*Garrulus glandarius*) noted at Brimham, and Green Woodpecker (*Picus viridis*) in Harefield Wood (W. S.).

July 23rd.—Old Wife Moth (*Mania maura*), Dark Arches Moth (*Xylophasia polyodon*) and other Moths, and small Cabbage White Butterfly (*Pieris rapæ*) taken at Pateley (W. S.).

July 27th.—Long-eared Bat (*Plecotus auritus*) caught at Gowthwaite Hall (W. Hannam).

July 31st.—Natterer's Bat (*Vespertilio Nattereri*) taken at Pateley (W. S.).

August 1st.—Larvæ of Emperor Moth (*Saturnia carpini*) secured on Pateley Moor (W. S.).

August 8th.—White Swallow observed on wing at Castlestead. This bird has been seen by several persons (W. S.).

August 11th.—Pied variety of House Martin, caught at Castlestead (H. Metcalfe); Night Jar found dead on the railway side, having killed itself against the telegraph wires, at Pateley (W. S.).

August 15th.—Larvæ of Emperor Moth (*Saturnia pavonia minor*) collected on Pateley Moor (W. S.): Mr. J. W. Binns reports that three pairs of Pied Flycatchers and a pair of Herons have nested and got their young safely away this summer, near Burnsall, in Wharfedale.

October 17th.—Cormorant (*Phalacrocorax carbo*) shot on the moors, near Middlesmoor, in Nidderdale, by Mr. Littlewood; this is the only instance of its occurrence in this valley that I am aware of (W. S.).

October 21st.—Woodcocks (*Scolopax rusticola*) and Goldcrests (*Regulus cristatus*) observed in Nidderdale (W. S.); also Water Rail (*Rallus aquaticus*) caught near Pateley (J. Jackson).

October 23rd.—Siskins (*Carduelis spinus*) noted at Burnsall, Wharfedale (T. Binns).

October 24th.—Hooded Crows (*Corvus cornix*) seen on Pateley Moor (W. S.); Goldfinch (*Carduelis elegans*) noted, near Pateley (J. Bell).

October 26th.—Pied and Grey Wagtails (*Motacilla lugubris* and *M. sulphurea*) seen in Nidderdale (W. S.).

October 27th.—Yellow Bunting (*Emberiza citrinella*) and Skylark (*Alauda arvensis*) in song, in Nidderdale (W. S.); Green Woodpecker (*Picus viridis*) caught in an old tree at Dougill Hall, Nidderdale (Frank Robinson).

November 2nd.—Long-eared Bat (*Plecotus auritus*) caught in old room at Dougill Hall (W. S.).

November 3rd.—Siskins (*Carduelis spinus*) first observed in Nidderdale (W. S.).

November 4th.—Field Fares (*Turdus pilaris*) noted, near Pateley (W. S.).

November 9th.—Jack Snipe (*Gallinago gallinula*) seen on Pateley Moor (W. S.).

November 10th.—Kingfisher (*Alcedo ispida*) observed on the margin of the Nidd, at Glasshouse (W. S.).

November 16th.—Siskins (*Carduelis spinus*) noted, feeding on trees on the margin of the Nidd, near Pateley (W. Knowles and J. Bell); Snow Buntings (*Plectrophanes nivalis*) heard and seen on Pateley Moor (W. S.).

Contributions to a Fauna and Flora of West Yorkshire.

Section B.—FLORA.

LIST OF AUTHORITIES AND CONTRACTIONS.

J. Abbott (J. A.)—P. Alexander (P. A.)—Bradford Naturalists' Society (B. N. S.)—C. Chapman (C. C.)—A. C. Davies (A. C. D.)—J. Emmet, F.C.S. (J. E.)—G. Hainsworth (G. H.)—T. Hebden (T. H.)—T. Hick, B.A. (T. H.)—Wm. Horne (W. H.)—H. Ibbotson (H. I.)—Ilkley Naturalists' Society (I. N. S.)—J. Jackson (J. J.)—W. Kirkby (W. K.)—P. F. Lee (P. F. L.)—B. B. Le Tall (B. B. L. T.)—J. R. Murdoch (J. R. M.)—H. L. Oxley (H. L. O.)—Ripon Naturalists' Club (R. N. C.)—B. M. Smith (B. M. S.)—W. Storey (W. S.)—A. R. Waller (A. R. W.)—Davis and Lees' West Yorkshire (W. Y.)—W. Whitwell (W. W.)

The numbers refer to the London Catalogue, 7th Edition.

Class I. *DICOTYLEDONS.*

Sub-Class I. THALAMIFLORÆ.

Order I. RANUNCULACEÆ.

1. Clematis vitalba (Traveller's Joy).

Collingham and Scarcroft, J. A. Thorp Arch, J. E. Wetherby (neighbourhood), J. J. Pontefract Road, Ackworth, A. C. D.

Hedges and thickets. This is naturalized in these localities, Stafford being its northern limit in a native state.

3. Thalictrum minus (Lesser Meadow-Rue).

Wetherby (neighbourhood) (var. *flexuosum*), J. J. Thorp Arch (rocks), B. B. Le T. (Var. *montanum*) Gordale, Arncliffe, Kettlewell, B. N. S.

In limestone districts.

4. **Thalictrum majus (Common Meadow-Rue).**

Bolton Woods, B. N. S. Thorp Arch (var. *flexuosum*), J. E. Wetherby (neighbourhood), J. J. Arncliffe, B. N. S. Near Ripon, B. M. S.

5. **Thalictrum saxatile.**

(Var. = *montanum*) Malham, Arncliffe, Kettlewell.

6. **Thalictrum flavum.**

Church Fenton, B. N. S. Banks of the Ouse, York, W. K., July, 1876. Wetherby, J. J. Banks of Went, Ackworth, A. C. D. Clifton Ings, York, Askham Bog, B. B. Le T. Potteric Carr, B. N. S. Near Cowthorpe, W. Y.

Watery places.

7. **Anemone pulsatilla (Pasque-flower).**

Knottingley, northern limit, lost, J. A. Danish Camp, Ackworth, A. C. D.

Dry chalky pastures.

8. **Anemone nemorosa (Wood Anemone.)**

Moist woods and pastures. Common.

10. **Adonis Autumnalis (Corn Adonis, or Pheasant's Eye).**

Malton, Yorkshire, A. W., August, 1882. Thorp Arch, J. E. Wetherby, J. J.

This is an imperfectly established alien, sporadic in the north and naturalized in the south of England. Occasionally in cornfields.

11. **Myosurus minimus (Mouse Tail).**

Ackworth Common, A. C. D. Knavesmire (now lost), B. B. Le T.

Cornfields and waste places. Gravelly or chalky soil.

12. **Ranunculus circinatus (Rigid-leaved Water Crowfoot).**

Coxley Dam, Dewsbury, P. F. L. Potteric Carr, B. N. S. Near Ripon, W. Y.

Ponds and ditches.

13. **Ranunculus fluitans (River Crowfoot).**

Above the Wharfe, Pool, Arthington, Thorp Arch, J. E. Wetherby, J. J. Bingley, Steeton, Saltaire, B. N. S. Near Ripon, W. Y.

Lakes, rivers, and canals, in deep water.

14. **Ranunculus peltatus.**

Meanwood Valley, W. Y. Wetherby (var. *b. floribundus*), J. J. Howley, Batley (var. *d. elongatus*), P. F. L. Hunsworth Dam, Ackworth, A. C. D. (Var. *c. penicillatus*) Gilstead, Malham, B. N. S. (Var. *c. penicillatus*) Near Thorp Arch, W. Y. (Var. *truncatus*) Washburn Valley, W. Y.

15. **Ranunculus diversifolius.**

Near Malham Tarn, near Doncaster (var. *radians*) W. Y.

16. **Ranunculus Drouetii.**

Near Ripon, W. Y. Near Knaresbro', W. Y.

17. **Ranunculus trichophyllus.**

Church Fenton, Ferrybridge, Goole, W. Y. Ilkley.

20. **Ranunculus Lenormandi.**

Harrogate, T. H. Stream, Mirfield, P. F. L. Bingley, Baildon, Ilkley, Wooley, Odsal, B. N. S. Malham, Y. Y. Copley, W. Y. Eldwick, Y. N. U.

Especially on elevated moorlands in many places.

21. **Ranunculus hederaceus (Ivy Crowfoot).**

Adel, J. A. Wetherby, J. J. Brierley Common, Ackworth, A. C. D. Baildon, B. N. S. Gipton, W. K. Alwoodly, P. A. Pateley, W. S.

Shallow pools of water and where water has stood. Common.

22. **Ranunculus sceleratus (Celery-leaved Crowfoot).**

Knostrop, Banks of the Aire, J. A. Pond Side, Old Foundry Lane, Low Gipton, W. K. Thorp Arch, J. E. Wetherby, J. J. Hemsworth Dam, Ackworth, A. C. D. Frizinghall, Rawcliffe, B. N. S. Snaith, J. R. M. Methley, H. L. O. Low Gipton, W. K.

Sides of pools and ditches.

24. **Ranunculus flammula (Lesser Spearwort).**

Woodhouse Ridge, Adel Bog, J. A. Bradley Wood, near Huddersfield, W. K., July, 1857. Wetherby, J. J. Baildon, Bingley, Ilkley, &c., B. N. S. Near Masham, W. S.

Ditches and watery places. Common.

26. **Ranunculus lingua (Greater Spearwort).**

Askham Bog, J. A. Bramham, J. E. Hemsworth, Ackworth, A. C. D. Buttercrambe Mere, B. B. Le T. Bishop Monckton, W. Y.

Deep ditches and sides of lakes.

27. **Ranunculus auricomus (Goldilocks).**

Bramhope, J. A. Bingley, Malham, with large petals, B. N. S. Spofforth, W. Y. Roundhay, G. H.

Hedge banks, woods, and coppices.

28. **Ranunculus acris (Bitter Buttercup).**

Common in meadows, pastures, &c.

29. **Ranunculus repens (Creeping Crowfoot).**

Pastures and moist hedge banks. Common.

30. **Ranunculus bulbosus (Buttercup).**

Meadows and pastures. Very common.

31. **Ranunculus hirsutus (Pale Hairy Crowfoot).**

Goole, J. A., B. N. S.

Meadows and waste ground, varying extremely in size. When very small it is *R. parvulus*, L.

34. **Ranunculus arvensis (Corn Crowfoot).**

Cornfields, Meanwood, Bramhope, J. A. Cornfields, Low Gipton, near Leeds, W. K., 1883. Tadcaster, Bilborough, Clifford, J. E. Shipley, in cornfield, B. N. S.

Cornfields.

35. **Ranunculus ficaria (Pilewort Crowfoot or Lesser Celandine).**

Pastures, woods, and hedge banks. Common.

36. **Caltha palustris.**

Adel Dam, J. A. Baildon, Apperley, Bingley, &c., B. N. S. Shadwell, G. H. Potternewton, W. K.

Wet places. Common.

38. **Trollius Europæus (Globe Flower).**

Bolton Woods, Banks of the Wharfe, J. A. Ripley, near Harrogate, T. H. Castle Howard, H. I. Malham, Arncliffe, Grassington, Ribblehead, Barden, B. N. S. Near Steeton, T. H. Clapham, Near Ripon, Dallowgill, W. Y. Masham, P. A. Staveley Carrs, W. K. Ingleton, G. H.

Moist woods and mountain pastures.

39. **Eranthis hyemalis.**

Wetherby, J. A. Hedge Banks, Wetherby Road, Knaresbro', W. K., March, 1874. Bishopthorpe Palace Grounds, B. B. Le T.

An escape from cultivation.

40. **Helleborus viridis (Green Hellebore).**

Kidhall, Collingham, J. A. Banks of the Nidd, Knaresbro', W. K., April, 1877. Thorp Arch, J. E. Wetherby, J. J. Mowthorpe, near Castle Howard; Beckdale, near Hemsley, H. I. Near Ilkley, as an escape, B. N. S. Tanfield, B. M. S. Leyburn, W. H.

Woods, thickets, and hedges, especially in calcareous soils.

41. **Helleborus fœtidus (Stinking Hellebore, Bear's-foot).**

Wood, Tulmire, B. B. Le T.

Pastures and thickets, especially in limestone districts.

42. **Aquilegia vulgaris (Columbine).**

Meanwood, J. A. Adel Bog, lost. Thorp Arch, J. E. Wetherby, J. J. Whitley (hedge bank), P. F. L. Hampole, near Ackworth, A. C. D. Grassington, B. N. S. Near Brotherton, W. Y.

Woods and coppices.

43. **Delphinium ajacis (Larkspur).**

Near Doncaster, W. Y.

Sandy or chalky fields. An escape from cultivation.

44. **Aconitum napellus (Monkshood or Wolfsbane).**

Thorp Arch (escape), J. E. Wetherby, J. J. Near Skipton, Y. N. U.

Moist pastures and thickets. An escape from cultivation.

45. **Actæa spicata (Baneberry or Herb Christopher).**

Newton-le-Willows, Brotherton, Thorp Arch, J. A. Wetherby, J. J. Rievaulx, B. B. Le T. Moughton, Malham, Ribblehead, B. N. S.

Bushy places. Limestone tracks in Yorkshire

Order II. BERBERACEÆ.

46. Berberis vulgaris (Barberry).

Brotherton, Pontefract, J. A. Knaresbro', W. K. Thorp Arch, J. E. Wetherby, J. J. Hampole, near Ackworth, A. C. D. Copmanthorpe Wood, York, B. B. Le T. Near Sherburn (abundant), W. W. Collingham, B. N. S. Near Ripon, Roche Abbey, W. Y.

Open woods, coppices, and hedges. Not really indigenous.

Order III. NYMPHÆACEÆ.

47. Nymphæa alba (White Waterlily).

Thorp Arch, J. E. Foss, York, B. B. Le T. Boroughbridge, Church Fenton; Near Doncaster, W. Y.

Still waters and slow rivers, &c.

48. Nuphar lutea (Yellow Waterlily).

Tadcaster, Staveley, Smeeton Crags, J. A. Thorp Arch, J. E. Smeeton Crags, Went, Ackworth, A. C. D. Foss, York, B. B. L. T. Gisburn, Potteric Carr, B. N. S. Boroughbridge, Church Fenton, Near Bawtry, W. Y. Staveley Carrs, W. K.

Similar habitat to N. alba.

Order IV. PAPAVERACEÆ.

50. Papaver somniferum (Opium Poppy).

Hawksworth, Grassington, B. N. S.

An escape from cultivation.

51. Papaver rhæas (Field Poppy).

Cornfields. Very common.

52. Papaver dubium (Long Smooth-headed Poppy).

(Var. *lamottei*) Saltaire, Frizinghall, B. N. S.

In waste and cultivated places.

53. Papaver Argemone (Long Prickly-headed Poppy).

Wetherby, J. J. Langwith, near York, B. B. Le T. Askham, H. I. Lowest portion of Aire Valley, W. Y.

Cultivated fields.

55. Meconopsis Cambrica (Welsh Poppy).

Malham, Bramham, J. E. Washburne Valley, Airton, B. N. S.

Probably as an escape from cultivation. In rocky and shady places.

57. **Chelidonium majus (Greater Celandine).**

Garforth, Aberford, J. A. Knaresbro', W. K. Wetherby, J. J. Dewsbury, P. F. L. Near York, Near Fulford, York, B. B. Le T. Doncaster, B. N. S. Near Masham, P. A.

This plant is often a naturalized escape. Waste places, chiefly near villages and old ruins.

Order V. FUMARIACEÆ.

58. **Corydalis lutea (Yellow Fumitory).**

Dringhouses, near York; Clifton, near Merton, B. B. Le T. Near Ripon, C. C.

An escape from cultivation. Stony places and old walls, &c.

59. **Corydalis claviculata (Climbing Fumitory).**

Adel, Weeton, Dacre Bank, J. A. Harrogate, J. E. Wetherby, J. J. Coxley Wood, Dewsbury, P. F. L. Baildon, Bingley, Doncaster, B. N. S. Brimham, Harrogate, Arncliffe, Copley, W. Y. Roundhay, P. A.

Bushy and shady places. In hilly districts and stony situations.

60. **Fumaria pallidiflora (Rampant Fumitory).**

Hartshead (var. *b. boræi*), P. F. L. Rawthey Dale (var. *b. boræi*), Harrogate (var. *b. boræi*), Stanley (var. *b. boræi*), Roche Abbey (var. *b. boræi*), W. Y.

Cornfields, hedges, and roadsides.

64. **Fumaria officinalis (Common Fumitory).**

Dry fields, roadsides, cornfields, &c. Frequent.

Order VI. CRUCIFERÆ.

69. **Raphanus raphanistrum (Wild Radish).**

Potternewton, W. K., June, 1865. Wetherby, J. J. Dewsbury, P. F. L. York (common), B. B. Le T. Esholt, &c., B. N. S.

Cornfields. Frequent.

71. **Sinapis arvensis (Wild Mustard).**

Very common in cultivated fields.

72. **Sinapis alba (White Mustard).**

Wetherby, J. J.

Waste and cultivated places.

73. **Sinapis nigra (Common Mustard).**

Wetherby, J. J. Spen Valley, Gomersal, P. F. L. Ouse Banks, H. I. Melham, B. N. S. Ferrybridge, Goole, W. Y.

Under hedges, and in waste and cultivated places.

76. **Brassica napas (Rape or Cole-seed).**

Near Skipton, W. K., August, 1860. York (common), B. B. Le T.

Not uncommon in cultivated fields.

78. **Brassica rapa (Common Turnip).**

Wetherby, J. J. York (common), B. B. Le T.

Borders of fields and waste places.

80. **Brassica cheirantha (Wallflower Cabbage).**

Wetherby, naturalized on railway embankment, J. J.

83. **Sisymbrium officinale (Hedge Mustard).**

Waysides and waste places. Very common.

85. **Sisymbrium Irio (London Rocket).**

Harrogate, T. H.

An escape from cultivation. Waste places, near towns.

86. **Sisymbrium alliaria (Jack-by-the-Hedge, Sauce-alone, Garlic Mustard).**

Harehills Lane, near Leeds, W. K.

Hedge banks and waste places. Common.

87. **Erysimum cheiranthoides (Treacle Mustard).**

This has been noticed as a weed in gardens.—J. A.

88. **Hesperis matronalis (Dame's Violet).**

Banks of the Wharfe, from Bolton Woods downwards, J. A. Thorp Arch, J. E. Wetherby, Wharfe side, J. J. Dewsbury, Waste Ground, P. F. L.

A garden escape.

90. **Cheiranthus cheiri (Wallflower, Gilliflower).**

Castle Walls, Knaresbro', W. K., May, 1865. Thorp Arch, J. E. Wetherby, J. J. Pontefract Castle, A. C. D. Abbey Walls, York. B. B. Le T. Settle, B. N. S.

Naturalized on old walls and ruins.

92. **Cardamine amara (Large-flowered Bittercress).**

Adel, Scarcroft, J. A. Plumpton, Knaresbro', &c., W. K. Thorp Arch, J. E. Wetherby, J. J. Coxley Dam, Dewsbury, P. F. L. Clifton Ings, near York, B. B. Le T. Skipton, Apperley, Esholt, Hawksworth, Bingley, Shipley Glen, B. N. S.

Wet meadows and near streams.

94. **Cardamine pratensis (Cuckoo Flower, Ladies' Smock).**

Moist meadows. Abundant.

95. **Cardamine hirsuta (Hairy Bittercress).**

Adel, Meanwood, J. A. Ilkley, Esholt, B. N. S.

Moist shady places. Very common.

96. **Cardamine sylvatica (Wood Bittercress).**

Adel, Meanwood, J. A. Wetherby, J. J. Dewsbury, North Wood, P. F. L. Castle Howard, H. I. Bingley, Esholt, Baildon, B. N. S.

Wet and shady places.

97. **Cardamine impatiens (Narrow-leaved Bittercress).**

Allermine Scars, near Settle, H. I. Sing Ghyll, B. N. S.

Moist rocks. Rare.

98. **Arabis thaliana (Rockcress).**

Malham, B. N. S., J. A. Acomb (walls), near York, Poppleton, near York, Wigginton, near York, Langwith, near York, Copmanthorpe Station, near York, B. B. Le T. Bolton Woods, Bingley, B. N. S.

Dry banks, old walls, and stony places.

102. **Arabis hirsuta (Hairy Rockcress).**

Malham, B. N. S. Pateley Bridge, W. K., July, 1862. Thorp Arch, J. E. Wetherby, J. J. Dewsbury, P. F. L. Acomb (on wall), B. B. Le T. Ilkley, B. N. S. Ripon, R. N. C.

Frequent on walls, banks, and rocks, especially on limestone.

103. **Arabis turrita (Tower Wallcress).**

Thirsk, H. I., June, 1861.

Shady banks and under rocks.

104. **Arabis perfoliata (Tower Mustard).**

Wetherby, J. J. Near Doncaster, Near Bawtry, W. Y.

On banks and roadsides.

105. **Barbarea vulgaris (Common Wintercress, Yellow Rocket).**

Banks of Bentley Beck, bottom of Woodhouse Ridge, Leeds, W. K. Thorp Arch, J. E. Harrogate, T. H. Shipley, &c., B. N. S. Low Gipton, G. H.

Wet places, edges of streams, and damp situations. Common.

107. **Barbarea stricta.**

Clifton Ings, near York, H. I. Calder Bank, Dewsbury, P. F. L.

Pastures and hedges.

110. **Nasturtium officinale (Common Watercress).**

Thorp Arch, J. E. Knaresbro', W. K. Goit, bottom of Woodhouse Ridge, G. H. Wetherby, J. J. Dewsbury, P. F. L. York, B. B. Le T.

Slow running streams. Common.

111. **Nasturtium sylvestre (Yellow Creeping Watercress).**

Adel, J. A. Ouse Side, York, B. B. Le T. Goole, B. N. S.

In wet places and river banks.

112. **Nasturtium palustre (Marsh Watercress).**

Adel, J. A. Wetherby, J. J. Dewsbury, P. F. L. Wiggington, York, H. I. Hawksworth, Goole, Frizinghall, B. N. S.

Muddy and watery places.

113. **Nasturtium amphibium (Great Yellow Watercress).**

Wetherby, J. J. Hessle, near Ackworth, A. C. D. Holgate (Bog), Clifton Ings, York, B. B. Le T. Goole, B. N. S. Near Pannel, Church Fenton, W. Y.

Moist meadows and watery places.

114. **Armoracia rusticana (Horse-radish).**

Wetherby, J. J. Calder Bank, Dewsbury, P. F. L. Bishop Monckton, W. Y. Ribblesdale, W. Y.

An escape from gardens. In waste grounds generally.

115. **Cochlearia officinalis (Scurvy-Grass).**

Banks of the Wharfe from Ilkley downwards, J. A. Thorp Arch, J. E. Wetherby, J. J. Collingham, W. K. Apperley, B. N. S.

Var. alpina, Gordale, B. N. S. Penyghent, &c., B. N. S.

Stony or muddy soils. Common.

118. **Draba verna** (**Whitlow-grass**).

Knaresborough, W. K. Thorp Arch, J. E. On walls, Pannal, T. H. Wetherby, J. J. Dewsbury, P. F. L. Brockendale, near Ackworth, and road near Hampole Stubbs, A. C. D. York (neighbourhood), B. B. Le T. Clapham, B. N. S. Smeeton Crags, B. N. S. (frequent). Malham, B. N. S. Ripon, R. N. C.

Walls, rocks, and dry banks.

120. **Draba muralis** (**Wall Draba**).

Malham, B. N. S. Malham, J. A.

Rocks and walls in limestone mountainous districts.

121. **Draba incana.**

Clapham, B. N. S. Malham, B. N. S. Whernside, B. N. S.

124. **Alyssum calycinum** (**Sweet Alyssum**).

Wetherby, J. J. Langwith, near York; Poppleton, near York; Acombe, near York, H. I.

Waste, dry pastures, but more frequently near the sea. Probably an escape from cultivation.

126. **Camelina sativa** (**Gold of Pleasure**).

Meanwood, J. A. Wetherby, J. J. Weetwood, W. K. Horbury (on old wall), P. F. L.

Waste places, where seeds are screened. Imported, appearing occasionally in corn and other cultivated grounds.

128. **Thlaspi arvense** (**Pennycress**).

Garforth. Bishop Wood.

Fields and waysides. Not common.

130. **Thlaspi alpestre** (**Alpine Pennycress**).

(Var. *occitanum*) Malham, B. N. S.

Mountainous pastures in limestone districts. Uncommon.

131. **Iberis amara** (**Bitter Candy Tuft**).

Calverley Wood, B. N. S.

As an escape. Often introduced with corn seed, limestone districts.

132. **Teesdalia nudicaulis** (**Naked-stalked Teesdalia**).

Cantley, B. N. S. Langwith, near York; near Grimston Woods, York, B. B. Le T.

Sandy and gravelly banks.

133. **Hutchinsia petræa** (**Rock Hutchinsia**).

There is an old record of this "near Malham Tarn." It would be interesting to have this confirmed; it should be looked for not later than April, among limestone *débris* on hill-slopes.

134. **Capsella Bursa-pastoris** (**Shepherds' Purse**).

Common everywhere.

137. **Lepidium sativum** (**Pepper Wort**).

Wetherby, J. J.

Escape from gardens.

138. **Lepidium campestre** (**Common Pepper Wort**).

Wetherby, J. J. Dewsbury, P. F. L. Skipton, W. Y. Near Bishops' Wood, B. N. S. Near Doncaster, B. N. S.

Corn-fields and dry waste places.

139. **Lepidium Smithii** (**Smooth Field Pepper Wort**).

Calder, Dewsbury (sandy bank), P. F. L. Arncliffe, B. N. S.

Hilly pastures, cultivated and waste places.

142. **Senebiera coronopus** (**Swine-cress**).

Goole, B. N. S. Goole, J. A. Stockton Lane, York, and between Clifton Green and the Ouse, H. I.

In waste ground. Not unfrequent.

(To be continued.)

ALGÆ (exclusive of Diatomaceæ).

AREA: WEST YORKSHIRE.

Contributors: Messrs. James Abbott, F. Emsley, Thomas Hick, J. Stubbins, W. B. Turner, and W. West, contracted to A., E., H., S., T., and W.

Class I.—CHLOROPHYLLOPHYCEÆ.

Order I.—COCCOPHYCEÆ.

Fam. I.—*PALMELLACEÆ.*

Pleurococcus vulgaris Menegh. Very common.

Glœocystis ampla Kütz. Goole Moor (W.).

Glœocystis rupestre (Lyngb.) Rabenh. Baildon, Bingley, Horton, &c., (W.); Seven Arches (T.).

Urococcus Allmanni Hass. Knaresborough.

Palmella Mooreana Harv. Leeds (T.).

Palmella prodigiosa Mont. Bradford (W.).

Porphyridium cruentum Näg. Saltaire, Bingley, &c. (W.). Common (A., E., and T.).

Botrydina vulgaris Breb. Penyghent, Ingleborough, Whernside, &c. (W.); Harrogate (A., E., and T.).

Tetraspora gelatinosa (Vauch.). Adel (W., A., E., and T.); Goole (W.); Cullingworth (W.).

Tetraspora bullosa Ag. Roundhay (A., E., and T.).

Botryococcus Braunii Kütz. Bradford (W.).

Apiocystis Brauniana Näg. Chapeltown (A., E., and T.).

Rhaphidium falcatum (Corda.). Bradford, Cullingworth, &c. (W.); Chapel-Allerton, Adel (A., E., and T.).

Rhaphidium duplex Kütz. Moortown, Roundhay (T.)

Dictyosphærium Ehrenbergianum Näg. Bradford (W.).

Hydrurus penicillatus Ag. Newsome Dean, near Keighley (T. Hebden).

Fam. II.—*PROTOCOCCACEÆ.*

Protococcus viridis Ag. Esholt, Eldwick, &c., &c. (W.). Common (A., E., and T.).

Chlamydococcus pluvialis Br. Leeds (A., E., and T.); Baildon (W.).

Scenedesmus acutus Meyen. Arncliffe, &c. (W.). Bramhope (A., E., and T.).

Scenedesmus obtusus Meyen. Cullingworth, Bradford, &c. (W.). Bramhope (A., E., and T.).

Scenedesmus quadricauda Bréb. Malham, &c. (W.); Bramhope (A., E., and T.).

Ophiocytium majus Näg. Bramhope (A., E., and T.).

Sciadium arbuscula Braun. Harrogate (A., E., and T.).

Pediastrum granulatum. Adel (A., E., and T.).

Characium ornithocephalum Br. Baildon (W.).

Hydrianum heteromorphum Reinsch. Near Mirfield (W.).

Fam. III.—*VOLVOCINEÆ.*

Volvox globator L. Bramhope, Hunslet (A., E., and T.); Bramham, Goole, &c. (Y. N. U. Meetings).

Pandorina morum Ehr. Bingley, Baildon, &c. (W.); Bramhope, York (A., E., and T.).

Gonium pectorale Mull. Cullingworth, &c. (W.); Wortley (A., E., and T.).

Order II.—ZYGOPHYCEÆ.

Fam. I.—*DESMIDIEÆ.*

Mesotænium De By. 1849.

,, **Braunii** De By. Adel Bog (T.),

,, **de Greyii** Turner. Blubberhouses Moor (T.).

Spirotænia Bréb. 1846.

,, **condensata** Bréb. Cullingworth (W.); Adel Bog (T.).

Penium Bréb. 1846.

,, **diplosporum** Lund. Adel Dam, Blubberhouses (T.); Cullingworth, Ingleborough (W.).

,, **rupestre** Kütz. = **Cyl. crassa** ? De By. Blubberhouses (T.).

,, **Brébisonii** Ralfs. Moortown (T.).

,, **digitus** (Ehr.) Rfs. Rombalds Moor, Cullingworth, (W.); Adel Dam (T.).

,, **oblongum** De By. Adel (T.).

,, **cylindrus** Ehr. Cullingworth (W.).

,, **Ralfsii** De By. Adel Bog (T.).

Closterium Nitzsch. 1817.

„ **rostratum** Ehr. Askwith Moor (T.). Cullingworth, Bingley (W.).

„ **setaceum** Ehr. Meanwood, Adel (T.).

„ **lunula** Müller. All over the Riding.

„ **lineatum** Ehr. Frizinghall (W.).

„ **Dianæ** Ehr. Bingley, Baildon, Cullingworth (W.). Askwith (T.).

„ **parvulum** Näg. Cullingworth, Eldwick, Bingley (W.).

„ **acutum** Lyngb. Adel Bog (T.).

„ **lanceolatum** Kütz. Ingleborough (W.).

„ **costatum** Cor. Markington (J. S. Tute).

„ **juncidum** Ralfs. Moortown (T.); Baildon (W.).

„ **striolatum** Ehr. Baildon, Cullingworth (W.).

„ „ v. **intermedium** Rfs. Baildon, Cullingworth (W.).

„ **Ehrenbergii** Mengh. Cookridge, Adel Bog (T.); Hawksworth Springs, Denholme (W.).

„ var. β = **Malinvernianum** De Not. Adel Bog (T.).

„ **moniliferum** Bory. Adel Bog (T.); Heaton (W.); Holme (H. F. Parsons).

„ **acerosum** Schranck. Markington (J. S. Tute); Ingleborough, Cullingworth (W.).

„ **Venus** Kütz. Allwoodley (T.); Cullingworth, Eldwick (W.).

Docidium Bréb. 1846.

„ **Ehrenbergii** (Kütz) Rfs. Moortown, Adel (T.).

„ **clavatum** Kütz. Meanwood (T.).

„ **nodulosum** Bréb. Adel Bog (T.).

„ **baculum** Bréb. Rombalds Moor, Cullingworth (W.); Adel Bog (T.).

Tetmemorus Ralfs. 1845.

„ **Brébissonii** (Men.) Ralfs. Eldwick (W.); nr. Halifax, Blubberhouses (T.).

„ **granulatus** (Bréb.) Ralfs. Cullingworth, Eldwick Austwick, (W.); Adel (T.).

„ **lævis** (Kütz.) Ralfs. Blubberhouses (T.); Cullingworth (W.).

Cosmarium Corda. 1835.

„ **crenatum** Cor. Cullingworth, Baildon (W.).

„ **tinctum** Ralfs. Cullingworth (W.).

Cosmarium botrytis Bory. Kildwick (W.); Markington (Tute); Cullingworth (W.); Frizinghall (W.).
" **margaritiferum** Mengh. Frizinghall (W.); Bramhope (T.).
" **orbiculatum** Ralfs. Cullingworth (W.).
" **bioculatum** Bréb. Cullingworth (W.).
" **cucurbita** Bréb. Cullingworth (W.).
" **pyramidatum** Bréb. Bramhope (A.).
" **undulatum** Cor. Cullingworth (W.).
" **biretum** Bréb. Cullingworth (W.).
" **Broomei** Thur. Cullingworth (W.).
" **tetrophthalmum** Kütz. Eldwick (W.); Bramhope (T.).
" **Brébissonii** Mengh. Cullingworth, Eldwick (W.).
" **quadratum** Ralfs. Eldwick (W.).
" **Holmiense** Lund. Baildon (W.).
" **Meneghinii** Bréb. Cullingworth (W.).
" **plicatum** Reinsch. Blubberhouses (T.).

Euastrum Ehr. 1831.
" **elegans** Bréb. Cullingworth (W.); Adel (T.).
" **binale** Turp. Cullingworth (W.); Adel (T.).
" **verrucosum** Ehr. Bramhope (T.).
" **ansatum** Ehr. Cullingworth, Baildon, Eldwick (W.)
" **pectinatum** Bréb. Cullingworth (W.).
" **didelta** Turp. Cullingworth (W.); Adel Bog (T.).
" **oblongum** Grev. Common.
" **ampullaceum** Ralfs. Cullingworth (W.); Adel Dam (T.).

Micrasterias Agdh. 1827.
" **rotata** Ehr. Common.
" **denticulata** Bréb. Cullingworth, Eldwick (W.); Adel Dam (T.).
" " **verrucose** variety. Cullingworth, Eldwick (W.); Adel Dam (T.).
" **fimbriata** Ralfs. Cullingworth, Eldwick (W.); Adel Dam (T.).
" **Americana** (Ehr.) Ralfs. Askwith Moor (Russell and Hebblethwaite).
" **truncata** Corda. Cullingworth, Eldwick (W.).
" " var. **crenata** Bréb. Cullingworth, Eldwick (W.).
" **papillifera** Bréb. Adel Dam (T.).

Arthrodesmus Ehr. 1836.
,, **convergens** Ehr. Bramhope (T.).
,, **incus** Bréb. Hassall. Adel Dam (T.).
Xanthidium Ehr. 1832.
,, **armatum** Bréb. Adel (T.); Cullingworth (W.).
,, **octocorne** Ehr. Bramhope (T.).
Staurastrum Meyen. 1829.
,, **teliferum** Ralfs. Adel Dam (T.); Cullingworth (W.).
,, **orbiculare** Ralfs. Cullingworth (W.).
,, **punctulatum** Bréb. Cullingworth, Kildwick, Hainsworth (W.).
,, **dejectum** Breb. Cullingworth (W.); Bramhope (A.).
,, ,, v. **apiculatum** Bréb. Cullingworth (W.).
,, **dilatatum** Ehr. Cullingworth (W.).
,, **furcigerum** Bréb. Bramhope (A.).
,, **hirsutum** Bréb. Cullingworth (W.).
,, **orthostichum** Lund. Cullingworth (W.).
,, **Dickiei** Ralfs. Cullingworth (W.).
,, **pilosum** Näg. Cullingworth (W.); Adel Dam (T.).
,, **gracile** Ralfs. Bramhope (T.).
,, **cuspidatum** Bréb. Cullingworth (W.).
,, **Meriani** Reinsch. Baildon (W.); Blubberhouses (T.).
,, **cosmarioides** Nordst. Blubberhouses (T.).
Desmidium Agdh. 1824.
,, **Swartzii** A. Local.
Sphærozosma Corda. 1835.
,, **excavatum** Ralfs. Adel Bog (T.).
Spondylosium Bréb. 1856.
,, **pulchellum** Archer. Adel (T.).
Didymoprium Kütz. 1843.
,, **Grevillei**. Adel Bog (T.).
Hyalotheca Ehr. 1840.
,, **dissiliens** (Smith) Bréb. Common.
Gonatozygon De By. 1856.
,, **Ralfsii** De By. Moortown (T.).

Fam. II.—*ZYGNEMEÆ*.

Zygnema cruciatum Vauch. Cullingworth, Baildon, &c. (W.).; Bramhope (A., E., and T.).
Zygnema Ralfsii Kütz. Bramhope, Adel (A., E., and T.).
Spirogyra crassa Kütz. Near Wakefield (W.).

Spirogyra insignis Hass. Near Mirfield (W.).
Spirogyra flavescens Hass. Cullingworth (W.).
Spirogyra nitida Dillw. Frizinghall, Harrogate, Malham, &c. (W.); Adel, Bramhope (A., E., and T.).
Spirogyra porticalis Vauch. Frizinghall, &c. (W.); Roundhay (A., E., and T.).
Spirogyra Weberi. Cullingworth (W.).
Spirogyra pellucida Kütz. Harrogate (T.).
Spirogyra longata Vauch. Baildon, &c. (W.); Adel (A., E., and T.).
Sirogonium sticticum Kütz. Baildon (W.); Hebden Bridge (W.).
Zygogonium ericetorum De Bary var. **terrestre.** Rombalds Moor (W.); Baildon (W.); Thornton Moor (W.); Bramhope (A., E., and T.).
Zygogonium ericetorum var. **aquaticum.** Harden; Thornton Moor; Rombalds Moor (W.); Askwith (T.)
Mesocarpus nummuloides Hass. Cullingworth (W.).
Mesocarpus parvulus Hass. Cullingworth (W.).; Askwith (T.).
Mesocarpus pleurocarpus De Bary. Baildon, Rawcliffe (W.).
Mesocarpus scalaris Hass. Roundhay (A., E., and T.).
Staurospermum viride Kütz. Near Rotherham (W.); Horsforth (A., E., and T.).

Order III.—SIPHOPHYCEÆ.

Vaucheria dichotoma Lyngb. var. *β.* **submarina.** Goole (W.).
Vaucheria sessilis Vauch. Baildon, &c. (W.); Adel (A., E., and T.).
Vaucheria geminata Vauch. Keighley, Baildon, &c. (W.); Harrogate (A., E., and T.).
Vaucheria racemosa Eng. Bot. Ingleborough (W.); Meanwood (A., E., and T.).
Vaucheria terrestris Lyngb. Bradford, Keighley, &c. (W.).

Order IV.—NEMATOPHYCEÆ.

Fam. I.—*ULVACEÆ.*

Prasiola crispa Kütz. Cullingworth, Bingley, Ilkley, Allerton, &c. (W.); Leeds (A., E., and T.).
Enteromorpha intestinalis. Garforth (A., E., and T.); Goole (W.).

Fam. III.—*CONFERVACEÆ.*

Microspora fugacissima Ag. Frequent (W.).
Microspora vulgaris Rabh. Frequent (W.).

Microspora floccosa Ag. Frequent; Chapel-Allerton (A., E., and T.).
Conferva tenerrima Kütz. Manningham, Baildon, Bradford, Ingleborough, &c. (W.); Bramhope, Roundhay, Adel (A., E., and T.).
Conferva bombycina Ag. Bingley, Baildon, Cullingworth (W.).
Conferva Funkii Kütz. Frizinghall (W.).
Cladophora glomerata L. Very common.
Cladophora crispata. Common (A., E., and T.).

Fam. V.—*ŒDOGONIACEÆ.*

Œdogonium Landsboroughii Hass. Mirfield (W.).
Œdogonium rivulare Leld. Baildon (W.).
Œdogonium ciliatum Hass. Bramhope (A., E., and T.).
Œdogonium tumidulum Kütz. Bramhope, Adel (A., E., and T.).
Œdagonium vesicatum Lyngb. Bramhope (A., E., and T.).
Œdogonium Braunii Kütz. Adel (A., E., and T.).
Bulbochæte setigera Ag. Cullingworth (W.); Adel (A., E., and T.).

Fam. VI.—*ULOTRICHEÆ.*

Hormiscia zonata W. and M. Malham, Frizinghall (W.).
Hormiscia moniliformis Kütz. Cullingworth (W.).
Ulothrix parietina Vauch. Bradford, &c. (W.).
Ulothrix radicans Kütz. Bradford, &c. (W.); Roundhay (A., E., and T.).
Ulothrix tenuis Kütz. Frizinghall, Eldwick, Morley (W.).
Ulothrix tenerrima. Baildon, Barnsley (W.).
Schizogonium murale Kütz. Bradford, &c. (W.); Garforth (A., E., and T.).

Fam. VII.—*CHROOLEPIDEÆ.*

Chroolepus aureus L. Baugh Fell, Ingleborough, Whernside, Bingley, Ilkley, Wetherby, &c. (W.). Common on the north side of Leeds (T.)

Fam. VIII.—*CHÆTOPHORACEÆ.*

Microthamnion vexator Cke. Roundhay, and nine other habitats near Leeds (T.); Bingley (W.).
Stigeoclonium protensum Dillw. Ilkley, Keighley, Wibsey, &c. (W.); Farnley (A., E., and T.).
Stigeoclonium fastigiatum Ralfs. Near Wakefield (W.).

Stigeoclonium nanum Dillw. Near Bradford (W.).
Draparnaldia glomerata Ag. Bingley, Steeton, Eccleshill, York, Ilkley, Halifax, &c. (W.); Roundhay (A., E., and T.).
Draparnaldia plumosa Vauch. Clayton (W.); Adel (A., E., and T.).
Chætophora endiviæfolia Ag. Bingley, Saltaire, Horton-in-Ribblesdale (W.).
Chætophora elegans Roth. Baildon, &c. (W.); Roundhay, Adel (A., E., and T.).
Chætophora tuberculosa Roth. Baildon, &c. (W.).
Coleochæte scutata Bréb. Bradford (W.); Adel (A., E., and T.).

Class II.—PHYCOCHROMOPHYCEÆ.

Order I.—CYSTIPHORÆ.

Fam. I.—*CHROOCOCCACEÆ.*

Chroococcus turgidus Näg. Cullingworth, Steeton, &c. (W.).
Glœocapsa polydermatica Kütz. Baildon, Bingley, Keighley (W.).

Order II.—NEMATOGENÆ.

Fam. I.—*NOSTOCEÆ.*

Nostoc rupestre Kütz. Ingleborough, Clapham, Malham (W.).
Nostoc sphæricum Vauch. Ingleton (A., E., T., and W.); near Bradford (W.).
Nostoc cœruleum Lyngb. Baildon, &c. (W.).
Nostoc commune. Knaresborough (A., E., and T.).
Cylindrospermum macrospermum Kütz. Horton, near Bradford (W.).
Cylindrospermum catenatum Ralfs. Goole.

Fam. II.—*LYNGBYEÆ.*

Spirulina oscillarioides Turp. Bramhope (A., E., and T.).
Oscillaria tenerrima Kütz. Bradford (W.).
Oscillaria Frölichii Kütz. Bingley, Baildon, Frizinghall (W.).
Oscillaria muscorum Carm. Hebden Bridge, Allerton (W.).
Oscillaria irrigua Kütz. Keighley, Addingham, &c. (W.).
Oscillaria tenuis Ag. Baildon (W.); Potternewton (A., E., and T.).

Oscillaria nigra Vauch. Shipley Glen, Frizinghall (W.); Potternewton (A., E., and T.).
Oscillaria subfusca Vauch. Baildon (W.).
Lyngbya ochracea Thur. Keighley, &c. (W.); Harrogate (A., E., and T.).
Lyngbya concinnata Kütz. Potternewton.
Lyngbya inundata Kütz. Chapel-Allerton, Bramhope, Harrogate (A., E., and T.).
Plectonema mirabile Thur. Malham, Ingleton (W.).

Fam. III.—*SCYTONEMEÆ.*

Scytonema myochrous Ag. Ingleton (A., E., T., and W.); Arncliffe (W.).
Petalonema alatum Berk. Malham (W.).
Tolypothrix distorta Kütz. Bradford, York (W.).
Stigonema saxicolum Näg. Ingleton (W.); (T. Hebden).
Stigonema ocellatum Thur. Sedbergh (W.).
Rivularia calcarea Eng. Bot. Ingleton, Malham, Austwick (W.)
Rivularia atra Kütz. Roundhay (A., E., and T.).
Rivularia crustacea Carm. Gordale (W.).

Class III.—RHODOPHYCEÆ.

Fam. II.—*CHANTRANSIACEÆ.*

Chantransia violacea Kütz. Ingleborough (W.); Eldwick (W.).
Chantransia chalybea Lyngb. Baildon. Near Halifax (W.).
Chantransia pygmæa Kütz. Ingleton (W.).

Fam. III.—*BATRACHOSPERMEÆ.*

Batrachospermum moniliforme Roth. Allerton, Baildon, Saltaire, &c. (W.); Meanwood (A., E., and T.).
Batrachospermum vagum Roth. Baildon, &c. (W.); Kirkstall (A., E., and T.).
Batrachospermum atrum. Meanwood (S.).

Fam. IV.—*LEMANEACEÆ.*

Lemanea fluviatilis Ag. Kildwick, Baildon, Ingleborough (W.); Harrogate (H.).

REFERENCES TO PLATE :—1.—Staurocarpus gracillimus *Hass.* in conjugation × 400. 2.—Ædogonium Landsbroughii *Hass.* showing spores × 200. 3.—Spirogyra Weberi *Kutz.* × 100 ; *a*, filaments ♂ empty, ♀ with spores therein ; *b*, conjugating filaments, impregnation. 4.—Scytonema myochröum *Agdh.* × 100, showing filaments in gelatinous sheath. 5.—An Alga parasitic on another Alga ; Closterium Lunula *Müller* attacked by Olpidium endogenum *Braun* × 200. 6.—Tetrapedia Crux-Michæli *Reinsch* × 580. 7.—Aphanizomenon flos-aquæ *Ralfs* × 400. 8.—Micrasterias fimbriata *Ralfs* × 200. 9.—Arthrodesmus incus *Hass.* × 500. 10.—Euastrum elegans *Bréb.* × 500 ; state of vegetative cell-division. 11.—Euastrum gemmatum *Bréb.* × 650. 12.—Cosmarium Meneghinii *Bréb.* × 500. 13.—Xanthidium cristatum *Bréb.* × 500. 14.—Staurastrum punctulatum *Bréb.* ; empty semi-cells of two copulating fronds, with zygospore × 500. 15.—Tetmemorus lævis *Kutz.* × 400. 16.—Closterium Eboracense *Turner MSS.* × 500. 17.—Closterium speciosum *Turner MSS.* part of frond × 500. [*Fig.* 5 *is after Archer, in Q. J. Mic. Sci. ; the rest are after nature, and, except* 17, *are from Yorkshire specimens.—W. B. T.*]

RULES.

THE LEEDS NATURALISTS' CLUB AND SCIENTIFIC ASSOCIATION,

Is established for the association of its members for mutual assistance in Natural History and Scientific research, and to spread a taste for Scientific knowledge in Leeds and district, together with the detailed and systematic investigation of the natural productions and physical features of West Yorkshire.

These objects it endeavours to attain by affording facilities for the reading and discussion of papers on scientific subjects, and the examination of specimens and apparatus; by the formation of a scientific library and of local collections; by the publication of reports and papers; and by the organising of out-door excursions.

Membership.

1. The Club consists of two classes of members—Ordinary and Honorary members.

2. Candidates for ordinary membership are proposed and seconded on a nomination form provided by the Club. It is read at the first ordinary meeting thereafter, and voted upon at the next meeting. Any ordinary member has the right to demand a ballot, when the votes of one-third of the ordinary members present shall reject the candidate. Ordinary members contribute not less than 6/- annually, which sum is due on the 1st January in each year.

3. Written resignation is necessary for the termination of membership, and subscriptions are due and payable down to the actual date of resignation.

4. A resolution of the Council, confirmed by the unanimous vote of a meeting of the Club at which ten ordinary members are present and vote, is sufficient for the exclusion of any member.

5. All ordinary members are entitled to free admission and the right to vote at all meetings of the Club, and to receive its publications on such terms as are from time to time fixed by the Club; also to the use of the Library and local collections, and such other privileges as the Club has to offer.

6. Honorary members may be elected by the Club at any meeting, upon the unanimous recommendation of the Council.

7. The Council

Has the general management of the Club's affairs, and regulates and decides all matters not specifically provided for in these rules. It consists of a President, four Vice-presidents (including the last two occupants of the Presidential chair), one or more Secretaries, a Treasurer, and six other members; five of whom form a quorum. They may appoint out of their number any committees they think proper.

8. They may, in case of emergency, suspend the operation of any rule, but their action in this respect must be confirmed by a subsequent meeting of the Club.

9. All members of the Council are eligible for re-election, save that the President shall not occupy that office for more than two years in immediate succession.

Meetings.

10. The Ordinary Meetings of the Club are held weekly, with such variations as the Council may direct, on such days and at such hour and place as the Council shall fix. Special meetings are convened by circular under the direction of the Council.

11. The sessions of the Club extend from the 1st of February to the first week in December inclusive. The first portion of each evening is devoted to short papers, demonstrations, and (when appointed) sectional meetings; after which opportunity is given for the exhibition of specimens, &c., and, after the chairman has left the chair, general conversation.

12. The Annual Meeting

Is the last meeting of the session. The annual report of the outgoing Council is then read, and the Treasurer's accounts are submitted to the members, and the Council and officers for the ensuing year are elected. The Treasurer's accounts shall have been previously audited by two members appointed by the Club at some previous meeting.

13. The outgoing Council submits to the meeting the names of members whom they deem most suitable to form the new Council;

but it is competent for the member voting to substitute the names of such other member or members as he may prefer, in lieu of any of the names on the list. The voting is by ballot. Two or more scrutineers are selected by the President, and receive papers for the first half-hour of the meeting, and report to the President the number of votes for each member, and the President then declares the names of the members so elected.

Library.

14. The Library shall be placed in the Reference Library of the Leeds Corporation, under the care of the Public Librarian. The affairs of the Library are entrusted to a Library Committee of the Council, who arrange with the Public Librarian for the issue of the books to the members, and the conditions of such issue. The Library Committee also have charge of the apparatus and other portable property of the Club.

Alteration of Rules.

15. No alteration of the Rules can be made except at a General Meeting of the members, specially convened for that purpose by a printed circular, sent seven days previously by post to every member; and every such proposed alteration shall be exhibited during that period in the meeting room of the Club.

Dissolution of the Club.

16. The Club cannot be dissolved except by a vote of a clear majority of its whole membership at a General Meeting specially convened for that purpose. In the event of such dissolution being resolved upon, the property of the Club shall not be divided, but shall be placed in the hands of the Mayor of Leeds for the time being and the then Principal of the Yorkshire College, who shall dispose of it in such manner as shall, in their absolute judgment, be most conducive to the advancement of the objects of the Club.

OFFICERS—1878 to 1885.

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ISAAC PATCHETT, F.C.S.	15, Highfield Terrace, Leopold Street, Leeds.
GEO. PAUL, F.G.S., F.R.Met.S.	Shadwell Lane, Leeds.
JOSEPH PEACOCK	Laurel Terrace, Armley, Leeds.
A. E. PEARSON, M.R.C.S.	Leeds Infirmary.
JOHN PEARCE	13, Commercial Street, Leeds.
S. S. PEAT	67, Woodhouse Lane, Leeds.
FREDK. PEMBERTON	Ivy House, Horsforth.
J. R. PENISTONE	36, Mount Preston, Leeds.
JAMES PICKLES	13, Warehouse Hill, Leeds.
JOHN J. PICKLES, M.R.C.S.	Camp Road, Leeds.
HENRY POCKLINGTON, F.R.M.S.	Barden Grove, Whingate, Armley, Leeds.
HENRY POLLARD	19, Britannia Terrace, New Wortley, Leeds
REV. ANNESLEY POWYS, M.A.	The Rectory, Meanwood.
GEO. J. PRICE	Larchfield House, Hunslet, Leeds.
W. NICHOLSON PRICE, M.D.	Mount Pleasant, Leeds.
ED. E. PRINCE	2, Willow Grove Road, Leeds.
G. A. PRINCE	Do. do.
T. E. PRITT	Regent's Lodge, Headingley, Leeds.
ARCHIE RAMSDEN	13, Spring Road, Headingley.
RICHARD REYNOLDS, F.C.S.	Cliff Lodge, Hyde Park, Leeds.
W. W. RICHARDSON	Alma Road, Headingley, Leeds.
G. H. L. RICKARDS	Manor House, Pool.
JOSE RICKARD	Park Lane Board School, Leeds.
EDWARD ROBINSON	7, Woodland Grove, Potternewton, Leeds.

W. DENISON ROEBUCK, F.L.S.	Sunny Bank, Leeds.
WALTER ROWLEY, F.G.S.	Alder Hill, Meanwood.
R. W. RUSBY	11, Mount Preston, Leeds.
W. B. RUSSELL, LL.B., B.A.	Newton Mount, Chapeltown Road, Leeds.
CHARLES RYDER	Chapeltown, Leeds.
BENJAMIN SAYNOR	4, Killam Street, Accommodation Road, Leeds.
J. F. C. SIEBER	Yorkshire College.
G. H. SCOTT, M.R.C.S.	Leeds Infirmary.
W. C. SCOTT	Otley Road, Headingley, Leeds.
HENRY SHACKLETON	Victoria Flour Mills, Leeds.
CHARLES SMETHURST	38, Allerton Place, Burley, Leeds.
W. H. SPICE	67, Sholebroke Avenue, Leeds.
ASHTON STREET, M.R.C.S.	Leeds Infirmary.
JOHN STUBBINS, F.R.M.S., F.G.S.	Inglebank, Far Headingley, Leeds.
J. SWITHENBANK	29, Endor Street, Hunslet, Leeds.
A. PECKETT TAYLOR	Spark Lane, Mapplewell, Barnsley.
JOHN W. TAYLOR	Outwood Villa, Horsforth.
W. A. TAYLOR, B.A.	Leeds Grammar School.
W. H. TAYLOR	C/o H.H. the Prince of Mantua and Montserrat, 18, Elgin Road, St. Peter's Park, London.
T. PRIDGIN TEALE, M.A., F.R.C.S.	18, Cookridge Street, Leeds.
WASHINGTON TEASDALE, F.R.M.S.	Rosehurst, Headingley, Leeds.
WILBERFORCE THOMPSON, M.R.C.S.	Leeds Infirmary.
T. W. THORNTON	22, Carr Road, Leeds.
H. TOWERS	66, Hyde Park Road.
JOHN THRIPPLETON	Burley View, Burley, Leeds.
W. BARWELL TURNER, F.C.S., F.R.M.S.	55, Reginald Terrace, Leeds.
V. H. TURNER	Borough Engineer's Office, Leeds.
GEO. TYAS	22, Bond Street, Leeds.
T. E. VASEY, F.C.S.	27, Corn Exchange Chambers, Mark Lane, London.
Miss EDITH WALKER	Osmondthorpe Hall.
E. R. WAITE	North Lane, Headingley, Leeds.
HERBERT WALKER	47, Mount Preston, Leeds.
MATTHEW WALKER	Swinnow Villa, Pudsey.
WILLIAM WALKER	Osmondthorpe Hall.
HENRY WARDMAN	New Briggate, Leeds.
ISAAC CROWTHER WATSON	Melton House, Morley.
W. H. WATSON	Inver, Horsforth.
THOS. G. WEST	Sweet Street Board School, Leeds.
R. WHITE	14, Commercial Street, Leeds.
A. WHITEHEAD	1, Vernon Road, Leeds.
A. L. WHITEHEAD	1, Vernon Road, Leeds.
THOS. WHITHAM	Bramhope, nr. Leeds.
H. B. WILSON	Brown's Bank, Commercial Street, Leeds.
LEONARD WILSON	Do. do.
RICHARD WILSON	Do. do.
GEO. WINGATE	17, Springfield Place, Leeds.
JOHN WOOD, B.A., F.R.A.S.	Wharfedale College, Boston Spa, Tadcaster.
JOHN WOOD	Woodville, Kirkstall, Leeds.
E. WORMALD	46, Great George Street, Leeds.
A. H. WRIGHT	89, Victoria Road, Headingley, Leeds.

INDEX TO PAPERS

(1885).

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TRANSACTIONS

OF THE

LEEDS NATURALISTS' CLUB

AND

SCIENTIFIC ASSOCIATION.

1890.

VOL. II.

Leeds:

PRINTED BY McCORQUODALE & CO. LIMITED.

1892.

The Leeds Naturalists' Club
and Scientific Association.

Westfield Armley

Leeds, 8 July 1896

Dear Sir

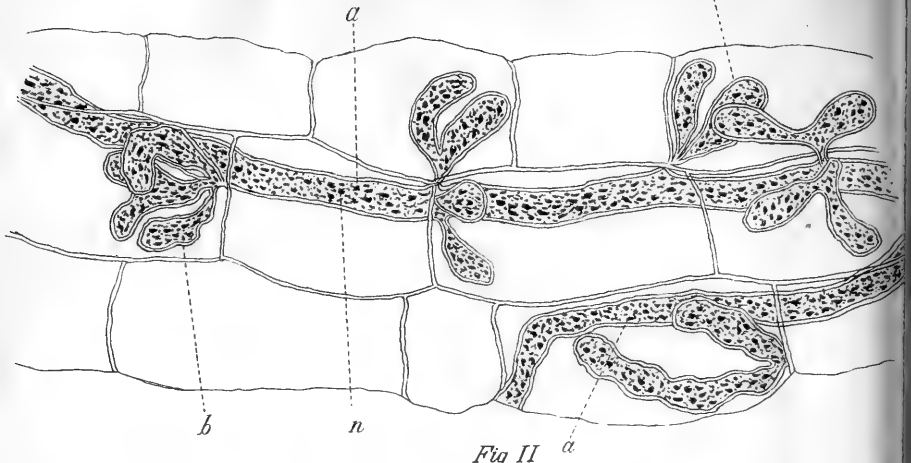
In reply to yours of the 18th June I beg to inform you that there has been no publication by this Society since the one quoted by you — in your possession.

Yours faithfully
Henry B Wilson
Hon Sec.

Charles Fagan Esq
Assist. Secy
Brit. Mus. (Nat Hist.)


NATURAL HISTORY

Fig I



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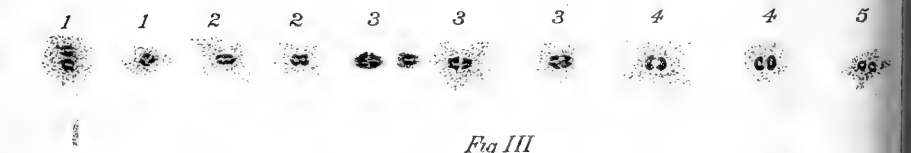
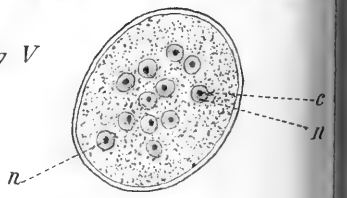


Fig III

Fig IV

Fig V



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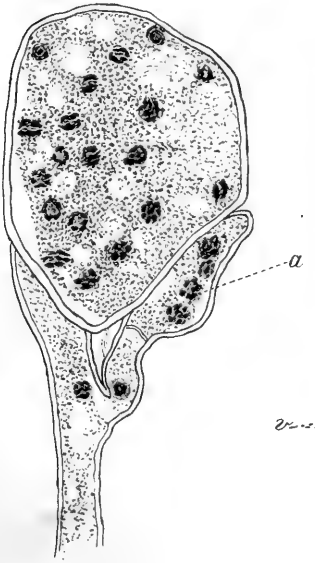

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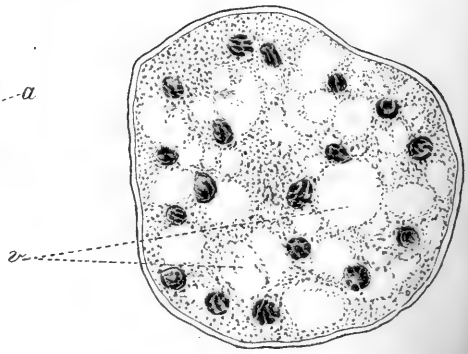

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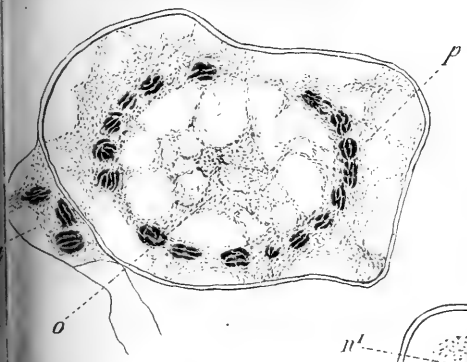

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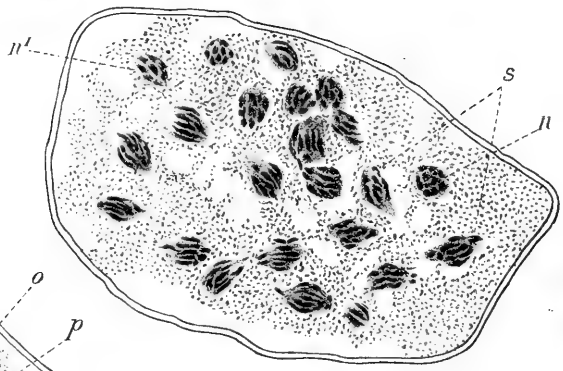

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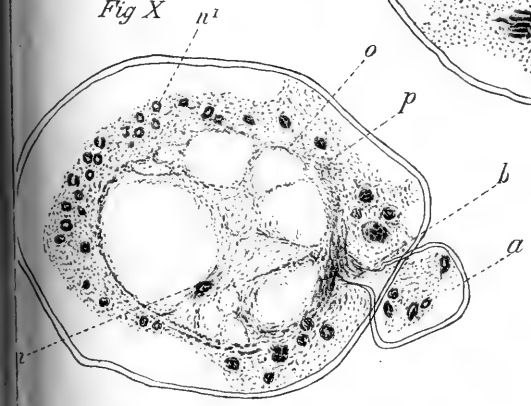

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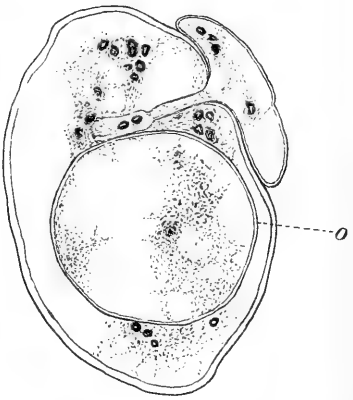

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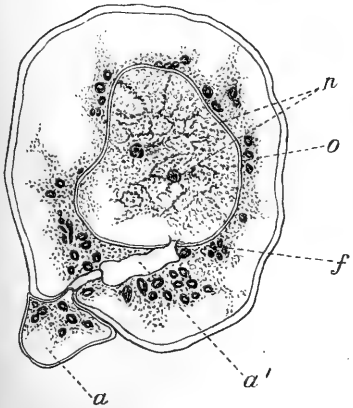


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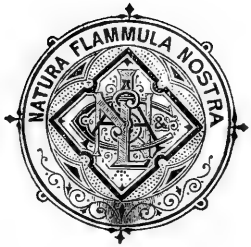

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1892.

CONTENTS.

ANNUAL REPORT

OF THE

LEEDS NATURALISTS' CLUB AND SCIENTIFIC ASSOCIATION.

1890.

THE Council, in presenting their twenty-first annual report, have pleasure in stating that the condition of the Society is most satisfactory, and promises well for the future; 21 new members have been enrolled during the year. Your Council record with regret the death of five members, namely:—Saml. A. Adamson, F.G.S., 52, Wellclose Terrace; Fredk. Akers, 34, Mabgate; John Grassham, 52, Lofthouse Place; Thomas Holroyd, 6, Cavendish Road; and Henry Oxley, Weetwood. Regarding the number of members on the roll, it will be one of the early duties of the new Council to decide as to the period of arrears of subscription which disqualify for membership. Thirty-six meetings have been held during the year, not including the excursions. Eleven of these on the first Monday evening in the month have been held in the Library of the Leeds Philosophical and Literary Society, Park Row.

The subjects were:—

The President's Address on the "Human Brain."

"Development of the Fly of Chironomus." Prof. L. C. MIALL, F.L.S., F.G.S.

"Exhibition of Insecta," with short addresses.

"Relics Found in Yorkshire Caves." Rev. ED. JONES.

"Exhibition of Tropical African Insects, mostly Lepidoptera."

"Examination of Results of Excursion to Boston Spa and District."

"General Natural History Exhibits."

"Exhibition of Mr. G. A. Keartland's donation of Australian Birds' Skins and Eggs."

"Some of the Possible Causes of Variation in the Shape and Colour in the Eggs of Birds." H. BENDELACK HEWETSON, M.R.C.S., F.L.S., F.Z.S.

"Sterna and Shoulder-Girdles of Birds," with short address and exhibition. EDGAR R. WAITE, F.L.S.

The Conversazione.

Four meetings have been held at the Leeds Medical School, under the direction of the President.

The following were the subjects :—

"Practical Work—The Preparation of Brain Tissue for Section Cutting."
"Address and Demonstration on Urine."
"Address with Demonstration and Experiments on Blood Pressure."
"Address and Demonstration on Digestion."

The remaining twenty meetings were held in the Club's Room, No. 80, Municipal Buildings, which has been kindly placed at the disposal of the Club by the Corporation of Leeds.

The following seven papers were given :—

"Trilobites." W. Lower Carter, M.A., F.G.S.
"The Specific Gravity of the Blood." Dr. E. Lloyd Jones.
"Bacteria, with regard to their conditions in life." Prof. E. H. Jacob, M.A.
"Notes on the Red Seaweeds." Harold Wager.
"Micro-Organism and Foul Air." Harold Wager.
"Sketch of the Life-History of Simulium." Arthur Walker.
"The Surface Film of Water and its Relation to Plants and Animals." Prof. L. C. Miall, F.L.S., F.G.S.

Three practical evenings were given as follows :—

"The Preparation and Mounting of Microscopical Objects." W. Clapham.
"The Preservation and Mounting of Aquatic Larvæ of Insects." Arthur Walker.
"The Preparation of Hard Structures for Microscopical Study." J. Charters Birch, L.D.S.

Four meetings were held for the examination of results of excursions and general Natural History exhibits.

The following six make up the total of thirty-six instructive and scientific meetings during the year :—

Short Address on Protozoa.
Conversational Meeting.
General Natural History Exhibits.
Exhibition of Pond-Life.
General Exhibits.
Annual Meeting.

Your Council have pleasure in noting that the attendance at the meetings and excursions has been satisfactory throughout the entire Session.

The Summer Excursions were as follows:—Woodlesford and district; Elbolton Cave, near Skipton; Boston Spa and district; Parlington Park and district; the Ruskin Museum, Sheffield; Messrs. James Backhouse & Son's Nurseries and Askham Bog, near York; and Adel.

The Library and Natural History Collection of the Club has been enriched during the year by the generous gift of Mr. G. A. Keartland, which consists of 28 Skins and Eggs of 16 species of Birds from the interior of Australia.

Prof. O. C. Marsh, of Yale University Museum, Newhaven, Con., U.S.A., a visitor to the Leeds Meeting of the British Association, has also been good enough to present to the Library a valuable series of his Papers, 22 in number, on American Palæontology:—

Birds with teeth.
Gigantic Mammals, Order *Dinocerata*.
Vertebrate life in America.
Palæontology discovery.
Gigantic Horned *Dinosauria* from the Cretaceous.
A perilous fossil hunt.
Polydactyle horses, recent and extinct.
A new family of Horned *Dinosauria*.
Comparison of the principal forms of the *Dinosauria* of Europe and America.
Distinctive characters of the Order *Hallopoda*.
The skull of the Gigantic *Ceratropsidæ*.
Restoration of *Brontops robustus*.
Description of new *Dinosaurian* reptiles.
Discovery of Cretaceous Mammalia.
American Jurassic Mammals (7 parts).
Characters of American Cretaceous Pterodactyls.

Mr. E. Robinson has presented to the Club a well-executed Cast of a Trilobite (*Asaphus expansus*) from Russia (Lower Silurian).

The following have been added to the Club's Library during the year:—

Griffith and Henfrey's Fourth Edition Micrographic Dictionary. *Purchased.*
Guide to the Mineral Gallery of the British Museum. *Presented by the Trustees.*
The Naturalist. *Purchased.*
Science Gossip. *Purchased.*
Cook's Fungi, Parts LXXII., LXXIII., LXXIV. *Purchased.*

Transactions of the Eastbourne Natural History Society, Part III., Vol. II., New Series. *Presented.*

Proceedings and Transactions of the Natural History Society of Glasgow, Vols. II., III., New Series, Parts 1, 2. *Presented.*

Reports and Proceedings of the Manchester Scientific Students' Association, 1889. *Presented.*

Land and Fresh Water Mollusca of Ingleton, Clapham, and District. *Presented by the author, W. E. Collinge.*

Journal of the Mineralogical Society, April, 1890, Vol. IX., Nos. 41, 42.

Guide, Parts I., II., Fossil Mammals and Birds. *Presented by the Trustees of the British Museum.*

Jonathan Salt's List of Plants of Sheffield and Neighbourhood. *Presented by the Sheffield Literary and Philosophical Society, per the Secretaries of the Yorkshire Naturalists' Union.*

The Yorkshire Carboniferous Flora, Studies of North Yorkshire Botany, Geology, Climate, and Physical Geography. *Presented by the Yorkshire Naturalists' Union.*

The Transactions of the Brighton and Sussex Natural History and Philosophical Society for 1888, 1889, and 1890. *Presented.*

Your Council has, during the year, concluded negotiations with the Library Committee of the Leeds Corporation.

The following is a Copy of the Agreement :—

FREE PUBLIC LIBRARY COMMITTEE,

12*th June*, 1890.

RESOLVED—

That the following arrangements made by the Sub-Committee appointed to have an interview with the Committee of the Leeds Naturalists' Club be approved.

9*th May*, 1890.

That the Naturalists' Library remain in the present room, and that it be considered a part of the Reference Library while remaining the property of the Club, so that members of the Club would be enabled to consult the books at any time, as well as other books from the Reference Library in their own room, and that the Club's stamp be retained on the books as a sufficient guarantee against loss.

That the issue of books from the Naturalists' Club Library to members of the Club as a Lending Library, and subject to rules as a Reference Library to the public, be undertaken by the Librarian and staff of the Public Library.

That the Public Library make good ordinary wear and tear by rebinding books when necessary.

The Library is estimated to contain about 400 volumes, many of which are very scarce.

(Signed) GEORGE W. MORRISON,
Town Clerk.

In accordance with the agreement the books of the Library will at once be formally handed over—with a few exceptions—to the custody of the Public Librarian, Mr. James Yates. Eventually books will be circulated to members by Mr. Yates, and in addition the books in the Reference Library of the Leeds Corporation will be available for use by members in the Club's Room.

A subject which has engaged the attention of your Council during the year has been the question of labelling the trees and shrubs in Roundhay Park; the matter is at present in abeyance. The Chairman of the Parks Committee authorises the statement to be made that the proposal is received with favour, provided the work can be done by means of a small expenditure.

A very successful Conversazione was held at the Philosophical Hall, December 3rd, and was attended by about 300 members and their friends. The loss on this was larger than usual, owing to the fact that fewer tickets were purchased by members. This is doubtless to be attributed to the fact that during the recent visit of the British Association quite a series of Conversaziones were held.

During the meetings of the British Association the Club was enrolled among the Corresponding Societies of the Association.

The financial year closes with a balance of £12 14s. 7d. in favour of the Association, notwithstanding that an extraordinary expenditure has been incurred in the purchase of a new bookcase, black board, Griffith and Henfrey's Micrographic Dictionary, &c., &c.

Your Council regret that Mr. J. Charters Birch, L.D.S., is unable to continue to fill the post of Hon. Treasurer, and desires to place on record its sense of obligation for the efficient services rendered during the last two years.

Your Council also desires to place on record the valuable services rendered by Mr. J. Phillips as Librarian for the year 1890.

President, DE BURGH BIRCH.
Secretary, ARTHUR WALKER.

December 8th, 1890.

List of Papers and Meetings.

1886.

President:—H. Bendelack Hewitson, M.R.C.S.

Feby.	1.	Opening Meeting.
,,	8.	General Exhibits.
,,	17.	How to skin a Bird.—The President.
,,	25.	Conversazione.
March	3.	The Migration of Birds.—W. Eagle Clarke, F.L.S., M.B.O.U.
,,	10.	Shrikes.—W. Cecil Scott.
,,	17.	British Macro-Lepidoptera.—H. Marsh, F.R.C.I.
,,	24.	The Orange Family.—G. Paul, F.G.S., F.R.Met.S.
,,	31.	The Kestrel.—W. W. Booth.
April	21.	The Structure of the Lobster.—T. London, F.R.Hist.S.
,,	28.	Exhibition of Specimens.
May	1.	Excursion to Adel Bog.
,,	5.	Micro-Photography.—F. W. Branson, F.C.S.
,,	12.	The Feet of Birds.—Edgar R. Waite.
,,	19.	Entomological Exhibits.
,,	26.	Travels of J. Broughton.—Rev. W. Broughton.
June	2.	Testacellæ.—W. Denison Roebuck, F.L.S.
,,	5.	Excursion to Bramley
,,	9.	*Stylops Spencii.*—J. Stubbins, F.R.M.S.
,,	16.	Botanical Exhibits.
,,	23.	Entomostraca.—W. B. Russell. LL.B.
,,	30.	Mosses.—W. West.
July	7.	The House-Fly.—T. London, F.R.Hist.S.
,,	14.	Microscopical Exhibits.
,,	21.	Natural History Notes from Switzerland.—The President.
,,	26.	Excursion to Wetherby.
,,	28.	*Limnæa peregra.*—W. Nelson.
,,	31.	Excursion to Shipley.
Aug.	4.	The Fertilization of Flowers.—Percy H. Grimshaw.
,,	11.	General Exhibits.
,,	18.	Ornithological Exhibits.
,,	25.	Entomological Exhibits.
Sept.	1.	The Collection and Preparation of Botanical Specimens.—W. Kirkby.
Sept.	8.	Entomological Exhibits.
,,	13.	Excursion to Bramley.
,,	15.	Examination of Results of Excursion.
,,	20.	Excursion to York.
,,	22.	General Exhibits.
,,	29.	The Honey Bee.—G. H. L. Rickards, M.R.C.S.

Oct.	6.	Parasites.—Dr. Spencer, of York.
,,	13.	General Exhibits.
,,	20.	Diatomaceæ.
,,	27.	Geological Exhibits.
Nov.	3.	General Exhibits.
,,	10.	The Life-History of *Helix aspersa*.—W. E. Collinge.
,,	17.	Exhibition of Parasites.
,,	24.	Distribution of British Butterflies.—H. Marsh, F.R.C.I.
Dec.	1.	General Exhibits.
,,	9.	The Alchemists.—C. H. Bothamley, F.C.S.
,,	15.	Annual Meeting.

List of Papers and Meetings.

1887.

President:—Prof. L. C. Miall, F.L.S., F.G.S.

Feby.	2.	Opening Meeting.—Address by the President.
,,	9.	Practical Microscopy.
,,	16.	The Ornithology of Flamborough.—Edgar R. Waite.
,,	23.	Geological Exhibits.
March	2.	*Volvox globator*.—James Abbott.
,,	9.	Practical Microscopy.
,,	16.	Leaves.—R. T. Taylor.
,,	23.	Visit to the Mediterranean.—H. Bendelack Hewetson, M.R.C.S.
,,	30.	The Honey Bee.—G. H. L. Rickards, M.R.C.S.
April	6.	Practical Microscopy.
,,	13.	General Exhibits.
,,	20.	The Fructification of the Carboniferous Rocks.—Wm Cash, F G.S.
,,	23.	Excursion to Adel.
,,	27.	Conversazione.
May	4.	Practical Microscopy.
,,	11.	Swammerdam's "Biblia Naturæ."—The President.
,,	14.	Excursion to Boston Spa.
,,	25.	The Structure of Mosses.—J. Stubbins, F.R.M.S.
June	1.	Examination of Results of Whitsuntide Excursion.
,,	8.	Practical Microscopy.
,,	11.	Excursion to Ripon.
,,	13.	Examination of Results of Excursion.
,,	22.	No Meeting (Jubilee Week).
,,	25.	Excursion to Weeton and Pool.
,,	27.	Examination of Results of Excursion.
July	6.	General Exhibits.
,,	9.	Excursion to Bishop's Wood.

July	11.	Examination of Results of Excursion.
,,	18.	Entomological Exhibits.
,,	23.	Excursion to Adel Bog.
,,	25.	Examination of Results of Excursion.
Aug.	3.	General Exhibits.
,,	6.	Excursion to Pannal and Birk Crag.
,,	8.	Examination of Results of Excursion.
,,	17.	Microscopical Exhibits.
,,	20.	Excursion to Pateley Bridge.
,,	29.	Examination of Results of Excursion.
Sept.	7.	General Exhibits.
,,	12.	Entomological Exhibits.
,,	19.	Microscopical Exhibits.
,,	26.	The Fossils of the neighbourhood of Leeds.
Oct.	5.	The Equisetaceæ.—The President.
,,	10.	Exhibition of Fruits and Seeds.
,,	17.	British Corvidæ.—Edgar R. Waite.
,,	24.	The Darts of the Helicidæ.—W. E. Collinge.
,,	31.	Practical Microscopy.
Nov.	7.	Differences in the Plumage of Birds, consequent on age, sex, and season.—Edgar R. Waite.
,,	14.	Demonstration of the Anatomy of *Anodonta cygnea*.—The President.
,,	21.	The Hessian Fly.—F. W. Branson, F.C.S.
,,	28.	Microscopical Exhibits.
Dec.	5.	Practical Microscopy.
,,	12.	Annual Meeting.

List of Papers and Meetings.

1888.

President:—Prof. L. C. Miall, F.L.S., F.G.S.

Feby.	6.	Opening Meeting. Exhibition of Plant Sections.
,,	13.	Practical Microscopy.
,,	20.	On the means of obtaining vacua, with experiments.—T. Fairley, F.C.S., F.R.S.E.
,,	27.	The Structure of a Feather.—The President.
March	5.	Exhibition of Insecta.
,,	12.	Practical Microscopy.—The President.
,,	19.	On Attractiveness in Nature.—H. Bendelack Hewetson, M.R.C.S.
,,	26.	Practical Microscopy.—The President.
April	2.	No Meeting (Easter).
,,	9.	Exhibition of Minerals and Rock Sections.

April	16.	Exhibition of Microscopic slides with polarised light.
,,	21.	Excursion to Knaresborough.
,,	25.	Conversazione.
,,	30.	On the Distribution of the British Flora.—W. West, F.L.S.
May	5.	Excursion to Fewston.
,,	7.	Examination of Results of Excursion.
,,	14.	Preparation of Birds' Eggs.—Edgar R. Waite.
,,	21.	No Meeting (Whitsuntide).
,,	26.	Excursion to Aberford.
,,	28.	Examination of Results of Excursion.
June	4.	Experiment on the Change of Colour in Fishes.—The President.
,,	9.	Excursion to Bardsey and Collingham.
,,	11.	Examination of Results of Excursion.
,,	15.	Excursion to Mr. Wood's Nurseries.
,,	18.	Exhibition of Living Micro-Organisms.
,,	23.	Excursion to Knaresborough.
,,	25.	Examination of Results of Excursion.
July	2.	Exhibition of Foraminifera.
,,	7.	Excursion to Bishop's Wood.
,,	9.	Examination of Results of Excursion.
,,	16.	Exhibition of Pond-Life.
,,	21.	Excursion to Bardsey.
,,	23.	Examination of Results of Excursion.
,,	30.	General Exhibits.
Aug.	11.	Excursion to Adel and Bramhope.
,,	13.	Examination of Results of Excursion.
,,	20.	The Lingual Ribbon and Mandible of *Limnæa*.—Wm. Nelson.
,,	27.	Marine Polyzoa.—G. Paul, F.G.S., F.R.Met.S.
Oct.	1.	The Station of a Species.—Oswald Dawson.
,,	8.	Practical Microscopy.—The President.
,,	15.	The Development of Chironomus.—The President.
,,	22.	Exhibition of Plant Structure.
,,	27.	Exhibition of Bees.
Nov.	5.	Practical Microscopy.—The President.
,,	12.	Ice and Glaciers.—J. Lewkowitsch, Ph.D., F.C.S.
,,	19.	The Structure of the Woodpeckers.—Edgar R. Waite.
,,	26.	Mimicry.—W. Cash, F.G.S.
Dec.	3.	The British Occurrences of Pallas' Sand-Grouse.—H. Bendelack Hewetson, M.R.C.S.
,,	10.	Annual Meeting.

Abstracts of Papers and other Proceedings

OF THE

LEEDS NATURALISTS' CLUB AND SCIENTIFIC ASSOCIATION.

1889.

Meeting held in the Library of the Philosophical Hall, February 4th, 1889. H. B. Hewetson, M.R.C.S., Vice-President, in the chair. The chairman introduced Professor De Burgh Birch, M.D., C.M., F.R.S.E., the elected President for the year.

Professor Birch then took the chair, and after expressing his thanks for the honour conferred upon him by the Club, gave his presidential address on "Low Forms of Life—Industrial, 'Putrefactive' and Pathological."

Exhibits :—

Dr. Jacob exhibited and described *Bacillus tuberculosis*, germs of Leprosy, Anthrax (woolsorter's disease), Abscess, and others.

Mr. Branson exhibited a number of lantern slides of Bacilli and other organisms on the screen.

Mr. George Hainsworth exhibited the Yeast Plant.

Mr. John Stubbins, F.G.S., F.R.M.S., exhibited *Actinophrys eichornii.*

Meeting held in Room 80, Municipal Buildings, February 11th, 1889. John Stubbins, F.G.S., F.R.M.S., Vice-President, in the chair.

Exhibits :—

Mr. Stubbins exhibited a small case of Bees which he had received from Mr. Fred. Enock, of London. These were arranged by the side of a corresponding number of Diptera which had taken to themselves certain notable features of resemblance so as to pass for and even to delude the actual Bees. The Bees and Insects shown were *Apathus vestalis* (*psithyras*) by *Volucella pellucens*, *Bombus lapidarius* by a variety of *Volucella bombylans*, and *Bombus muscorum* by *Volucella bombylans.*

Mr. Phillips showed *Polypodium vulgare.*

Mr. Boulton exhibited a microtome which he had just completed, adapted for cutting sections by the paraffin and celluloidin process.

Mr. W. Kirkby exhibited a large and valuable collection of plants, some ninety in all, from France, Norway, and New Zealand, giving several interesting notes on certain peculiarities, and on their actual or allied representatives in Britain.

Meeting held in the Lecture Theatre of the Medical School, Park Street, February 18th, 1889. Professor De Burgh Birch, M.D., C.M., F.R.S.E., President, in the chair.

DEMONSTRATION ON METHODS OF APPLYING CHEMICAL RE-AGENTS TO OBJECTS UNDER THE MICROSCOPE.

PROFESSOR BIRCH.

The methods of applying re-agents in the examination of microscopic objects were first of all described. The following substances were then examined in the Laboratory—starch grains from wheat, cotton and linen fibres, and uric acid.

Meeting held in Room 80, Municipal Buildings, February 25th, 1889. J. Charters Birch, L.D.S., in the chair.

DEMONSTRATION OF TAXIDERMY.

EDGAR R. WAITE.

The word Taxidermy is derived from two Greek words, signifying the arrangement of skins. It has, however, a much wider significance, and embraces the preservation of natural history objects in general. Among the ancient Egyptians it was extensively practised, as shown by the mummies of human bodies, birds, cats, and other animals to be seen in the museums. A mummy of the sacred Ibis and young Crocodile, together with some excellent photographs of mummies of distinguished rulers (Seti I., Prince Djet, &c.) were exhibited, and some remarks made on the preparation of mummies by the ancients. Taxidermy, as practised at the present day, was then introduced, and a bird was chosen as the subject of the demonstration.

No very elaborate or expensive instruments are required in order to skin a bird, and the only tools used by Mr. Waite were a penknife and a pair of ordinary scissors.

A Rook was selected to illustrate the process, a bird of this kind having not a few features of advantage for such a demonstration, *e.g.*, being of moderate size and having a tough skin. Several ways of skinning a bird were mentioned—on the breast, the abdomen, the back, and under the wing. The plan of skinning a bird on the breast is the easiest and at the same time the most generally practised, but is open to several objections, not the least being that of the fatty matter making its way through the incision and soiling the feathers. This is more especially the case with water-birds, where a layer of fat usually intervenes between the skin and the flesh.

The method advocated and practised by Mr. Waite was that of skinning under the wing. The incision was easily concealed and there was no danger of the oily matter soiling the plumage. It was admitted that of all methods this was perhaps the most difficult, but it was undoubtedly found to give the most satisfactory results. Corrosive sublimate in alcohol was recommended as a preservative, and naphthaline as an insect deterrent.

Meeting held in the Library of Philosophical Hall, March 4th, 1889. John Stubbins, F.G.S., F.R.M.S., in the chair.

DEMONSTRATION OF THE USE OF SOME FORMS OF SUBSTAGE APPARATUS FOR MICROSCOPICAL ILLUMINATION.

JOHN STUBBINS, F.G.S., F.R.M.S.

This demonstration was arranged to give those commencing microscopical studies an opportunity of observing in practical use a variety of forms of apparatus and the advantages derived from their use in the better delineation of form and structure.

The apparatus exhibited and used included:—Beck's achromatic condenser, and large and small spot lens; Webster's condenser; Kellner's eye-piece, mounted as a condenser; Bramhall's oblique illuminator; Col. Horsley's silvered cylinder; oil immersion illuminator for high powers; Reade's rectangular prism; Lord S. G. Osborne's diatom exhibitor, an Iris diaphragm, and a complete set of polarising apparatus.

The arrangements of the lenses, &c., were explained by black-board sketches.

Mr. F. W. Branson, F.C.S., exhibited cholera bacillus under high power illumination.

Messrs. J. Moorhouse and J. W. Addyman, B.A., exhibited Abbe's condenser and other apparatus.

Mr. W. Clapham exhibited stage illuminator and spot lens made by himself at very little expense, and which certainly had the merit of giving similar results to apparatus of much greater cost.

Mr. F. Emsley exhibited Wenham's half-circle illuminator.

Meeting held in the Club's Rooms, 80, Municipal Buildings, March 11th, 1889. T. Fairley, F.C.S., F.R.S.E., in the chair.

THE CRUCIFERÆ.

JAMES ABBOTT.

The name, which is derived from *Crux* (Cross) and *fero* (I bear), is especially appropriate to plants of this order, since the flowers have four usually equal petals, which greatly resemble a cross in their arrangement. Crucifers include many of our familiar vegetables, such as cabbage, mustard, watercress, and others, besides many common garden plants, such as stocks, wallflowers, &c. They are readily distinguished by their flowers from all other British plants, but are so much like each other in character that the determination of their very numerous genera is attended by some difficulty, and various expedients have been made use of in classifying them. De Candolle applied the relative positions of the radicle and the cotyledons, while some of our British botanists have distinguished the plants by the differences in the shapes and various modifications of the

seed vessels. The lecturer pointed out the importance of having the specimen in fruit, and described the method of examining the seed. He also referred to several of the anomalous species belonging to the order, and illustrated his remarks throughout by numerous drawings on the blackboard.

Meeting held in the Lecture Theatre and Laboratory of the Medical School, Park Street, March 18th, 1889. Professor De Burgh Birch, M.D., C.M., F.R.S.E., President, in the chair.

DEMONSTRATION OF METHODS OF INJECTION.

PROFESSOR BIRCH.

Injection, as a method of preserving animal tissue, was shown not to be by any means a new process. It was practised to some extent by the ancients when embalming bodies. In medical science also it dates back a very considerable period, but by a method now quite superseded. Mercury, until somewhat recent years, was used, which had the disadvantage of destroying minute detail of structure. This was shown by a number of exhibits from the museum of the School. The method now practised is by means of coloured fluids, which are of a preservative nature and obviate the obliteration of minutiæ of structure ; and further, most successfully bring out into more immediate notice these details. This was illustrated by injected specimens of epidermis, intestinal wall, and also of bone. The President, in demonstrating the principal methods of use, divided the subject under three heads :—(1) That of filling an organ with a preservative fluid, which afterwards solidifies, fixing it in a dilated form as in life ; (2) That of fixing blood vessels so as to demonstrate their course throughout the body ; (3) Interstitial injection. A number of formulæ were given for the coloured preserving and fixing media in general use, *e.g.*, carmine and Prussian blue, which are forced when in a liquid state by means of suitable apparatus into the vessel it is desired to demonstrate or trace out. Demonstrations in the three above mentioned methods were made upon the rabbit, and were most clearly shown.

Meeting held in the Club's Rooms, 80, Municipal Buildings, March 25th, 1889. J. Charters Birch, L.D.S., in the chair.

ON VARIATION IN LEPIDOPTERA.

HENRY MARSH, F.R.C.I.

After briefly reviewing the state of knowledge on the subject, the lecturer discussed some of the causes of variation and modes under which variation was produced, and the classes into which these variations are divided. The two great families are the "aberrational" and "constant" variations, or as they are scientifically called heteromorphisms and orthopœcilisms. Under the former were classed : albinism or white variation ; xanthism or

pallid variation; melanism or darkening; heteropœcilisms or spots; gynandrochromism or male assuming the female form; and hermaphrodism or the combination of the two sexes in one individual. The principal groups of orthopœcilic varieties are—polymorphism, or numerous variations rendering the type uncertain; topomorphism, or varieties due to habitat; atavism, or reversion to an earlier type; dimorphism, or two static conditions of the same species; and horeomorphism, or seasonal variations. After defining a type, the theories of Lord Walsingham on melanism, and of Mr. Duprè were discussed, and the facts inconsistent with each theory pointed out. With some diffidence, the lecturer ventured to name the result of some of his own experiments, which induced him to think that possibly humidity might be an element in some of these changes. An interesting discussion followed.

Meeting held in the Library of the Philosophical Hall, Park Row, April 1st, 1889. John Stubbins, F.G.S., F.R.M.S., Vice-President, in the chair.

Exhibits:—

The chairman called attention to a fine collection of Indian Ferns and Mosses beautifully arranged and mounted, retaining to a remarkable extent their natural colour, exhibited by Mr. James Moorhouse.

Mr. Edgar R. Waite exhibited and described a collection of birds' nests. In the course of his remarks, the speaker stated that although this was an important branch of ornithology comparatively few students in this section of natural history collected the nests of birds. Mr. Waite, however, exhibited a very representative collection, and so illustrated the most important peculiarities of nest construction. This was made still more complete by the exhibition of sketches of other nests which will not admit of being removed in their entirety, *e.g.*, those of the Sand Martin, Kingfisher, and similar nesters. The speaker called attention to a great variety of nests, and in order to render the subject more comprehensive, proceeded to classify them according to their various peculiarities, which classification he remarked was of the rudest description, having nothing in common with the systematic classification of the birds themselves, the following are the groups into which the subject was roughly divided, together with the representative, illustrated either by actual specimens or by drawings:—Weavers—Baltimore Oriole, Baya Weaver Bird, Crested hangnest, &c.; Tailors — *Orthotomus sutorius;* Felters — Penduline Tit, Pinc-pinc; Basketers—Magpie, &c.; Plasterers—Swallow, Martin, &c.; Excavators—Sand Martin, Woodpecker; Ground Builders—Flamingo, Megapodes; Non-nest Makers—Guillemot, Razorbill; Parasites—Cuckoo, Cowbird (*Molothrus pecoris*).

Mr. J. W. Addyman, B.A., exhibited a number of Diatoms, and gave a short account of the variety of forms, structure, and life-history of the group.

Mr. Wm. Kirkby exhibited a large collection of seeds.

The chairman briefly described a series of lantern slides of typical examples and structures of insects which were thrown on to the screen. Specimens were also shown under the microscope.

Meeting held in the Club's Rooms, 80, Municipal Buildings, April 8th, 1889. J. Lewkowitsch, Ph.D., F.C.S., in the chair.

THE INTERFERENCE OF LIGHT IN RELATION TO THE COLOUR OF FEATHERS AND OTHER OBJECTS.

F. W. BRANSON, F.I.C., F.C.S.

The undulatory theory of light was first discussed, and shown to be capable of satisfactorily explaining the phenomenon of interference of light, as a result of which objects devoid of colour appear variously coloured according to the angle of the illuminating ray. Interference of light was shown to result when the paths of two nearly parallel pencils of light intersect. The coloured spectrum of white light was shown on the screen, and white light was shown to result from the blending of the coloured prismatic tints which are visible when white light is passed through a prism. Two methods whereby colour is produced by means of interference of light were then discussed, viz., reflection from a very thin film, *e.g.*, a soap bubble, or an oily layer on water, and reflection from a minutely-grooved or closely striated surface, as in many feathers.

A number of objects interesting to the naturalist were then shown and explained—objects which owe their colour wholly or partially to interference, viz., feathers of peacock and humming bird, elytron of beetle, wing of moth, &c.

Dr. Lewkowitsch supplemented the paper with some observations.

Meeting held in the Club's Rooms, 80, Municipal Buildings, April 15th, 1889, F. W. Branson, F.I.C., F.C.S., in the chair.

PHOTO-MICROGRAPHY.

H. POCKLINGTON, F.R.M.S.

In the introduction was given a short sketch of the history and present state of knowledge in this particular section of photography, in which even now, although some very excellent results have been achieved, there is much to be done before it can be really useful in all kinds of microscopical work. It was observed that micro-photography as compared with hand drawing had the advantage of defining with the greatest possible accuracy minute details of structure, and in a fraction of the time that would be taken in ordinary drawing, but that is only as regards one plane, and when objects are not of uniform thickness they turn out blurred,

so in this, hand drawing is yet without its equal. Still, as was subsequently pointed out, all microscopists are not good draughtsmen; and to such photography, is of valuable assistance. A number of processes were explained, and Mr. Pocklington gave many hints and devices by which better results were to be obtained. By means of the lantern a large and varied number of slides, including several of special difficulty, were thrown on the screen.

ANNUAL CONVERSAZIONE.

The conversazione held on May 1st, 1889, at the Philosophical Hall was a great success. Between three and four hundred persons were present, comprising members of the Club and their friends, and every part of the programme arranged for their delectation appeared to meet with hearty appreciation. The guests began to arrive at half-past seven o'clock. About half an hour later, the company having partaken of coffee, and having also had the opportunity of preliminarily, though cursorily, inspecting the numerous exhibits, a general move was made to the Lecture Theatre, where Professor De Burgh Birch, the President, welcomed those present on behalf of the Club, and mentioned the principal objects of interest which had been got together. To enumerate every item in the attractive collection of scientific and artistic matters which were brought together would occupy much more space than is at our disposal. The microscopical section was fraught with unusual interest on account of the serial slides illustrating the life-history of the parasite of the wild bee (*Stylops Spencii*) in its development from the primitive larva to the male stylops emerging from the bee; and the Hessian Fly, whose ravages upon the stems of barley are well known. Mr. C. P. Hobkirk showed some semi-fossil moss from the caulking of an ancient boat found at Brigg, Lincolnshire. Several of the exhibits were made by members of the Skipton Naturalists' Society. Another portion of this section was set apart for studies in pond-life by Mr. W. T. Grimshaw; among the miscellaneous items under the microscope were three which Dr. E. H. Jacob exhibited as the causes respectively of "Favus" (a kind of skin disease which occurs on the human head, and of which the exhibitor has only known three cases during the last twelve years), "Ringworm," and "Thrush." Altogether about 60 microscopes were employed. In the same room were shown about 50 water-colour drawings of the ducks of Europe, the work of Mr. Edgar R. Waite, who also exhibited his working collection of British Birds' skins. A collection of eggs of British and foreign birds, by Mr. R. Middleton; examples of ortho-chromatic photography, by Mr. C. H. Bothamley; North African and Continental photographs, lent by Councillor Ambler; and a collection of Norwegian jewellery and curiosities, exhibited by Messrs. Tom Atkinson, J. Buckley, E. C. Midgley, and Mrs. Addyman—some of the last-named articles

being specially admired for their quaintness—also found a place around the walls. In another part of the building Mr. Lomas Joy had on view a fine collection of British and foreign butterflies and moths, and Mr. H. Bendelack Hewetson showed living specimens of the green tree frog, and nests of trap-door spiders from Mentone. Mr. Hewetson also made some experiments with "animated oats," demonstrating the susceptibility of the species, thus playfully named, when wetted. Perhaps the greatest attraction of the independent exhibits was the "Tainter" graphophone, an instrument similar in some respects to the phonograph, and designed to obtain the registration of speech or sound by cutting into or engraving upon a waxen surface. A selection of music was performed by the members of the Leeds Private Orchestral Society. It should be added that the library was comfortably furnished for the occasion, and the walls hung with a number of admirable paintings in oil and water-colour, lent by members.

Meeting held in the Library of the Philosophical Hall, Park Row, May 6th, 1889. J. Charters Birch, L.D.S., in the chair.

Exhibits :—

Messrs. W. L. Carter, M.A., F.G.S., and J. W. Addyman, B.A., exhibited among others, White Primrose (*Primula veris*), *Cardamine amara*, *Equisetum Telmateia*, *E. palustre* (fruiting and barren fronds), *Lathræa squamaria*, *Orchis mascula*, *Chrysosplenium oppositifolium*, *Ranunculus auricomus*, *Scilla nutans*.

Meeting of the Club, held in the Club's Room, Municipal Buildings, May 13th, 1889. J. Charters Birch, L.D.S., in the chair.

DEMONSTRATION OF TAXIDERMY.

EDGAR R. WAITE.

Mr. Waite described the treatment required to prepare and preserve the skin of a mammal. A rabbit was chosen as the subject of demonstration.

Meeting held in the Municipal Buildings, May 20th, 1889. The chair was occupied by Professor De Burgh Birch, M.D., C.M., F.R.S.E., President.

The meeting of the Club was devoted to the examination of the results of the excursion to Embsay, which took place on the preceding Saturday. To the botanists the excursion was most profitable, as the following list of plants in flower will testify; and under the kind direction of Mr. Lister Rotheray, of Skipton, those present had splendid opportunities of collecting and making observations.

Mr. F. W. Branson, F.C.S., described the plants taken, namely:—*Ranunculus bulbosus, Ranunculus auricomus, Anemone nemorosa, Draba verna, Cardamine hirsuta, Cardamine pratensis, Sisymbrium alliaria, Viola sylvatica* var. *Riviniana* (?), *Lychnis diurna, Stellaria holostea, Arenaria trinervia, Cerastium triviale, Oxalis acetosella, Vicia sepium, Lathyrus macrorrhizus, Prunus spinosa, Prunus padus, Geum rivale, Fragaria vesca, Alchemilla vulgaris, Adoxa moschatellina, Chærophyllum sylvestre, Valeriana dioica, Veronica chamædrys, Linaria cymbalaria, Nepeta glechoma, Myosotis sylvatica, Primula vulgaris, Primula veris, Primula farinosa, Rumex acetosa, Orchis mascula, Allium ursinum, Scilla nutans, Arum maculatum, Luzula campestris.*

Mr. Branson also called attention to a beetle collected, which illustrated very clearly as the insect moved its legs the effect of the interference of light in relation to colour.

Specimens of the rock formations from the Embsay district were also exhibited.

Mr. William Kirkby exhibited and described the following plants, collected at Adel:—Common Milkwort (*Polygala vulgaris*), Bitter Cress (*Cardamine amara*), Tuberous or Heath Pea (*Orobus tuberosus*), Hairy Bitter Cress (*Cardamine hirsuta*), Club Rush (*Scirpus cæspitosus*), Ivy-leaved Crowfoot (*Ranunculus hederaceus*), Blinks, or Water Chickweed (*Montia fontana*); Common Whortleberry (*Vaccinium myrtillus*), Wood Sanicle (*Sanicula europæa*), Hare's Tail Cotton-grass (*Eriophorum vaginatum*), Common Cotton-grass (*Eriophorum angustifolium*), Common Speedwell (*Veronica officinalis*), and Lousewort (*Pedicularis sylvatica*).

Meeting held in Municipal Buildings, May 27th, 1889. John Stubbins, F.G.S., F.R.M.S., Vice-President, in the chair.

FLORAL DEVELOPMENT.

HAROLD WAGER.

The most important work on this subject was done many years ago by a Frenchman named Payer, whose observations, made almost entirely with a pocket lens, were so complete that little has been left for others to do. By means of the Ribbon section-cutting microtome some further interesting points have been made out. The flower first begins to form as a lateral rounded projection of the stem. It finally becomes the flower stalk. On this projection are borne a number of smaller ones, which develop into the various organs of the flower. The sepals are the first to arise, then the petals, stamens, and lastly the pistil. The pistil is formed either from outgrowths—carpels—near the centre of the flower stalk, or partly from these and partly by the formation of a pit in the receptacle. In the inferior ovary the ovules are borne on placentas formed partly by the receptacle and partly by the carpels. In the superior ovary the ovules are

borne entirely on the carpels. To prepare young flowers for section cutting, take freshly collected flower buds, place them in methylated alcohol, and allow to remain until thoroughly saturated. Pass them into staining fluid, such as hæmatoxylin. When the tissue is fully stained, which takes about a week, change them into 70 per cent. alcohol, then into methylated, and afterwards into absolute alcohol, and allow to remain three or four days, then place them in turpentine until thoroughly permeated, requiring about a week, when they are ready to put into paraffin wax, melting at about 45 deg. Small blocks, containing the embedded flowers, are then made and fixed to a ribbon microtome, when consecutive and uniform sections can be obtained ready to mount for microscopical examination.

EXCURSION TO ABERFORD, SATURDAY, JUNE 1ST, 1889.

A most successful excursion of the Club took place to Parlington Park and Aberford. Over fifty members took advantage of the kind facilities afforded by Colonel Gascoigne to ramble over his beautiful estate, and also the use of the "Highflyer" from Garforth to convey them thereto. The weather was most favourable, and the country at spring-time never looked better. The main body of the party first visited the lake, where microscopists and botanists began earnestly to work. Other branches took directions which they considered most productive for their own particular section. Several members with cameras accompanied the party, and were much interested in Colonel Gascoigne's large collection of photographs. Special interest attached to the series, as the negatives were produced by means of the wet-collodion process about thirty years ago. The party all joined again at six o'clock at Aberford to have tea, after which a hearty vote of thanks was passed to Colonel and Mrs. Gascoigne for the warm reception given the members on this, their second visit to Parlington. Before leaving Aberford by the "Highflyer," photographs were taken of the party, who had arranged themselves about the engine and carriages attached.

Meeting held in the Municipal Buildings, June 3rd, 1889. J. Charters Birch, L.D.S., in the chair.

Mr. Edgar R. Waite read the following notes on the fauna, made during the excursion to Aberford:—With regard to the mammals, owing to the party leaving the district in broad daylight no bats were seen, but Mr. Jas. Dixon stated that several inhabit an old house at Aberford. Judging from the number of molehills, moles appear to be plentiful in the district. A water-shrew was seen, but not the fox, although strictly preserved to afford sport for the members of the Bramham Moor Hunt. Other mammals observed were the House Mouse, several of which were sporting about the hay-ricks; the Brown Rat, represented by sundry trapped specimens;

the Water Vole, very common at the beck-side; the common Field Vole, the Hare, and last, but by no means least plentiful, the Rabbit, which crossed our path every score yards or so. The district is not such as to allow the ornithologist to present a very long list of birds, being flat, and possessing little physical diversity. Owing to absence of moorland, such birds as the Ring Ouzel, Golden Plover, and Red Grouse are wanting, as are also many of the smaller birds, probably owing to the fact that the woods are remarkably devoid of underwood. The district is drained by a stream known as Cock Beck, which empties itself into the Wharfe below Tadcaster. This stream is rendered famous by the very sanguinary engagement which took place on its banks near Towton, about two miles from Aberford, on Palm Sunday, 1461. It is of a sluggish nature, and not attractive for such birds as the Heron, Kingfisher, Sandpiper, and Dipper, but admirably suited for the Water Hen, several of which were seen. The following is a complete list of the birds recorded:—Missel Thrush, Song Thrush, Blackbird, Whinchat, Redstart, Redbreast, Whitethroat, Lesser Whitethroat, Blackcap, Garden Warbler, Chiff Chaff, Willow Warbler, Sedge Warbler, Hedge Accentor, Great Tit, Coal Tit, Blue Tit, Wren, Pied Wagtail, Yellow Wagtail, Meadow Pipit, Tree Pipit, Spotted Flycatcher, Swallow, Martin, Sand Martin, Greenfinch, House Sparrow, Chaffinch, Redpoll, Yellow Bunting, Lark, Starling, Jay, Crow, Jackdaw, Rook, Swift, Cuckoo, Sparrow-hawk, Kestrel, Ringdove, Pheasant, Partridge, Landrail, Water Hen, and Lapwing. Many nests were found containing either eggs or young birds, several of the latter being seen also on the wing. Reptiles were represented by the Frog and Smooth Newt. The insects seen were *Pieris brassicæ*, *P. rapæ*, *P. napi*, *Anthocharis cardamines*, *Cabera pusaria*, *Tephrosia crepuscularia*, *Odontopera bidentata*, *Rumia cratægata*, and *Abraxas ulmata*.

Mr. W. E. Collinge furnished the following conchological record:—*Arion ater*, *Limax agrestis*, *Zonites nitidulus*, *Z. crystallinus*, *Helix aspersa*, *nemoralis*, *hortensis*, *rotundata*, *hispida*, and *rufescens*; *Cochlicopa*, *lubrica*, *Sphærium corneum*, *Pisidium nitidum*, and *Limnæa peregra*.

Mr. W. Clapham collected and exhibited *Plumatella repens*, *Ephemera*, larvæ, Scarlet-velvet Earth Mite.

Mr. J. Phillips exhibited *Hydra vulgaris*, *Hydra viridis*, &c.

Mr. H. Lucas showed his photograph of the party arranged on the "Highflyer."

Mr. William Kirkby gave the following amongst the plants seen, and exhibited specimens:—Water Milfoil (*Myriophyllum spicatum*), Curly Pond Weed (*Potamogeton crispus*), Twayblade (*Listera ovata*), Green Habenaria or Frog Orchis (*Habenaria viridis*), Wood Sanicle (*Sanicula Europæa*), Celandine (*Chelidonium majus*), Fly Honeysuckle (*Lonicera xylosteum*), Birdsfoot Trefoil (*Lotus corniculatus*), Wild Strawberry (*Fragaria vesca*), Thyme-leaved Sandwort (*Arenaria serpyllifolia*), Procumbent Pearlwort (*Sagina procumbens*), Common Carex or Sedge (*Carex vulgaris*), and others.

Among other plants exhibited were the following, by Mr. J. W. Addyman, B.A., collected at Bilton, near Knaresborough :—*Vaccinium myrtillus*, *Lysimachia nemorum*, *Asperula odorata*, *Ophioglossum vulgatum*, *Equisetum sylvaticum*, *Stellaria graminea*, *Luzula maxima*, *Lychnis diurna*, *Orobus tuberosus*, *Chrysosplenium oppositifolium*, *Cardamine amara*, *Cardamine pratensis*, *Arenaria trinervia*, *Ajuga reptans*, and *Sanicula europæa*.

Meeting of the Club held at the Medical School, Park Street, June 17th, 1889. Professor De Burgh Birch, M.D., C.M., F.R.S.E., President, in the chair.

DEMONSTRATION OF CILIARY MOVEMENT.

PROFESSOR BIRCH.

A short lecture was given first on "The Structure and Function of Cilia." The members then went into the Laboratory, where each was provided with microscope and appliances necessary for the intended work. First the gill of the Common Mussel was examined immediately on taking it out of the shell, when the beautiful wave-like movement of the cilia, carrying fluid along in a definite direction, was distinctly seen. The tissue was then subjected to the fumes of ether, which produced a cessation of movement, which was again recovered by means of heat brought to bear upon the glass slip by a simple and effective contrivance. An interesting demonstration of ciliary movement was shown upon the Common Frog, which, when dead, the mouth being laid open, a piece of cork placed upon the roof of the mouth could be distinctly seen to be carried down the œsophagus.

EXCURSION.

An excursion was made on June 24th, 1889, to the nurseries of Mr. Featherstone, of Kirkstall. The party was cordially welcomed by Mr. Featherstone's son, who conducted them over the numerous houses. Mr. Featherstone courteously answered the many questions which were pressed upon him, and gave much interesting information respecting the varied and beautiful exotic plants which were examined. Among these claiming especial notice were *Gloriosa superba*, a lilaceous plant, with an abnormal arrangement of the parts of the flower. Some fine specimens of *Marchantia polymorpha*, showing antheridia and archegonia; *Eucharis candida*, so named from its chalice-like centre; the Tuberose (*Polyanthes tuberosa*), with its sweet fragrance, which came in for a share of admiration. The Palms, Cycads, Ferns, and Roses were very attractive, and the variegated foliage of the Crotons, as well as the great variety of Pelargoniums (among which was a pure white one), were very much admired; in fact, the entire collection deserves all the encomiums passed upon it by the members, as also the warm and hearty thanks accorded

to Mr. Featherstone for his very kind and courteous attention to the visitors. A meeting was afterwards held in the Club-room, 80, Municipal Buildings, to examine the results of the above excursion. F. W. Branson, F.C.S., in the chair.

EXCURSION TO ARTHINGTON AND RAWDON.

Upwards of 40 members took advantage of the beautiful afternoon of Saturday, June 29th, 1889, and joined in an excursion of the Club to Arthington, Rawdon, and Harewood. Some members of the party drove by conveyance from Leeds, the remainder following by the 2.40 p.m. train, and met at Arthington the other division. Here the party divided, one portion proceeding to Harewood, and investigated the high ground adjacent to the Castle and Park. The other proceeded to the bank of the river, and thence followed its winding course towards Harewood.

The members of the excursion then visited, by invitation, Mr. W. Johnson Cheetham, at his residence, Rawdon Hill, which is situated about midway between Arthington and Harewood, and stands at a considerable elevation. At this delightful place the members were most heartily and hospitably received. The evening was remarkably clear, and the visitors greatly enjoyed the magnificent prospect, with Whernside looming far away as a background, and with Lower Wharfedale showing to great advantage in the evening sunlight as a foreground, and the lovely valley of the Washburn in the middle distance. Prior to departure a hearty vote of thanks was proposed by Mr. Councillor Hepworth, and seconded by Mr. F. W. Branson, F.C.S., and cordially passed to Mr. and Miss Cheetham for their kindness.

Meeting held in the Library of the Literary and Philosophical Society, Park Row, July 1st, 1889. John Stubbins, F.G.S., F.R.M.S., Vice-President, in the chair.

The first part of the evening was devoted to the examination of and reports on the results of the excursion on Saturday.

Mr. Edgar R. Waite gave the following list of birds seen and heard, comprising 37 residents and 19 migrants:—Missel Thrush, Dipper, Whinchat, Redstart, Redbreast, Whitethroat and Lesser Whitethroat, Blackcap, Hedge Accentor, the Great, Coal, Blue, and Long-tailed Tits, Wren, Tree, and Meadow Pipits, Tree and House Sparrows, Bullfinch and Goldfinch (the latter recorded by Mr. F. W. Branson), Lesser Redpoll, Common and Yellow Buntings, Lark, Jackdaw, Swift, and Ringdove.

Exhibits:—

Mr. George Brunton showed a portable electric lamp adapted for microscopical illumination, &c.

Mr. Stubbins exhibited an exceedingly interesting form of Fresh-water Algæ (*Nostœ-pruniforme*), and gave a short description of this organism.

Mr. F. W. Branson, F.C.S., showed under microscope a leaf of *Drosera rotundifolia*, an insectivorous plant.

Mr. J. Phillips exhibited *Melicerta ringens*, a building rotifer attached to *Anacharis*.

Mr. Henry Marsh, F.R.C.I., exhibited a Long-eared Bat and several lepidopterous larvæ prepared for the cabinet.

EXCURSION TO BRIMHAM ROCKS, JULY 6TH, 1889.

The district between Pateley Bridge and Brimham Rocks was the locality selected for this excursion. The party left Leeds by the 11.0 a.m. train. Although the weather on starting was sultry and hazy, it was found on arrival at Pateley Bridge that a westerly breeze tempered the sun's rays to a pleasant degree, and eventually dissipated the haze, thus permitting charming views of Nidderdale to be made. It would be difficult to select a time when this particular neighbourhood could be seen to better advantage than in July, much grass—owing doubtless to the elevated position in which it stands—being still uncut, and the Honeysuckle and Dog Rose occurring in great plenty. The party was most efficiently conducted by Mr. William Storey, his accurate local information greatly adding to the interest of the day. The departments of geology, botany, pond-life, entomology, and ornithology were represented. Mr. Storey supplied the following list of birds observed :—Missel and Song Thrushes, Blackbird, Ring Ouzel, Redstart, Redbreast, Whitethroat, Chiffchaff, Willow, Wood, and Sedge Warblers, Hedge Accentor, Long-tailed, Great Marsh and Blue Tits, Creeper, Wren, Pied, Yellow, and Grey Wagtails, Meadow Pipit, Spotted and Pied Flycatchers, Swallow, Martin and Sand Martin, Greenfinch, House Sparrow, Chaffinch, Linnet, Twite, Bullfinch, Common and Yellow Buntings, Skylark, Starling, Magpie, Jackdaw, Rook, Swift, Cuckoo, Sparrowhawk and Kestrel, Ring and Stock Doves, Red Grouse, Landrail, Moor Hen, Golden Plover and Lapwing, common Snipe, Sandpiper, and Curlew—54, comprising 17 migrants and 37 residents. At a quarry on the hillside, where fossils were found in abundance, several of the members remained some time. At a slightly greater elevation a quarry of millstone grit was found, near the top of which are the remains of a very extensive and, from the method of construction which can still be traced, a very ancient location for lead smelting—an industry still carried on in the district. The high road was subsequently left, and a pleasant walk of two or three miles through fields and woods brought the party to Brimham Rocks, near the summit of which the Bog Asphodel was found. The fantastic shapes caused by the unequal weathering of the large blocks of rocks in this locality result from the strata being of variable hardness ; the softer portions, therefore, disappear first and leave the harder layers projecting.

Meeting held in Room No. 80, Municipal Buildings, July 8th, 1889. F. W. Branson, F.I.C., F.C.S., in the chair.

Exhibits :—

A number of the specimens collected at Pateley Bridge and Brimham Rocks were exhibited, including fossils from what is known as the "Shell Bed," and a number of plants, among which were Bog Asphodel, *Senecio aquaticus*, &c.

Mr. W. Storey exhibited and presented a Swift to the Club's local collection.

The Rev. James Horn exhibited and presented to the local collection a Pipistrelle (*Vesperugo pipistrellus*), taken at Harewood.

Messrs. J. Phillips and W. Leggett showed *Plumatella repens* in various stages of development ; the latter also exhibited an interesting Diatom (*Navicula*).

Meeting held at the Medical School, Park Street, July 15th, 1889. Professor De Burgh Birch, M.D., C.M., F.R.S.E., President, in the chair.

DEMONSTRATION OF THE STRUCTURE OF THE HUMAN EYE.

PROFESSOR BIRCH.

The President, by means of drawings, pointed out the several parts, their functions, arrangements, and relations one with the other, in producing normal sight, and also some of the causes of abnormal sight. The description and demonstrations with reference to the focal action of the eye through the alteration of the lenses was most clear and interesting. The presence of what is known as a blind spot in the human eye, as well as in other animals, was most conclusively proved by means of a simple experiment. The spot is situated at the hinder part of the eye, and with the exercise of a little care and patience its exact size can be actually drawn by the person himself. After the lecture several skilful dissections were made upon the Eyes of Sheep, when the structures and arrangement previously described were demonstrated.

MARINE DREDGING EXCURSION.

A "Marine Dredging Expedition" took place on Saturday, July 20th, 1889. The party was essentially a working one, with the President of the Club, Professor De Burgh Birch, M.D., C.M., F.R.S.E., as leader. Through the courtesy of Major Woodall, of Scarborough, vice-chairman of the Harbour Commissioners, their steam tug Alexandra, in charge of Mr. John Stephenson, secretary to the Board, with two experienced

fishermen, trawling apparatus, &c., were in readiness, and when other necessary paraphernalia was got on board, work commenced by letting down the trawl. The course taken first was across the bay, with orders to steam very slowly. In the meantime the tow-net was paid out, and tables extemporised to examine specimens upon. A large number of bottles and cases were taken suitable to hold in a rough classified way the various objects expected to be found. After a little time the tow-net was drawn up and its contents emptied into a pail of water. It was soon evident from the first haul that numerous specimens of interest had been taken, which were then assorted and placed in jars with preservative media. At length the bay was crossed. The vessel was then stopped, and preparation made for bringing up the "trawl." Very soon about 150 yards of cable was coiled in, and finally the net itself and its varied contents laid out on the deck, then classified and stored. Another stretch or two across the bay, and the vessel's head was set for Filey. A large number of sea-birds were observed on the cliffs and about the shore, including the Razor-bill, Guillemot, and several species of Gulls. At this stage sunshine assisted the operations of the tow-net by attracting to the surface many larval forms of marine life. The white chalk cliffs at Speeton also showed to greater advantage than would have been the case under less favourable atmospheric conditions, and contrasted markedly with the sombre-looking cliffs which extend from Scarborough to Filey Brigg. From this point could be well seen the Castle Rock at Scarborough, and also far beyond the distant coast-line in the direction of Whitby. By this time the tow-net and trawl had been examined several times, and Filey Brigg was approached, and being a rocky bottom, the trawl was kept aboard until the middle of the bay was reached, when dredging was continued uninterruptedly for several hours with abundant results. At six o'clock the trawl was drawn up for the last time, and the vessel's course set for Scarborough. Soon after rounding the end of the Brigg a shoal of porpoises passed to seaward. A little further along the coast, high among the dark cliffs, were seen great numbers of sea-birds clustered together, giving a white appearance to the cliff, which might be easily mistaken for a stratum of chalk. By the time nets, &c., were washed, bottles sealed and safely packed, Scarborough was reached, when the first train home was taken, after a most enjoyable day.

Meeting held in the Club's Rooms, 80, Municipal Buildings, July 22nd, 1889. Professor De Burgh Birch, M.D., C.M., F.R.S.E., in the chair.

A short account of Saturday's dredging was given, and most of the specimens collected were on exhibition. The following fish were recorded:—Turbot, Sole, Flounder, Skate, Spotted Ray, Gurnard, Haddock, Herring, Whiting, Devil Fish.

Exhibits :—

Mr. Oliver exhibited and described a dissection of the Devil Fish (*Lophius piscatorius*). It is found on the coasts of Europe, Western North America, and Cape of Good Hope. *Exo-skeleton*—Skin naked, and coloured like the bottom on which the fish is lying. It has the power of rapidly changing the colour. Processes of skin are attached along the sides of the body, which looks like seaweed, and assist in concealing the fish. *Endo-skeleton—Notochord constricted, vertebra central, amphicœlous,* tail *homocucal;* skull completely ossified ; pectoral and central fins are articulated so as to assist jaws in seizing food. Three spines on head are developed for anterior dorsal fin. *Circulatory System.*—Single auricle and ventricle. Bulbus arteriosus is not contractile and provided with a single row of valves. *Respiratory System.*—Gill filaments free on both sides, only attached by inner ends. Gill cover (operculum) large and supported by rays ; the opening being below the pectoral fin. *Swimming Bladder.*—Absent. *Nervous System.*—Cerebellum large ; optic lobes large ; cerebral hemisphere small ; optic nerves cross. *Eye.*—Sclerotic, formed of fibrous tissue, with two cartilages to strengthen it. *Reproductive and Urinary Organs.*—There being no cloacas, the oviducts open immediately posterior to the anus. The ureters from the kidneys open into a large bladder, which opens to the surface close to the oviducts. *Visceral Arches and Clefts.*—Jaws well ossified ; teeth on jaws ; palate and pharynx viliform in character ; spiracles are absent. *Limbs.*—The pectoral fins are small, and placed on the ventral surface. Pelvic fins, much larger, are placed laterally, and but slightly posterior to the pectoral fins. *Alimentary System.*—No spiral valve in the intestine. No cloaca, and the pancreas is rudimentary. Mouth very large ; stomach large, and very distensible ; it is said to sometimes contain a fish nearly as large as the lophius itself. Pylorus small, and placed close to the œsophagus. Two diverticula are present at the upper part of the intestine. An interesting parasite, *Lernentonia lophii*, was found in the pouches of this creature.

Mr. W. Nelson exhibited a white variety of Wild Strawberry, collected at Spofforth.

Meeting held in the Club's Rooms, 80, Municipal Buildings, July 29th, 1889. Professor De Burgh Birch, M.D., C.M., F.R.S.E., President, in the chair.

ON THE MARINE DREDGING EXPEDITION TO SCARBOROUGH AND FILEY.

PROFESSOR BIRCH.

Some little attention was first given to dredges and other apparatus necessary on these excursions, as considerable experience had been derived from the last, and, as it is intended to have another on September 14th, the knowledge and experience obtained would go a long way to make the next even more successful. Then followed a description of the several

specimens obtained, arranged separately in such a way as to be readily examined, and taken in their proper order, with special reference to their structure and mode of life :—Hydrozoas, several varieties, and free *Medusiform gonophore ; Clytia Johnstoni*, Polyzoa, Flustra, Tubulipora, Medusæ (Jelly Fishes), several forms in various stages of development ; Ctenophora, Asteroidea (Star Fishes), Sagitta. Crustacea :—Pagurida, Hermit Crab. Anomoura. Brachyura, Corystida, C. cassivelaunus. Several prepared slides of interesting parts of structure were shown under the microscope.

Exhibits :—

Mr. Westerman exhibited several tubes of *Volvox globator*, collected at Hunslet, where it occurs in great quantity.

Meeting held in the Library of the Philosophical Hall, September 2nd, 1889. Edgar R. Waite in the chair.

Mr. Waite gave an interesting account of his holidays spent on the west coast of Ireland. Though the rain fell almost incessantly, it did not entirely preclude him from making natural history observations. A somewhat detailed account was given of each day's results. In the ornithological section several more or less interesting birds, chiefly sea-birds, were obtained. Copious notes on the geology, botany, and entomology of the district were made.

The Hon. Secretary, on behalf of Mr. Abbott, showed one of the large Saw Flies (*Sirex gigas*), an insect not indigenous to England, though scarcely a summer passes without some of these insects being captured in the town of Leeds and brought to the Club. This insect by its saws, which are situated at the posterior end of the body, bores into timber, where a portion of its life is spent. In the meantime the timber is conveyed to other countries, where in the summer season the imagos emerge. Considerable injury is often done by these Saw Flies to timber, water finding its way into holes made by them and rotting the wood.

Meeting held in the Club's Room, 80, Municipal Buildings, September 9th, 1889. J. Charters Birch, L.D.S., in the chair.

BOTANICAL NOTES ON NORWAY.

J. W. ADDYMAN, B.A.

The author of the paper devoted a portion of his remarks to the discussion of the geological features of west and south Norway, and their effect upon the character of the vegetation at various zones. Assisted by a map thrown upon the screen he pointed out the localities subsequently referred to, which may be shortly summarised as from Bergen on the Molde Road as far as Nedre Vasenden, thence returning by Borgund, through the Nærodal and Eide, and thence by Odde and the Haukelid

route to Hitterdal and Christiania. He then gave an account of the more interesting plants gathered during the tour and their localities. Many of these plants, although common in Norway, are rare, and in several cases unknown, in Britain. A number of lantern slides from photographs taken by the author were exhibited.

MARINE DREDGING EXCURSION TO FILEY.

On Saturday, September 14th, 1889, a marine excursion took place. Filey was the place selected. Mr. Burton, of the Cleveland Society, and Mr. Percy Davis, of Halifax, the Secretary of the Marine Zoology Committee of the Yorkshire Naturalists' Union, joined the party *en route*. Arriving at Filey at 11.45, the contingent proceeded to the Crown Hotel for refreshments, and then divided into two parties. One, under the guidance of Mr. Davis, to investigate the rockpools on the Brigg, and the other embarked in a fishing boat for the purpose of dredging the bay and taking surface and free swimming organisms in the tow-net. The weather was cloudy and slightly breezy, circumstances which accounted not only for the meagre results of the tow-net, but also for a somewhat hurried adjournment on the part of two members to the firmer footing of the Brigg. Five hauls were made with the dredge, kindly lent to the Club by the Cleveland Society. The contents were at once emptied into a bucket and the sorting of its very miscellaneous captures was assisted by the vigorous use of the familiar wire coffee strainer, in the hands of one of the secretaries. The vagaries of this individual were variously commented on, but eventually the objects collected were placed in large bottles, with suitable preservatives, for examination on Monday evening. After about four hours' work the dredging party landed and noticed stranded on the shore a shark, of which Mr. Edgar R. Waite made a hurried sketch, and noted its distinguishing characteristics. The two sections re-united and adjourned to the railway station, whence, at 6.12 p.m., they departed for Scarborough.

Meeting held in the Municipal Buildings, September 16th, 1889. Edgar R. Waite in the chair.

EXCURSION TO FILEY.

Mr. Waite presented a report on the birds and fishes observed during the excursion to Filey. Few birds were seen, and those which were observed appeared to be very shy. They included an immature Lesser Black-backed Gull, and also a few Kittiwakes, but the great majority were the Common and Black-headed Gulls. Several Herring Gulls were seen all in immature plumage. Of the *Alcidæ* a single Guillemot was the only representative. Three Ducks (*Fuligulinæ*) but too distant to be specifically named. Of the fishes the Shark was determined as the common Tope (*Galeus canis*). This shark is common on our southern coasts, and has been observed as far north as Berwick. It has been taken at Scarborough

and Bridlington, but it is certainly not common at either of these places, and this is its first recorded appearance at Filey. The maximum length is 6 ft.; the Filey specimen, however, only reached 4 ft. 6 in. Mr. Waite developed his sketch into a water-colour drawing, which he exhibited, and pointed out the most noticeable peculiarities. A small specimen of the Shanny (*Blennius pholis*) was taken in the dredge, and was easily distinguishable from the other British Blennies by the absence of the filament on the top of the head. Among the *Ophiuridea* two species were obtained, the Sand Star (*Ophiura albida*) and the Brittle Star (*Ophiothrix fragilis*), both common on our coast. Strange to say, not a single specimen of the common Starfish was dredged. Several Crustaceans were obtained, the most interesting being the Acorn Barnacles (*Balanus balanoides*). Some of the cirri were dissected out by the chairman and shown under the microscope, and the mode in which they secure any food brought by the water within their reach was explained. A minute spider crab (*Maia squinado*) the body of which was not larger than a carraway seed, but whose limbs were each at least three-quarters of an inch in length, was an object of interest. Many shells, all of common species, some, in the case of *Cardium*, showing whelk-borings, were found.

Mr. J. W. Addyman remarked that the *Hydrozoa* and *Polyzoa* were of ordinary species, including *Sertularia* and *Hydractinea*. The *Medusoids* were also of common species, *Meröe*, &c. In the freshly taken specimens the cilia were observed in rapid motion, and, indeed, were almost the only indication of the existence of these lovely transparent jelly-fish.

Meeting held in the Municipal Buildings, September 23rd, 1889. F. W. Branson, F.I.C., F.C.S., in the chair.

Exhibits :—

After the usual formal business the gift of a specimen of the Nutcracker (*Nucifraga caryocatactes*) was announced from Mr. W. Kirkby, and two fossil ammonites from one of the secretaries.

Mr. Branson showed a series of lantern slides sent by Mr. Stubbins, illustrating the plants of the carboniferous system and their recent allies, and a series of six photographs of sections of the carboniferous strata taken along a line from Harehills Lane to Elland Road. These illustrations form a permanent record of the highest value, as many of the sections are now covered up by *debris* and will probably never again be exposed.

Mr. Branson also exhibited a number of interesting slides illustrating the geology of Yorkshire.

Mr. Addyman exhibited slides showing effects of glaciation in Norway, and photographs of sections of the strata exposed between Filey Brigg and Speeton.

Mr. Lower Carter, M.A., F.G.S., exhibited trilobites from the Menevian beds near St. Davids, and graptolites from near Whitesand Bay, Pembrokeshire, also a collection of fossils from the Cambridge Greensand, Cambridge.

Mr. E. S. Pickard showed a series of crystalline rocks from Kerrera Island, Ben Nevis, Ben Cruachan (near Oban), and Killin, together with copper pyrites from Coniston, encrinites and other fossils from the mountain limestone at Arnside and Bivatoes, and ammonites from the Whitby Lias.

Mr. J. Phillips showed a large series of geological slides, and a number of minerals and specimens of fossil bone were also shown with the polaziscope.

Meeting held at the Yorkshire College, September 30th, 1889. Professor L. C. Miall, F.L.S., F.G.S. (Vice-President), in the chair.

THE STRUCTURE AND LIFE-HISTORY OF A FUNGUS (PERONOSPORA PARASITICA).

HAROLD WAGER.

This paper is fully reported elsewhere.

Meeting held in the Library of the Leeds Literary and Philosophical Society, Park Row, October 7th, 1889. J. Charters Birch, L.D.S., in the chair

GENERAL MICROSCOPICAL EXHIBITS.

Mr. J. Phillips exhibited and described a number of insect larvæ, of the group *Ephemeridæ*, including *Corethra plumicornis*; also a number of double-stained botanical sections, including *Villarsia nymphæoides* (White Water-lily), *Eucalyptus globulus*, mid-rib of leaf, *Ficus Carica*, *Larix Europæa*.

Mr. George Brunton showed sections of Bracken Fern and Wax Plant (*Hoya carnosa*).

Mr. W. Clapham exhibited specimens of *Rotifer vulgaris* and Tripod Rotifer (*Actinurus neptunius*); also *Euglena* mounted in preservative fluid, with colour and form perfectly intact.

Mr. Birch showed *Corethra* under polarised light.

Mr. W. Clapham exhibited slides of marine algæ, *Polysiphonia nisrexlus*, *Pryopsis plumood*.

Meeting held in Room No. 80, Municipal Buildings, October 21st, 1889. J. Charters Birch, L.D.S., in the chair.

DEMONSTRATION OF TAXIDERMY.

EDGAR R. WAITE.

This was the third of a series of demonstrations on this subject, of very practical interest to naturalists. On this occasion one of the Amphibia, as represented by the Common Frog (*Rana temporaria*), was chosen. It

will be readily seen by the three subjects—bird, mammal, and amphibian—taken to produce the same result, viz., a perfect skin in a preserved and life-like condition, will require, owing to their dissimilarity of character and structure, a different *modus operandi*. A freshly killed frog was taken, and, instead of making an incision in the abdomen, as in the case of the rabbit, or on the breast or side, as in the rook, the whole of the interior was extracted through the mouth. This may seem rather a novel procedure, but when we consider the very wide oral aperture of the frog and its very contractile skin the advantage of this mode will be readily apparent—that of leaving the entire skin intact. A sharp pair of dissecting scissors are carefully put down the mouth. First, the vertebra is severed, then the attachments of the limbs, and bit by bit the whole interior is got out, leaving the collapsed skin, which is filled with powdered plaster of Paris. The frog is then put into its natural shape and immersed in water, when, of course, the plaster inside sets firmly. By this method the specimens are permanently, with life-like appearance, preserved. The colour, too, is by this process retained.

Meeting held in the Club's Room, Municipal Buildings, October 28th, 1889. John Stubbins, F.G.S., F.R.M.S. (Vice-President), in the chair.

ALBINO BIRDS.

J. B. HALL.

Mr. Hall pointed out that he brought the subject forward not with the idea of dilating on any particular theory, but rather of laying before the society a number of facts and observations collected during the last six years. He stated that there are two conditions in birds commonly classed under the term albinism; one, which may be called the complete form, which probably does not differ from true congenital albinism in mammals, and another, the incomplete form in which only single feathers or groups of feathers are affected, this last form being possibly the result or rather the sequence of disease. That these two forms, whatever be their origin, are distinct and separate is shown by the fact that the complete has been observed in young birds still in the nest and still acquiring their first plumage, and that the incomplete has been observed to remain unchanged through several years without varying in the slightest degree. In mammals, true albinism is well known, but with the exception of domesticated animals there is no form which corresponds to the incomplete form in birds. There is, however, a similar condition produced in mammals by certain diseases, and the analogy points rather to the incomplete form in birds being a condition of the same kind. The nature of the disease producing this result it is impossible to determine until more evidence has been collected, but three morbid conditions may here be mentioned as showing the close analogy existing between the two conditions in the bird and the mammal. Parasite affections of the skin in mammals produces white

patches of hair. But in birds the peculiar characteristic of the incomplete form is the symmetrical arrangement of the white plumage. This alone, though strongly in favour of disease as a cause, would quite destroy any parasite theory. Again, turning to the possibility of other diseases, Erasmus Wilson has pointed out that certain nervous affections produced patches of baldness often symmetrical in human beings. Patches of grey and white hair in the eyebrows and hair on the face are occasionally seen in cases of severe neuralgia. Here, then, are examples of trophic disturbances in the appendages of the skin following on obscure nervous changes. Whether the incomplete form in birds may be due to similar causes or not remains to be proved; all that can be said is that the posssibility is not unlikely. From nervous disease it is only one step to those phenomena due to what is known as correlation, a long name given to a physiological connection between two organs, a connection which we do not understand. If certain organs in the human body become diseased the skin becomes pigmented, producing an affection known as "black jaundice." Here is an example of a correlation—an obscure connection between these organs and the skin, in consequence of which if one organ be diseased the other exhibits morbid changes also. Other instances may be quoted, among which perhaps the most striking is the blue-eyed white cat, which, according to Darwin and Tait, is always deaf. The latter authority also states that this peculiarity is confined to males. These instances point rather to the probability of the incomplete form being a result of disease; and when it is considered how difficult it is to associate the incomplete form with any other cause, the argument for disease is further strengthened. In support of the argument, Mr. Hall pointed out that age, food, cross-breeding, though commonly mentioned as likely causes, cannot be considered as such. He also showed that though the complete form may be hereditary, the incomplete is not so. This, again, favours the argument that the latter is a result of disease, and is not a congenital peculiarity.

Mr. M. J. Oliver pointed out that Mr. Hall's paper was of great interest, the subject not appearing hitherto to have been much studied; and secondly, because it was of interest not only to naturalists, but also to physiologists and pathologists. He considered that Mr. Hall, in confining himself to albino birds, increased the difficulty of finding a cause for a condition which occurred in various orders, and was widely distributed in nature.

Mr. Hall stated on Darwin's authority that albino birds have never been seen to pair in the wild state, but do so when domesticated. Referring to this fact it is stated by Wallace that our domestic breeds of white animals, *e.g.*, mice, rats, cats, pigeons, ducks, &c., were probably derived from albino specimens, which on account of their rarity were preserved and bred from by man. And in the case of species inhabiting Alpine or Arctic regions were preserved by the white colour proving a protection, affording concealment in the snow.

Mr. Oliver thought that the albino condition could not be explained by the theory that animals when breeding throw back to an original stock, because the original species of pigeon is supposed by Darwin to be allied to the "blue rock," which would negative the theory of reversion when applied to white pigeons. With regard to the rarity of the condition, he showed that there were no land birds or quadrupeds in Europe in the feral state of a white colour, although blackbirds, starlings, crows, deer, hares, moles, rats, &c., occasionally were albinos, and considered this due to, firstly, sexual selection, the females not caring for white males; and, secondly, white not affording protection to an animal by enabling it to hide from birds and beasts of prey, instancing in this connection the case of moles, rats, mice, and bats, where dark colour assists in concealing them during the night. Mr. Oliver agreed with Mr. Hall in thinking that parasitic disease could not be considered a cause of the condition, and showed that nerve disease would hardly be a cause; nerve disease, as a rule, commencing only in parts of the body supplied by certain nerves, while albinism affected the body generally, and often symmetrically. Mr. Oliver thought that Mr. Hall's observations on albinos were although incomplete of great value, and would like to hear of further observation in the same direction.

Meeting held in the Library of the Leeds Literary and Philosophical Society, Park Row, November 4th, 1889. John Stubbins, F.G.S., F.R.M.S., Vice-President, in the chair.

EXHIBITION OF "MARINE FAUNA AND FLORA."

Mr. F. W. Branson, F.C.S., exhibited a small marine aquarium, set up with a view of experimenting on the possibility of rearing marine-life away from the coast. The experiment had proved successful. Some interesting notes were given. The aquarium must be kept covered, so as not to allow evaporation. In the above experiment a glass jar was used a little more than half filled with sea-water, containing a piece of rock, upon which were growing algæ, &c., a number of organisms, chiefly small crustaceans, young anemones, and two or three periwinkles were admitted. Although the water had not been disturbed for more than two years all seemed in healthy condition.

Mr. Edgar R. Waite exhibited and gave short notes on a large and representative number of marine birds, including Terns, Gulls, Skuas, Rock birds, Divers, Sea Ducks, and sundry waders. Of the *Laridæ* the most notable example was a Richardson's Skua (*Stercorarius crepidatus*), obtained at Settle in September by Mr. Charlesworth (*vide Naturalist* for November). The Skuas are pre-eminently sea-birds, and it is rare to find them far inland. The *Alcidæ*, or rock birds, were well represented, special attention being called to two Black Guillemots (*Uria grylle*) in the

extremes of seasonal plumage, summer and winter. The Black Guillemots differ from the rest of the family *Alcidæ*, as they sit on two eggs, whereas the other species sit on one egg only. In the course of his remarks Mr. Waite drew attention to the feet of the Divers (*Colymbidæ*), which are solely adapted to swimming and diving, and are incapable of supporting the bird in the upright attitude common to the Guillemot and its allies. During the terrestrial progression of the Diver the breast is rested on the ground, making a distinct track by the bird sliding and floundering about. Another of the several interesting features pointed out was the difference between the hind toes of the ordinary ducks and the diving ducks (*Fuligulinæ*), the former being simple, as seen in the Wigeon, Teal, Mallard, Sheld-duck, &c., and the latter lobed, as exemplified in the large number of Diving Ducks laid on the table. Many good examples were shown of birds in different states of plumage consequent on age, sex, and season; and in addition to the marine birds proper many waders which live almost wholly on the coast were also exhibited. There was a short discussion, and some questions asked and replied to.

The Chairman exhibited and described a very extensive and exceedingly valuable collection of microscopic marine fauna and flora.

The Hon. Secretary showed, on behalf of Mr. J. Phillips, prepared slides of marine algæ, exhibiting different stages of development; among them were *Plocanium coccineum*, *Corallina officinalis*, and *Corallina* from the Isle of Man.

Meeting held in the Medical School, November 11th, 1889. Professor De Burgh Birch, M.D., C.M., F.R.S.E., President, in the chair.

MOVEMENTS OF THE HEART, CHEST, AND PULSE.

PROFESSOR BIRCH.

The lecturer referred to the debt under which physiologists and physicians lay to Mr. Marey for the introduction of the pneumatic system, through the aid of which the movements of an organ could be transmitted to a recording apparatus, not directly attached to the object observed. The movements of the heart, pulse, and chest were exhibited on a screen by lantern projection as they were being made, by means of an arrangement devised by the President. Subsequently the methods of automatically recording frogs' muscle and heart movements were shown, and the pulse-tracings of members present were taken.

Meeting held in the Club's Room, Municipal Buildings, November 18th, 1889. John Stubbins, F.G.S., F.R.M.S., Vice-President, in the chair.

STRUCTURE AND LIFE-HISTORY OF AN INSECT (STYLOPS SPENCII).

J. STUBBINS, F.G.S., F.R.M.S.

Slides of the anatomy of this peculiar parasite of the Wild Bee were exhibited under several microscopes, and tubes containing affected Bees; also a large number of drawings illustrating numerous peculiarities.

Mr. W. Dixon exhibited and presented to the Club a small case containing worker, queen, and drone of Honey Bee; also queen cells.

Meeting held in Room No. 80, Municipal Buildings, November 25th, 1889. F. W. Branson, F.I.C., F.C.S., was in the chair.

WATER.

J. LEWKOWITSCH, PH.D., F.C.S., F.I.C.

After a few short introductory remarks with reference to the earlier opinions as to the true nature of water, the lecturer briefly referred to the circulation of water on our globe as caused by evaporation. Passing to the main theme of the evening, he said water has to be considered as one of the most necessary foods, and therefore we must have this food as pure as possible. Water may be considered as pure if it is not contaminated with impurities, derived either from the atmosphere or from humous or putrid substances of an animal or vegetable character; further, if it is limpid and free from suspended matter, either organised, organic or mineral, and if it holds only small quantities of mineral matters in solution. Of course, such an ideal water will not be found everywhere, and therefore it becomes necessary to state the limits within which the nature of a water has to keep in order to be admitted for daily use. The examination as to its admissibility as a food will best be carried out under the following heads:—Examination of the local conditions of the source of the water, of the physical conditions (taste, odour, colour, temperature), chemical analysis, microscopical examination and biological examination of the micro-organisms present. It will be easily understood that in most cases some of these points will bear sufficient evidence so as to allow or disallow the use of a water as food, but such a full and exhaustive research as indicated above will certainly decide the question in an unmistakable sense. The local conditions must be such that casual pollutions of the water are rendered impossible. From this point of view open water, *e.g.*, river water, ought to be rejected, and we should only use it, if no other water is at hand, after careful filtration. Water from springs and wells will be better suited, but in the latter case, when the well is situated in a densely-populated locality, it is of the most vital importance that the well should be guarded against the influx of any refuse water, &c. The physical properties mentioned above will show at once which water ought to be rejected. The chemical analysis, in the hands of a person who knows how to interpret the figures, will lead to very important results. Although the mineral matters usually found in water are not poisonous, a larger amount of them will point to the necessity of examining the local conditions of the well; and if a higher percentage of chlorine be found than the composition of the geognostic strata admits, or, worse still, if ammonia and nitrous acid, which ought to be absent, are present, it may be safely presumed that the water has been, or is being, polluted. Of the organic substances present in water, the so-called humic

substances are not poisonous, but they impart a disagreeable taste of flatness to the water. Perhaps some water may contain the highly-poisonous ptomaïnes, which, unfortunately, cannot be easily determined yet, but whose ever-present products of decomposition, the ammonia, can be readily shown to be extant in the water. The microscopical examination was shown by the lecturer not to stand in any direct connection to the findings by chemical analysis. The microscope will reveal suspended mineral matters, or perhaps eggs of parasitical worms, or—and this is the most important point—a larger amount of micro-organisms. Among these there may possibly be found some pathogenetic microbes, especially where the water has been drawn from wells, &c., in the vicinity of human abodes. Such a water is naturally unfit for use. But it is not easy to identify such pathogeneous germs, and very often the examination will come either too late or will be without a tangible result, notwithstanding well-founded suspicion, as those germs may have passed away in some way or other. Therefore it will be incumbent on us to prevent the possibility of any germs getting into the water, or to remove those present. It follows that open water ought to be carefully filtered. This is most effectually done by the huge sand filters now in vogue. Recent experiments, carried out with sterilised sand filters, have shown that it is not the sand which filters effectually, but that it is the thin film of bacteria and other—mostly organic—substances on the top of the sand beds which sieves off the microbes. Unless such a film has been formed, the filtering beds do not work efficiently; for, during the first days or weeks they allow all the microbes to pass through, and as soon as the really effective film has been formed, the water trickles so slowly through the filters that they generally get cleaned out. The water from springs or deep wells will usually be free from microbes, as the latter cannot live in any great depth, and if wells be guarded against contamination of any kind, they will yield the best and most wholesome water.

Abstract of Papers and other Proceedings

OF THE

LEEDS NATURALISTS' CLUB AND SCIENTIFIC ASSOCIATION.

1890.

Meeting held in the Library of the Philosophical Hall, February 3rd, 1890. Arthur Smithells, B.Sc., F.I.C. (Vice-President), in the chair.

THE PRESIDENT'S ADDRESS.

THE HUMAN BRAIN.

PROFESSOR DE BURGH BIRCH, M.D., C.M., F.R.S.E.

A description was given of the brain of the lower animals where the development is very rudimentary. The first drawing shown upon the screen was that of the brain of a carp, which exhibited two bulbs, comprising nearly the whole brain, and whose functions belong to the sense of sight. Then followed a large and unique set of slides showing the gradual development of the brain in the animal kingdom, from the very simple to the most complex of all, viz., the human. Among the drawings shown were the brains of the frog, pigeon, guinea pig, rabbit, dog, jackal, and ape. The chief features were explained as they occurred. The topography of the human brain was next considered, and the functions and their location were briefly shown. Several of the demonstrations and experiments of the authorities on the human brain were also recounted. The physiological structure was pointed out, and the great differentiation of various portions. The address was illustrated throughout by lantern slides, drawings, and specimens, and was thoroughly practical, and rendered in a most instructive and interesting way, greatly to the appreciation of those present.

Meeting held in Room No. 80, Municipal Buildings, February 10th, 1890. John Stubbins, F.G.S., F.R.M.S. (Vice-President), in the chair.

ON THE PREPARATION AND MOUNTING OF MICROSCOPIC OBJECTS.

W. CLAPHAM.

It was pointed out that this subject was almost an unlimited one, as most objects require some special treatment, and that it would be quite impossible—in one evening—to take more than one class of microscopic objects. Therefore the attention of members was directed to the epidermis

and stomata of vegetable tissue. The stomata are mostly in the epidermis on the under side of the leaves. The epidermis is a thin transparent skin, which can be readily separated; it is composed of a single layer of cells containing air. These are closely fitted to each other, and thus confine the moisture, which otherwise would quickly evaporate by the hot sun, and the leaf soon becomes dried up and withered. The following figures give some idea of their number:—In the house leek 10,700 stomata to the square inch, mistletoe 11,000, and in the vine 13,000. To prepare these structures the leaf is taken and placed in slightly acidiferous water to macerate for a few days, to separate more readily and completely the epidermis from the rest of the leaf; after being cleansed by gently drawing over a soft sable brush it is ready to stain. The reason for this course is to bring out more clearly details of structure, and may be done by two processes, viz., rapid and slow. In the slow process the tissue is allowed to remain in the staining media a considerable time according to its density; in the rapid process a stronger fluid is used, and the tissue allowed to remain in only a few minutes. Afterwards the stain is wasted away, and the stain which has permeated through the structure is fixed. It is then ready for mounting on a glass slip with balsam. The three stages of how to prepare, stain, and mount this object for the microscope were clearly shown, and the formula required to obtain these results were also given. Several specimens of epidermis, showing stomata, were mounted and exhibited under the microscope; slides were also shown of the stomata in the mistletoe, laurel, india-rubber plant, onion, and in the petals of pelargonium and hyacinth.

Meeting held in Municipal Buildings, February 24th, 1890. John Stubbins, F.G.S., F.R.M.S. (Vice-President), in the chair.

TRILOBITES.

W. LOWER CARTER, M.A., F.G.S.

Trilobites are extinct marine crustaceans entirely confined to the primary geological beds. Their remains consist of a test generally composed of carbonate or phosphate of lime and certain indications of limbs. They take their name from the body being marked out longitudinally into three lobes by two grooves which sometimes extend its whole length. The test is divided transversely into three portions—(1) the head, which is unsegmented; (2) a segmented body; (3) an unsegmented tail. The head is generally semi-circular, surrounded by an external raised margin, which may be entire or produced into lateral and posterior spines. The median portion of the head, called the *glabella*, is usually convex, and is often marked out into lobes by pairs of transverse furrows. The lateral portion of the head are called the cheeks. These are divided by the *facial suture* into the outer or free cheeks, and the inner or fixed cheeks, which are attached to the glabella. The eyes, which are compound

and sessile, are placed on the free cheek near the facial suture. They are generally composed of a number of spheroidal lenses, covered by a smooth cornea, which differs from the test of the rest of the body. In Phacops and Dalmanites the cornea is similar to the rest of the test, and is pierced by a series of pores in which the lenses lie. These lenses vary greatly in number in the different genera—from 15 to 15,000. The form of the eye also varies considerably. The body is composed of a series of from 2 to 29 narrow rings, more or less movable one on another. Each of these pleuræ is divided by the longitudinal grooves into a central axial portion, which is convex, and lateral portions. These parts in each pleura are firmly united. The pleuræ may be smooth or separated by a groove or ridge into an anterior articulating portion and a posterior or non-articulating portion. This shows that many trilobites had the power of rolling up into a ball-like shape as a protection. The extremities of the pleuræ are usually bent back, and may be rounded or produced into spines. The tail is composed of a number of segments fused into a shield. Its size varies considerably in different genera, and its margin may be entire or spinous. It is usually trilobed. On the under surface of the body, attached to the front of the head, is a lip-plate or *hypostome*, situated in front of the mouth. For a long time no trace of limbs was discovered, but during the last 25 years careful investigation has yielded interesting results. One or two unrolled specimens showed evidence of pairs of limbs, some of which appeared to have a masticatory function, others to be walking legs, and a third set swimmerets. From 1874 to 1880 Walcott made a series of interesting researches by cutting thin sections of rolled-up trilobites. He obtained as results that the under surface of the body was enclosed by a membrane, strengthened by calcified arches, to which the appendages were attached. Attached to the head were four pairs of manducatory jaws; a series of jointed legs extended beneath the body and tail, one pair to each segment. To these limbs were also attached gills. The development of the trilobite has been worked out very carefully by Dr. Barrande. In some genera the head only appears in the youngest forms, whilst in others a rudimentary tail and one or two ribs appear from the beginning. As the animal grew, new ribs appeared one by one. The association of trilobites with undoubted marine organisms in the geological strata proves them to have lived in the sea. They probably lived round the coasts in moderately deep water, and swam on their backs near the surface. With regard to their zoological position there has been much controversy. They were described first as the skeletons of unknown fish, then as molluscs, then as insects; one observer placed them among the caterpillars. Modern investigations have decided their position among the Crustacea. It has been proposed to refer them to the Phyllopods, and also to the Isopods, but they appear to be most nearly allied to the Merostomata, of which the Limulus, or King Crab, is the only living representative. There are, however, sufficient differences to warrant them being placed in an order—Tribolita, by themselves. In the

absence of settled information about the limbs and internal structure of tribolites considerable difficulty has been experienced in their classification. Barrande based his classification of the various genera on the characteristics of the pleuræ. But Salter considered this distinction artificial; for though the exterior of the ribs be smooth, there are often indications of grooving on the under surface. Salter based his classification on—(1) The nature of the facial suture; (2) the structure of the eyes; (3) the number of segments in the body. The lecture was concluded by a description of many of the principal genera, and was illustrated by large diagrams, numerous specimens, and the splendid plates from Barrande's "Le Systême Silurien."

Meeting held in the Library of the Philosophical Hall, March 3rd, 1890. Professor De Burgh Birch, M.D., C.M., F.R.S.E. (President), in the chair.

THE DEVELOPMENT OF THE FLY OF CHIRONOMUS.

PROFESSOR L. C. MIALL, F.G.S., F.L.S.

In the introduction the lecturer briefly described the life-history of the Larvæ of Chironomus. It belongs to the *Dipterous* order of insects. When full grown it is about one inch in length, and is of a reddish colour, and is popularly but erroneously called the blood worm. It is found in ditches and other collections of water, and feeds on vegetable matter. It is not provided with any means of defence, but has a strong propensity to burrow in the mud at the bottom, which is doubtless a most effectual protection against other carnivorous forms. This habit of burrowing has in all probability been the result of diminishing the growth of the *Tracheal* system, common to most aquatic larvæ of insects, but which in chironomus is very rudimentary, and confined entirely to the first segment, after the head, or what is known as the prothorax. At the hinder end of the body are three tubercles, which have a significant relation to this mode of life. With the aid of a remarkably complete series of lantern slides, the first and subsequent indication of the transformations from the larva to the pupa, and afterwards the Imago (one of the perfectly harmless gnats), was clearly and interestingly shown. The development of the compound eyes or facets which takes place in the larval period, and their immediate connection with the antennary bulbs, was admirably studied. The important organs of chironomus were also shown in sections, giving a greater idea of the development of the head, legs, wings, and respiratory appendages in the life-history of this insect. A short account was given of the reproductive organs which are present in the larval stage, and can even be traced back to the earlier development of the egg.

A discussion followed the paper, in which the President adduced some interesting facts on the question of absorption, which was shown to occur in the advanced larvæ of this insect. The casting of the antlers of deer is due to similar cause, viz., absorption of the blood.

Meeting held in the Medical School, Park Street, March 10th, 1890. Professor de Burgh Birch, M.D., C.M., F.R.S.E. (President), in the chair.

THE PREPARATION OF BRAIN TISSUE FOR SECTION CUTTING.

PROFESSOR BIRCH.

The first part of the meeting was devoted to an outline description of a number of methods. Brain tissue being of such soft structure and so soon fractured, gives rise to many difficulties in preparing so as to get it into a condition of toughness and elasticity for cutting. The first method was the use of chromic acid of 1 per cent. solution downwards, but the disadvantage occurred that the chromic did not readily penetrate, but formed an incrustation on the outside; the chromic also caused a green precipitate, which interfered with successful staining. The second method was in the use of Müller's fluid in the proportion of $\frac{1}{6}$ per cent. to $\frac{1}{8}$ per cent. Professor Hamilton's method was the use of bichromate of ammonia of $\frac{1}{4}$ per cent. solution upwards. Another method was the use of gum and sugar, one part saturated solution of gum and a quarter its bulk of saturated cane sugar. Good results were obtained by these methods, but the time which they take was a disadvantage, especially in cases of *post-mortem*. The most successful method was that of Mr. Bevan Louis, and which has yielded in his hands such excellent results. The portion of tissue to be cut is first frozen into a block on the freezing microtome, the sections are then cut, and placed in a $\frac{1}{4}$ per cent. solution of osmic acid for two or three minutes, so as to fix the tissue. It is then placed on a glass slip and stained by a fluid of $\frac{1}{4}$ per cent. solution aniline blue-black, the superfluous stain is washed away, and the section is ready for mounting. The whole process can be done within half-an-hour, a great advantage over the other methods, which take weeks. In the laboratory Mr. Louis's method was practically demonstrated, several sections were cut and examined under microscopes, along with previously prepared slides of brain structure. The meeting was exceedingly interesting, especially to those members who were present at the President's address at the opening of the session.

Meeting held in the Library of the Philosophical Hall, March 17th, 1890. H. Bendelack Hewetson, M.R.C.S., F.L.S. (Vice-President), in the chair.

EXHIBITION OF INSECTA.

Mr. Hewetson exhibited and described living specimens of some extraordinary sand beetles, obtained by him in the desert near Ismalia, Egypt, where they were very plentiful. What is most remarkable about

these insects is that they were taken from the sandy desert, where no trace of life, either vegetable or otherwise, was to be seen. Their mouth parts and also their organs of sight are very rudimentary, and especially so when compared with coleopterous insects generally. What nutriment they can get out of the desert sand is not quite clear, but evidently seem contented, and in their movements are very active. Mr. Hewetson also showed examples of Scarabei beetles, taken from Mentone, along with ball of dung and earth containing their eggs. The ball, which is about one inch in diameter and about two or three times the size of the beetles themselves, is taken about by them by a peculiar mode of throwing, exceedingly interesting to observe. Together with these beetles was shown a relic of the ancient Egyptian Scarabeus found at Zagazig, and cut out on the under side are the Egyptian characters of "Thommus III. with, Cartouche."

Mr. Edgar R. Waite, F.L.S., described a number of interesting insects, and illustrated his remarks by means of drawings thrown on the screen, and beautifully executed figures. Among others, he described the following:—Drone Fly (*Eristalis tenax*). This is a common British insect, and the larva is known as the "Rat-tailed Maggot." This larva is aquatic, and is very partial to water which oozes from manure-heaps. The oval body terminates in a long tail, composed of two segments, one of which can be telescoped within the other. The larva feeds head downwards. Its tail places the body in communication with the air, and the sliding motion enables it to be lengthened or shortened as required by the varying depths of the water. Chameleon Fly (*Stratiomys chamæleon*). The larva of this fly has a long tail, the extremity of which is provided with a circlet of barbed hairs. These are capable of being folded together so as to enclose a small bubble of air, with which the creature descends, returning to the surface when the air is exhausted by respiration. The Chigoe (*Pulex-penetrans*), a near relative of our common flea, burrows into the feet of human beings, and if not ejected forms a hollow in which the young are produced. This little creature is popularly known as "The Jigger." The Cochineal Insect (*Coccus cacti*) is one of the numerous tribe known to gardeners as "Scales" or "Mealy-Bugs." This species supplies the cochineal of commerce. At a suitable time these insects are collected and placed in a pot, where they are confined for some time, and then killed by the application of heat. Specimens were exhibited, and when crushed and mixed with a little spirit and water produced the beautiful crimson colour used for dying.

Mr. John Stubbins, F.G.S., F.R.M.S., exhibited a magnificent and extensive series of slides on Insecta, a number of which was shown under microscopes.

Messrs. W. Nettleton, C. Chapman, J. Phillips, and E. Thompson also contributed a number of microscopic objects.

Meeting held in the Municipal Buildings, March 24th, 1890, Professor de Burgh Birch, M.D., C.M., F.R.S.E., in the chair.

THE SPECIFIC GRAVITY OF BLOOD.

E. LLOYD JONES, M.B., C.M.

Blood consists of plasma and corpuscles, the former has a specific gravity of about 1·025, and the latter of about 1·200, hence, when the specific gravity of the blood of a living individual has been determined an accurate judgment can be formed of the proportions of these ingredients in the specimen. The older methods of determining the specific gravity of blood all necessitated a relatively copious supply, whereas the method shown which was first the idea of Professor Roy, of Cambridge (though not practically worked out by him), but has been built up and modified by Mr. Jones, that now one can determine the exact specific gravity very accurately without shedding more than a minute drop, and is one of the most reliable methods of examining and ascertaining the condition of blood known, and at the same time the most rapid. Several experiments were made in demonstration of the method, which is briefly as follows:—The back of the middle finger, a little beyond the nail, was pricked with a fine needle—an operation without any appreciable pain—which is followed by a small drop of blood. This is drawn up into a glass tube or pipette. It is then blown into fluids of varying standards of gravity, and when in these fluids the blood rises or sinks according as it is lighter or heavier. An account was then given of the influences which alter the specific gravity of blood—namely: age, sex, food and drink, alcohol, sleep, exercise, season, race, temperament, &c. It also varies widely in different parts of the body, and is affected by emotions and mental states. "Blood is thicker than water," says the proverb; but how much thicker depends upon all the influences named above. The healthiest condition of blood is that in which the specific gravity is neither too high or yet too low, but of the average, and is least susceptible to change as the result of the influences given.

The President highly complimented Mr. Jones on the importance of his research, and spoke of the old methods, when bleeding was in vogue, of testing the condition of human blood. He said the subject was a very difficult one, and showed how earnest had been the determination to grapple with it and to obtain such excellent results.

Meeting held in the Municipal Buildings, March 31st, 1890, F. W. Branson, F.I.C. F.C.S., in the chair.

BACTERIA IN RELATION TO THEIR CONDITION OF LIFE.

PROFESSOR E. H. JACOB, M.D.

Bacteria may be divided into three forms or classes—(1) inert, of which there are a large quantity; (2) useful, as in the ripening of cheese, brewing (fermentation) of beer, wine, &c., making leaf mould,

putrefaction of corpses—in other words, to resolve dead bodies to their primitive elements; (3) harmful, as causes of nearly all communicable diseases. The subject of microbes (germs, mostly vegetable) was arranged under two heads—(1) effect on soil; (2) effect of soil and general conditions on them. Attention was specially called to the latter, as both would be too lengthy for one evening. Among the many circumstances affecting bacterial growth was mentioned some chemical actions—presence of oxygen, heat and cold, movement and rest—under pressure and effect of re-agent, examples in each of these were given. Then followed an account of the condition of growth specially worked out in connection with certain microbes which produce abscesses under the following circumstances: (1) where they are accompanied by material which makes them stick in the capillaries; (2) when mixed with blood clot; (3) general and local depression of vitality and fatigue; (4) early stages of inflammation; (5) injury, as instanced in anthrax or wool-sorters' disease, which grows only in cellular tissue, not in the blood; (6) seat of inoculation and anatomical arrangement; (7) indefinite conditions in body, age and youth. It was pointed out under the head of local and seasonal conditions that erysipelas was most prevalent in February and November, diphtheria in cold and moist weather, typhoid in summer and autumn. The general conditions to avoid growing microbes were stated to be general good health, temperance, exercise, and fresh air. The general use of disinfectants in sick rooms, &c., was severely criticised and pronounced in nearly all cases to be perfectly useless, as they do not kill the microbes nor yet prevent their multiplication.

Meeting held in the Library of the Philosophical Hall, April 14th, 1890. John Stubbins, F.G.S., F.R.M.S. (Vice-President), in the chair.

RELICS FOUND IN YORKSHIRE CAVES.

REV. EDWARD JONES.

Caves, it was shown, are almost entirely confined to the limestone districts; the reason for this is the endurability of the limestone's chemical constituents, which also act as a potent preservative of animal remains, &c. Caves may be looked at, firstly, from their physical condition; and secondly, and more particularly, as interesting to naturalists from their collections of remains of animals, many of which are now quite extinct, or extinct to this part of the world; also others which have been the progenitors of some of the present fauna. References were made to the cave at Kirkdale, near York, and the Victoria Cave of Settle, both of which have been well worked and given valuable results; but the main attention was directed to the cave found a short while ago at Elbolton or Thorp, which is situated ten miles north of Skipton and two miles from Grassington. Through the energy of the president and members of the Skipton Natural History Society, this cave, which, in fact, has been handed over to them, has been worked with great

earnestness, and although it appears far from being exhausted, a very numerous collection of bones has been turned up. Human remains, representing some thirteen bodies, have been found in an excellent state of preservation. Doubtless these human beings have been buried there, as they were all found much in the same position, viz., sitting, with the knees brought under the chin. Several specimens of bones of boars, red deer, fox, dog, badger, grizzle and brown bears, &c., &c., have been found. So far the excavations have not got beyond what is known as the Neolithic period; but judging from facts deduced from caves of similar formation, it is very probable that the Paleolithic period will be found as the study is pursued. The Elbolton Cave has doubtless also been inhabited by human beings, as remains of charcoal fires, burnt bones, and pieces of pottery have been found.

A large number of specimens of bones, &c., from the lecturer's extraordinary collection, obtained from the Elbolton Cave, was exhibited.

Mr. Edgar R. Waite, F.L.S., proposed a vote of thanks, and, mentioning that on two occasions he had had the pleasure of accompanying Mr. Jones into the cave, spoke of the great enthusiasm with which the lecturer had gone into the work, and of the by no means always pleasant, nor yet safe, occupation in turning up these animal remains. The motion was seconded by Mr. Wm. Nettleton, and heartily endorsed by the meeting.

Meeting held in the Municipal Buildings, April 21st, 1890, F. W. Branson, F.I.C., F.C.S., in the chair.

PROTOZOA.

WASHINGTON TEESDALE, F.R.M.S.

The class protozoa is an extensive one, embracing most of the lowest forms of animal life, mainly aquatic. This class has numerous subdivisions, and of late years has undergone much change in its classification. Extracts were read from the address of the President (Dr. C. T. Hudson) of the Royal Microscopical Society, London, which appears in the current month's part of that Society's journal, where this subject is dealt with in an interesting manner. In the discussion which followed, Mr. W. Clapham informed the meeting that *Melicerta ringens* could be obtained all the year round from a small pond off York Road, Leeds.

EXCURSION TO WOODLESFORD.

The first excursion of the season for outdoor work of this Society was made on Saturday, April 26th, to Woodlesford, Swillington, and district. Some twenty members attended, proceeding to Woodlesford by the 1.10 p.m. train. The party here divided, the ornithologists taking the country in the immediate neighbourhood of the river, while the microscopists made for the ponds at Leventhorpe and Swillington. Fine

weather prevailed, excepting by one slight shower, but the spring season being so very late the trees were only just bursting forth into foliage, and plant life generally had scarcely woke up from winter rest; therefore, in the important section of botany, only a few records were made. Insects also had not yet found the season sufficiently congenial to leave their winter resting-places. Only larval forms were recorded.

Meeting held in the Municipal Buildings, April 28th, 1890, Edgar R. Waite, F.L.S., in the chair.

Mr. Waite presented a report on the animals seen in the Woodlesford district during the excursion on Saturday.

Twenty-eight birds were seen, of which the Tree Sparrow and the Black-headed Gull (in full summer plumage) were the most notable examples. The following is a complete list, five of which are summer visitants :—Missel and Song Thrushes, Blackbird, Redbreast, Willow-warbler, Hedge Accentor, Blue Tit, Pied and Yellow Wagtails, Meadow Pipit, House and Sand Martins, Greenfinch, House and Tree Sparrows, Chaffinch, Yellow Bunting, Starling, Magpie, Rook, Skylark, Mallard, Ringdove, Partridge, Waterhen, Lapwing, Sandpiper, and Black-headed Gull. Several nests, containing eggs, were also seen. Mammals were represented by the Water Vole, Hare, and Rabbit ; amphibians by the Crested and Smooth Newts, and the Common Frog ; while the Stickle-back and Minnow represented the fishes.

Mr. J. Phillips, of the microscopical party, exhibited larvæ of one of the Dragon Flies, numerous specimens of larvæ of May Flies (*Ephemeridæ*), and several dipterous larvæ and pupæ, notably *Coretha plumicornis*, or the phantom larvæ.

Meeting held in the Library of the Philosophical Hall, May 5th, 1890, John Stubbins, F.G.S., F.R.M.S., in the chair.

Exhibits :—

Mr. William Watkins, of London, forwarded an extraordinary collection of tropical African Insects, mostly Lepidoptera. Some interesting notes on the capturing of these insects were given, and several interesting illustrations of mimicry were pointed out. A number of curious beetles were also shown.

Mr. W. E. Collinge exhibited specimens of *Sphærium corneum*, and drew the attention of the meeting to the peculiar habit these molluscs possess of spinning under water gelatinous threads, by means of which they suspend, raise, or lower themselves.

Meeting held at the Medical School, May 12th, 1890, Professor de Burgh Birch, M.D., C.M., F.R.S.E., President, gave a lecture and demonstration under the title of " Practical Work."

EXCURSION TO ELBOLTON CAVE.

An extremely enjoyable excursion (the second of the season) took place on Saturday, May 17th, 1890, to Elbolton Cave, *viâ* Skipton, under the leadership of the Rev. E. Jones, to whom much credit is due for working so thoroughly the deposits on the floor of the cavern. At Skipton the party was increased to seventeen by the Skipton naturalists, and a splendid drive of about eight miles in clear weather brought the party to Cracoe. The ascent of the hill was then made, leaving the lead-mines on the right, the highly fossiliferous rock being explored *en route*. The charming and well-lighted views to be seen from the elevated site of the cave detained the party a little time, and then a descent was made into the cavern, which was explored for a distance of one hundred feet, and to a vertical depth of some thirty feet, many stalactites and stalagmites in course of formation were seen, and, in addition, the osseous remains of animals (some now extinct) were noticeable *in situ*. Mr. Jones was good enough to point out the former location of several human skeletons, and it is fortunate that the position as to vertical depth and location of the other numerous objects removed is correctly mapped out. To those members especially who had recently listened to Mr. Jones' lecture on the cave the visit was full of interest. The return journey was made *viâ* Burnsall, Appletreewick, and Barden, a route rich in highly picturesque scenery of valley and moorland. The most lovely portion of the day was perhaps the close, when the ruddy glow of sunset, as noticed from the Wharfe Valley, gave very noticeable prominence and sharp outline to Barden and Burnsall Fells.

The following forty-six species of birds were recorded by Mr. W. Storey :—Skylark, Tree Pipit, Meadow Pipit, Grey Wagtail, Yellow Wagtail, Pied Wagtail, Wheatear, Redbreast, Wren, Willow Warbler, Cuckoo, Garden Warbler, Wood Warbler, Whin-chat, Chaffinch, Greenfinch, Linnet, Redpoll, Redstart, Blue Tit, Long-tailed Tit, Coal Tit, Landrail, Common Bunting, Yellow Bunting, Hedge Accentor, Tree Sparrow, House Sparrow, Starling, Curlew, Grouse, Lapwing, Rook, Jackdaw, Sandpiper, Waterhen, Magpie, Missel Thrush, Song Thrush, Blackbird, Swift, House Martin, Sand Martin, Swallow, and Dipper. A large number of plants common to the district were not yet in flower, but the finds included three specimens of the very pretty *Primula farinosa* (Bird's-eye primrose), which were left undisturbed, and a specimen of abnormal poppy. The following were also collected :—*Geranium lucidum*, *Draba verna*, *Saxifraga granulata*, *Saxifraga tridactylites*, Blue Sesleria (*Sesleria cærulea*, a mountain grass), Brittle Bladder Fern (*Cystopteris fragilis*), Knotted Pearlwort (*Sagina nodosa*).

Meeting held in the Municipal Buildings, May 9th, 1890, F. W. Branson, F.I.C., F.C.S., in the chair.

Exhibits :—

Dr. E. Lloyd Jones showed specimens of teeth of woolly rhinoceros, elephant, horse, and hyena from a cave in Carmarthenshire, with coprolites of the hyena and bones ground by the same animal. Teeth of the grizzly bear, bison, and reindeer from Castleton. Tooth of the hippopotamus. A specimen of *Cyrena* from the Cambridge district.

Mr. William Nelson exhibited and presented to the Club's local collection the following land shells :—*Bulimus montanus, Clausilia rolphii, C. laminata, and C. albida* (variety). Also *Limnæa peregra* and *L. glutinosa*, fresh-water shells.

EXCURSION TO THORPARCH AND BOSTON SPA.

A most delightful excursion (the third of the season) was made on Saturday, May 31st, 1890, to Thorparch, Boston Spa, and district, under the most favourable auspices. The party, which numbered twenty-five, left Leeds New Station by the 1.45 p.m. train, and in a journey of a little under an hour reached Thorparch village, where they were joined by Mr. John Emmet, F.L.S., whose knowledge of the botany and conchology of this locality is complete.

Through the great kindness of Mrs. Hatfeild, of Thorparch Hall, the members had permission to go over these extensive grounds, and, further, had generously placed at their disposal the services of the gamekeeper, who proved an excellent guide. These advantages, combined with fine weather, through rich woodland scenery and the picturesque Wharfe in constantly changing views, gave much pleasure. The botanical section was exceptionally strong, including the leader, Mr. John Emmet, Professor L. C. Miall, F.L.S., F.G.S. ; Messrs. F. W. Branson, F.I.C., William Kirkby, and W. H. Taylor. Members present and representing other sections included Messrs. Harold Wager, Edgar R. Waite, F.L.S., W. E. Collinge, &c.

The route taken was through the woods to Flint Mills, which takes its name from the grinding of flint years ago, but which is now utilised as a flour mill. Here also, it may be noted, is a capital view of the magnesian limestone of this district. The party then returned, keeping close to the bank of the river, where Jackdaw's Crag, opposite, was seen to fine advantage in its spring verdure. A halt was made at the pond, where dredging was pursued. Then again at the fine oak tree, remarkable for its size and symmetry, notes on which, dating back 200 years, are in the library of the Hall. After this enjoyable excursion the members proceeded at six o'clock to the Royal Hotel at Boston Spa, where tea was provided. With the exception of two members, who desired to see more of the district, the party returned by the 7.15 train.

Meeting held in the Library of the Philosophical Hall, June 2nd, 1890, John Stubbins, F.G.S., F.R.M.S. (Vice-President), in the chair.

The results, including reports and specimens of the Saturday excursion to Thorparch, were read and exhibited. Mr. William Kirkby showed the plants found, including the following :—Dame's Violet (*Hesperis matronalis*), London Pride, or None-so-pretty (*Saxifraga umbrosa*), Twig Rush (*Cladium mariscus*), also Turk's-cap Lily (*Lilium martagon*), in fruit; Twayblade (*Listera ovata*), some fine specimens of Broad-leaved Helleborine (*Epipactis latifolia*), but not in flower; Wall Hawk-weed (*Hieracium murorum*), Winter-cress (*Barbarea vulgaris*), Large-flowered Bitter-cress (*Cardamine amara*), Scurvy-grass (*Cochlearia officinalis*), Common Meadow-rue (*Thalictrum flavum*), in bud; Broad-leaved Garlic or Ramsons (*Allium ursinum*), Ivy-leaved Toad-flax (*Linaria cymbalaria*), Weasel-snout (*Lamium galeobdolon*), Common Spurge-laurel (*Daphne laureola*), in fruit; Woodruff (*Asperula odorata*), Herb Paris (*Paris quadrifolia*), and Wild Lettuce (*Lactuca virosa*), though not in flower yet. Three species of parasitic fungi were also taken.

Mr. Edgar R. Waite, F.L.S., forwarded the following notes in the Vertebrate Section :—Comparatively few birds were seen. This was chiefly owing to the sameness of the country traversed, it being nearly all woodland, hence the following birds were met with :—The Missel and Song Thrushes, Blackbird, White-throat, Chiffchaff, Willow and Sedge Warblers, Great and Blue Tits, Wren, Ring and Stock Doves. The fields and hedgerows added to the list the Chaffinch, Greenfinch, Pied Wagtail, Meadow and Tree Pipits, Yellow Bunting, Starling, Rook, Lark, Landrail, and Lapwing; and the waterside supplied the Swallow, Martin, Sand Martin, Water-hen, and Swift. The total list of birds, including the ever-present Redbreast, Hedge Accentor, and House Sparrow, was 31, of which 10 were migrants and 21 residents. Nests and eggs of 5 species were found, and 4 species of young birds were seen. Of mammals, the Water and Short-tailed Field Voles and the Rabbit were the only representatives.

Mr. W. E. Collinge collected and exhibited *Limax maximus*, *L. agrestis*, *Vitrina pellucida*, *Hyalina cellarius*, *H. nitidulus*, *H. crystallinus*, *Helix fusca*, *H. nemoralis*, *H. hortensis*, *H. rufescens*, *H. hispida*, *H. concinna*, *Cyclostoma elegans*. Of the latter form Boston Spa and district is the most northerly place where it is found in plenty.

Exhibits:—

Mr. Tom Atkinson showed a number of interesting Mosses and flowering plants.

Mr. William Nettleton exhibited under the microscope, Fungi parasitic on the Lily of the Valley, and Peristome of Mosses.

Mr. W. Clapham showed larvæ of large Water Beetle (*Dytiscus marginalis*), and several Marine Zoophytes.

Meeting held in the Municipal Buildings, June 9th, 1890, F. W. Branson, F.I.C., F.C.S.,in the chair.

THE RED SEAWEEDS.

HAROLD WAGER.

The group of the red seaweeds, or *Florideæ*, is one which is, in some respects, sharply marked off from all other *Algæ*, more especially as regards the formation of the reproductive organs. It is possible, however, to show that the red seaweeds are ultimately connected to the lower unicellular forms (of the *Algæ*), and that they form the culminating point of one of the lines of descent of their group. These plants have a very varied and at the same time a somewhat simple structure. They form branching filaments, flat leaf-like expansions, which often exhibit a simple venation, or branched in a very regular and symmetrical manner. They have generally a delicate texture, and are divided up in such a manner as to render them the most beautiful of the seaweeds. Most of the *Florideæ* contain a red colouring matter, but there are a few forms which are of a green colour. In addition to the red, however, there is in all the red seaweeds a green colouring matter, which can be extracted by means of alcohol, and is evidently the same substance, or nearly so, as the chlorophyll of the higher plants. The red pigment is insoluble in alcohol, but can be extracted by water. The sexual methods of reproduction are extremely interesting. They depend largely upon the mode of life of the plant, and yet they exhibit an approach to what is obtained in the higher flowering plants. The female organ consists of a central cell or group of cells, surmounted by a long, or in some cases, a short hair-like structure, known as the trichogyne. This structure may be compared to the pistil of the higher plants. The male organs are borne in special cells of the vegetative body, and consist of small rounded cells, which are, unlike the same structure in the lower *Algæ*, incapable of movement. These small bodies may be compared to the pollen grains of the higher plants. They are carried through the water by currents, and are brought into contact with the trichogyne, to which they adhere firmly. The cell walls between the two, fuses, and the contents of the male organ pass into the trichogyne, and through the trichogyne to the cells below. These cells then develop and give rise to spores, from which new plants eventually develop. In some forms there is a suppression of the trichogyne in the majority of the female organs, one or two only being developed, and these do the work for the remainder. The female organ, to which a trichogyne is attached, becomes fertilised, and then sends out tubes which pass through the tissues to fertilise those which do not possess a trichogyne. In all cases fertilisation results in the formation of a more or less complex fruit, in which spores are formed, and from these new plants are developed.

EXCURSION TO PARLINGTON PARK AND ABERFORD.

The fourth excursion of the season of this Society took place on Saturday, the 14th of June, 1890, to Parlington Park, Aberford, and district. The party, which numbered thirty-four, proceeded to Garforth by the 1.50 p.m. train. On their arrival the Highflyer was waiting to convey them to Parlington Park, which, through the great kindness of Colonel and Mrs. Gascoigne, the Society had the privilege to visit. The weather was most propitious, and after the recent rain the country was full of freshness and beauty. The party left Garforth accompanied by Mr. Walter D. Hollis, whose local knowledge was of much service in directing the various groups. The majority of the members made their way first to the lake, where dredging operations were carried on, and the remainder were leisurely conducted through the gardens, conservatories, and fine timbered grounds, where deer were seen. The interesting process of the swarming of a colony of bees was also witnessed through glass.

Subsequently the members who had proceeded by way of the lake and woods, arrived, and a pleasant walk brought the excursionists to Aberford, where tea was provided at the Arabian Horse Inn. After tea Mr. Hollis conducted the party over some private grounds, and also pointed out the various beauties of the village. The party left at 7 p.m.

Meeting held in the Municipal Buildings, June 16th, 1890, Professor de Burgh Birch, M.D., C.M., F.R.S.E. (President), in the chair.

Exhibits :—

OBJECTS TAKEN IN THE ABERFORD EXCURSION.

Mr. W. Clapham :—*Volvox globator*, *Closterium*, larva of Beetle (*Dytiscus marginalis*), and of dragon fly.

Mr. J. Phillips :—*Hydra vulgaris*, *Plumatella repens*, larva of May fly, phantom larva (*Coretha plumicornis*), and *chironomus*.

Mr. Norman Walker exhibited, on behalf of Mr. Harold Wager, the following slides illustrating the structure and reproduction of the red seaweeds :—*Spirogyra* in conjugation, *Vaucheria* oogonium after fertilisation, Antheridia of *Polysiphonia*, Tetraspores in *Delesseria*, Apex of Thallus of *Dictyota*, Sporangia of *Ectocarpus*, Tetraspores of *Rhodomela*.

Professor Edward J. Prince, of Glasgow, exhibited and described living specimens of the Natterjack Toad (*Bufo calamita*) and viviparous lizard (*Zootoca vivipara*), from County Kerry, Ireland.

Mr. John Nicholson exhibited a viper, or adder (*Vipera berus*), captured on Bishop Moor, Pateley Bridge.

EXCURSION TO THE RUSKIN MUSEUM.

The fifth excursion of the present season took place on Saturday, June 21st, the place visited being the Ruskin Museum, Meersbrook Park, Sheffield. The party, which proceeded by the 1.25 train (London express), was in excellent hands. Mr. H. Bendelack Hewetson, M.R.C.S., F.Z.S., who kindly acted as leader, knows intimately the priceless treasures which the Museum contains. On arriving at Sheffield those present, numbering about twenty, were quickly conveyed to Meersbrook Park, a distance of a little short of two miles, the site of the new Museum, from which point exceedingly pretty views are obtainable. The Park and immediate surroundings most favourably impressed the members, and a very pleasant and profitable afternoon was spent. The very courteous and able curator, Mr. William White, explained in detail many of the interesting objects in the Museum. The party were first conducted to the room which contains the casts and minerals, and these were interpreted by Mr. Hewetson and Mr. White.

The casts are the exact representatives in plaster of specimens of the highest sculptured art of Venice in her prime, and of early Gothic carvings from cathedrals in Normandy. These choice works were most carefully produced by Mr. Ruskin without regard to the expense involved in the process, full liberty and every facility having been at all times granted to him by the different local authorities for the prosecution of his unusual labours. The largest of the series include the "Largitas" and other capitals, and four "Flying Angels" from the Ducal Palace; the Virtues, carved bosses, and scrolls, from St. Mark's (Venice); and amongst the smaller productions are "Aristotle" and birds and grapes from the Ducal Palace, and from Rouen the Seven Days of Creation, the Vices, and two Garden of Eden subjects, besides borders and fragments of friezes. Next followed a description of the minerals comprising a series of agates in perfect variety of their different forms, including many examples in elucidation of their origin and development, in relation to flint and chalcedony, jasper, quartz, and other siliceous products, the study of which has occupied Professor Ruskin's attention throughout a lifetime. It may be remembered that a valuable collection of these minerals, which was presented by him to the nation, and which is accompanied by a special catalogue from his pen, occupies an important position in the British Museum Gallery at South Kensington. Not the least interesting of the specimens in the Meersbrook series are some of the brecciated agates and pseudomorphic pudding-stone forms which have been so abstrusely studied by Mr. Ruskin with the result of forming a basis of a new theory as to the real character of such examples.

The various forms of quartz crystallisation are illustrated by many beautiful examples, while native silver and gold in different matrices richly furnish another case. Indeed, where there is such a wealth of grand specimens of mineral forms, it is difficult to refer briefly to them;

but mention must be made of a superb block containing blue topazes of great size, in connection with smoky quartz crystals and mica (an extremely valuable and unique specimen), a huge block of small crystals of pale yellow topazes (from Siberia), and an enormous dark amber crystal of the same class of stone, of great value; beryls of rich quality; opals of the choicest character, in their native state, from different parts of the world; Labradorite and Amazon stone; emeralds of great size and depth of colour; and crystals of quartz containing acicularrutile in fine variety. Of special interest, particularly to those members who recently visited Elbolton Cave, near Skipton, also is a beautiful polished slab of calcite from Mexico, of a rich brown colour, presented to Mr. Ruskin by Mr. Hewetson, a stalagmitic product somewhat resembling onyx in its form, with the "core" admirably displayed. In the same room is placed a splendid specimen of the peacock, also presented and stuffed by that gentleman. The large room containing the pictures was next visited, which includes St. Mark's, Venice, by John Bunny; and many perfect drawings of architectural detail and street architecture, besides beautiful copies in water-colour of works by the Italian masters, all commissioned by the founder of the museum, and in some instances his own handiwork cover the walls.

The library was next visited, and, although not yet open to the public, the visitors were admitted to a private view of some of the treasures in this department of the collection. Manuscripts of early Visigothic and later centuries, missals, illuminated Bibles, &c., form a valuable part of the contents of this room; while hand-coloured drawings and other finely illustrated plates adorn the pages of many a large volume of natural history works. The Eyton collection of ornithological plates in 38 large portfolio volumes, consisting of the illustrations from such choice works as those by Gould, Audubon, Temminck, for which these valuable productions were broken up, is alone sufficient to render the library famous, while the original drawings by Edward Donovan of insects, shells, crustacea, &c., and by Miss Bowdich of British fishes, are beautiful in the extreme. To the botanist Curtis's "Flora Londonensis," with the continuation by Hooker, in five volumes, is of lasting interest, as may be also said of Hedvig's work on mosses, with which the library is likewise enriched. Amongst British standard literature it need scarcely be said that the works of the master-founder hold an important place with those of Bacon, Johnson, Pope, and Carlyle.

Meeting held in the Municipal Buildings, June 23rd, 1890, John Stubbins, F.G.S., F.R.M.S. (Vice-President), in the chair.

Exhibits:—

Mr. Alderman Gilston exhibited specimens of *Trientalis europœa* (Chickweed Winter-green), from Scarborough. This plant is rare in

Yorkshire, common in the Highlands of Scotland, and absent altogether from Ireland.

Mr. James W. Addyman, B.A., exhibited and gave a short account of the following:—*Geranium sanguineum*, *Genista tinctoria*, *Polygala vulgaris*, mass of leaves preserved in peat from an ancient bog near Filey, and a piece of birch timber from the same place.

Mr. F. W. Branson, F.I.C., showed from Sevenoaks, Kent:—*Herminium monorchis* (the rare Musk Orchis), *Ophrys apifera* (Bee Orchis), *Gymnadenia conopsea* (Fragrant Orchis or Gymnadenia), *Cephalanthera grandiflora* (White Helleborine).

Meeting held in the Library of the Philosophical Hall, July 7th, 1890, John Stubbins, F.G.S., F.R.M.S. (Vice-President), in the chair.

The following books were added to the Library:—Parts I. and II. of the Catalogue of the Fossil Mammals and Fishes of the British Museum, presented by the trustees; Jonathan Salt's Catalogue of the Plants of Sheffield, presented by the Sheffield Library and Philosophical Society, per the Secretaries of the Yorkshire Naturalists' Union.

Exhibits:—

Messrs. T. Atkinson and W. Nettleton exhibited a number of mosses and flowering plants.

Mr. George Brunton also showed remarkably fine specimens of *Orchis maculata*, the flower-spike measuring five inches in length, collected in the neighbourhood of Bardsey.

EXCURSION TO YORK.

On Saturday, July 19th, 1890, a most enjoyable excursion was made to Messrs. James Backhouse & Son's Nurseries, York, who very kindly made their extensive grounds accessible to the members who attended. The party, which numbered 23, proceeded to York by the 1.35 p.m. express. The weather was most favourable throughout, and on arrival at the garden shortly before three o'clock the visitors were at once conducted over the Alpine grounds by the manager, who interestingly described their arrrangement so as to provide as far as possible a natural habitat for the very numerous forms of Alpine flora. Starting at the lowest level, where water forms an important part and temperature is the smallest, the plants peculiar to that environment were pointed out, and pleasing notes were given on the greater rarities. A gradual ascent was then made to the highest elevation, where all along was one garden of ever-changing bloom transplanted from the Alps, Himalayas, and other remote places, and seemed to flourish none the less under their rather altered conditions. The rhododendron grounds were next visited, and afterwards the extraordinary collection of orchids, palms, ferns, and roses for which the

nurseries are famous. Some interesting shells were collected by Mr. W. E. Collinge in the garden. After leaving the nurseries the party divided, some of the members starting for Askham Bog, others returning to the ancient and historical city of York to examine a number of the chief features of interest. Askham Bog was found to be a very profitable collecting ground.

Meeting held in the Medical School, July 21st, 1890, Professor de Burgh Birch, M.D., C.M., F.R.S.E. (President), in the chair.

DEMONSTRATION OF BLOOD PRESSURE.

PROFESSOR BIRCH.

It was shown that the action of the heart is for the purpose of keeping up the blood pressure, so as to circulate the blood to the extremities of the body; how through the vital tree, as it is called, the blood passes from the heart, where the pressure is greatest, into the arteries, then into the veins, and afterwards the capillaries; also the causes of diminution of blood pressure, which are very variable.

Meeting held in the Municipal Buildings, July 28th, 1890, James W. Addyman, B.A., in the chair.

Exhibits :—

Mr. Edgar R. Waite, F.L.S, exhibited and described a collection of foreign birds' nests. The most remarkable nest was, perhaps, that of one of the oven bird (*Furnarius rufus*), a native of South America. The nest is chiefly composed of mud bound together by straws and grasses, which, when hardened by the sun, forms a compact and massive structure. A domed arch in one side forms the entrance, and the whole bears some rude resemblance to a bee-hive or oven—whence the bird takes its trivial name. Another notable nest was that of the edible nest swiftlet (*Collocalia nidifica*), from China. The nest is formed of a mucus secreted by the salivary glands, and is held in great esteem by the natives, being chiefly used for making soup. Many other nests were exhibited, among which were those of various Weaver Birds, Hang Nests, Humming Birds, &c. Mr. Waite also exhibited some British birds' nests, including those of the House Martin (*Chelidon urbica*) and Swallow (*Hirundo rustica*). It was pointed out that the nest of the martin, usually built under the eaves of houses and in window-corners, is a ball-like structure with a hole in the side. The nest of the swallow is, on the other hand, merely a shell of mud, built on a rafter in a barn, or other buildings, and quite open above. Having shown typical nests of the two species, one was then shown of a swallow, built under the eaves of a house, but still preserving the character of the swallow's by being open above. The nest was obtained at Wilstrop

Hall, the residence of Mr. John Harrison. Mr. Waite also exhibited some Bats, recently obtained in the Thorparch district, the most notable being the Reddish-grey or Natterer's bat (*Vespertilio nattereri*).

Mr. Addyman exhibited specimens of glaciated limestone and shale boulders from the Filey boulder clay, also a fine example of *Anodonta cygnæa*.

Mr. W. E. Collinge showed a peculiar variety of *Spherium corneum*, collected on Hampstead Heath.

Mr. J. Phillips exhibited a parasitic alga on leaf stem of frog-bit.

EXCURSION TO ADEL.

On Saturday, September 13th, 1890, a most enjoyable excursion took place to Adel and district. The members, numbering about twenty, met at the tram terminus, far Headingley, at three o'clock, and thence proceeded by the Weetwood Road to Adel. The party there divided, one section under the leadership of Mr. W. E. Collinge, making for Adel Dam, while another section, with Mr. Edgar R. Waite, F.L.S., as leader, investigated Adel Moor and Bog. The afternoon was beautifully fine and the heather and autumn tinted foliage gave the moor a most picturesque appearance.

Meeting held in the Municipal Buildings, September 22nd, 1890, J. Phillips in the chair.

Mr. Edgar R. Waite, F.L.S., described a specimen of the Rove Beetle (*Ocypus olens*) which had been sent to the Club, through Mr. Addyman, by Mr. Edward Wilson, of Halton, for identification. The popular name of this creature is the Devil's Coach-horse or Black Cocktail, no doubt given to it on account of the diabolical appearance which it possesses. It is quite black, and when touched curls up the abdomen and separates its wide mandibles or jaws. Moreover, it has the power of emitting a disagreeable odour which is penetrating and persistent to a degree, refusing to be driven off even with many washings. These insects are scientifically named *staphylinidæ* or *brachelytra*, the latter name signifying short elytra or wing covers. The wings, which are folded under the elytra, are quite ample, and when the insect alights it throws its wings into loose folds, and then by means of its mobile tail pushes them under the covers. The process, although elaborate, is rapidly performed. The forceps of the earwig are employed for a similar purpose.

Meeting held in the Municipal Buildings, September 29th, 1890. J. Charters Birch, L.D.S., in the chair.

The Secretary read a letter from Mr. G. A. Keartland, of Melbourne, who had forwarded, per favour of Mr. W. A. Carlton, a number of birds'

skins and birds' eggs. The donor writes to say the birds sent have not been chosen for their brightness of plumage, but he selected those not likely to be obtained from other sources. Many of them are from nearly 200 miles in the interior.

ON THE PRESERVATION AND MOUNTING OF AQUATIC LARVÆ OF INSECTS.

ARTHUR WALKER.

The object in the study of these larvæ is to preserve them so as to cause as little contraction as possible, and retain the internal structure and external appendages intact. To obtain these results the following method was recommended and demonstrated on *Coretha plumicornis*:—Take freshly collected larvæ and place them in 1·3 per cent. solution of chromic acid for three days. The structure is then fixed, and without any of the parts being displaced. It is then necessary to remove all loose chromic acid. This is done by placing the larvæ in equal parts of methylated alcohol and water for twenty-four hours. Then change into two parts—methylated alcohol one part, and water also—for twenty-four hours, afterwards into methylated alcohol, where they are then preserved ready for use, and can be studied during the winter months when living specimens cannot be obtained. The method for making microscopical preparations of the larvæ was next recommended as follows:—Select the specimens to be mounted out of the methylated alcohol and place into absolute alcohol to dehydrate there—to remain in a few minutes. Then pass into oil of cloves; afterwards mount in Canada balsam. The methods were practically shown and the preparation mounted at the meeting examined under the microscope, along with several others treated in a similar manner. It was pointed out that this method was not by any means confined to the preservation of aquatic larvæ of insects, but answers equally well for lepidopterous larvæ, &c., intended for anatomical study. The success of the methods were readily apparent from the slides shown under the microscope of *Coretha plumicornis*, an organism of very delicate and contractible structure. Preparation of whole larvæ of simulium were exhibited, also parts and stained sections showing the internal structures perfectly intact.

Exhibits:—

Mr. W. Kirkby:—Giant Puffball (*Lycoperdon giganteum*).

Mr. J. Phillips:—Double stained section of *Ruscus aculeatus*.

Meeting held in the Library of the Philosophical Hall, October 6th, 1890, H. Bendelack Hewetson, M.R.C.S., F.L.S., in the chair.

The Australian birds' skins and eggs presented to the Club by Mr. G. A. Keartland, of Melbourne, were exhibited. The skins, about 28 in number, are excellently preserved, and form a valuable collection. The

donor states in his letter that "the English thrush, starling, skylark, goldfinch, and sparrow are as common around Melbourne as some of the native birds, and, in fact, measures are being taken for the destruction of the latter in some of the fruit-growing districts. Foxes are also becoming numerous, and every holiday sportsmen may be seen at the railway stations with either foxes strung on their backs or a brush in their hats. We do not venerate Reynard here, but shoot every one we get a chance at. They are destroying too many of our ground birds, and dearly love a nice young lamb. Hares and rabbits are also too numerous in some parts." Mr. Keartland, a stranger to the Club, according to his letter, had presented this collection entirely through reading the interesting accounts of these meetings which have been generously accorded an important amount of space in the pages of the *Leeds Mercury Weekly Supplement* from a very early period of the Club's career. This act speaks volumes also for the way in which our hon. secretaries have conveyed to the outside natural history world the essence and core of the work, valuable as it is, which has from time to time been accomplished. But few would be stirred (with no other than the common tie of a love for nature, which knows not the limits of citizenship or nationality) to present from a distant land so marked a proof of the appreciation in which he held the working of the Club.

Mr. J. Phillips showed a fine specimen of a large dragon fly, taken near Halifax; also tropical beetle (*Buprestis canose*), from the West Indies, which showed remarkably fine metallic hues.

Meeting held in the Municipal Buildings, October 13th, 1890, Harold Wager in the chair.

THE PREPARATION OF BONE STRUCTURES FOR MICROSCOPICAL STUDY.

J. CHARTERS BIRCH, L.D.S.

A brief description was given first of tooth structure, the difference between the enamel dentine and bone and the connection between them. To obtain sections the tooth or bone is sawn either in longitudinal or transverse sections as thin as possible, using an ordinary fret saw frame, with a blue steel saw. The sections are then placed between two pieces of ground glass, with a little powdered pumice stone and plenty of water. A rotatory motion given to the upper glass soon reduces the sections to the required thinness. They are then placed between two pieces of smooth glass with a little whiting and water, and the rotatory motion continued until smooth and polished. They are then immersed in a weak aqueous solution of aniline dye and allowed to remain for a few minutes. In the meantime clean glass slips and cover glasses, warm them, and place on each a small quantity of Canada balsam, then taking

the section out of the dye, drain it and place on the palm of the hand, and with finger rub the surface of the section so that the superfluous fluid may be removed, whilst the *tubule canaliculi*, &c., remain filled with the solution, and mount in this condition, when the structure will be well seen. To mount the section place it in the centre of the balsam on the slip, then lay the cover glass on warm and gently press down, and if necessary keep under pressure until the balsam sets. When the balsam is hard the slide is ready for ringing with cement. Aspinall's enamel answers admirably for this purpose, it dries quickly, and can be obtained in all colours, and has also the advantage of not being affected by moisture, and does not leave the glass if there is any concussion. Mr. Birch demonstrated how readily a section could be prepared by cutting, grinding, polishing, staining, and mounting examples, and placing them under a microscope. A number of members afterwards joined in the work, and prepared slides.

Meeting held in the Municipal Buildings, October 20th, 1890, F. W. Branson, F.I.C., F.C.S., in the chair.

MICRO-ORGANISMS AND FOUL AIR.

HAROLD WAGER.

The association of foul air with micro-organisms and disease has of late years been so fully recognised, that the question of the nature of foul air and the causes which produce it becomes a most important one. The air, for example, in close stuffy rooms, living rooms, concert halls, theatres, and the like, is often so full of impurities that it becomes distinctly injurious, and its effects, even after two or three hours, become apparent to those who breathe it, in the feeling of depression and headache, which is so often produced. And it is much worse when persons have to remain in the same room for several hours, perhaps day after day, for the greater part of the year, for in such cases the foul air produces that paleness and general ill-health so common in those who are engaged in sedentary occupations. The evil effects of foul air are generally recognised to some extent by everyone, but there are very few perhaps who can, or who care to take the trouble of finding out of what foul air really consists, even in extreme cases, and fewer still who do so where ordinary living and sleeping rooms are concerned. The sources of the impurities which exist in air are many. Air is always full of minute suspended particles of various kinds. Their numbers vary in different places, being generally larger in towns and crowded districts than in villages and country places. Many of these suspended particles, however, are not to be looked upon as impurities; they are of use, as pointed out by Professor Tyndall, in diffusing the light in all directions in the atmosphere; and, as pointed out by Mr. Aitken, if it were not for their existence we should have no fogs

or clouds, and consequently no rain. This suspended matter consists of small particles of organic and inorganic substances, produced by the breaking down and decay of various natural objects, of various kinds of dust produced in our manufactures, and last, but not least, of small living bodies known as micro-organisms derived from putrefying animal and vegetable matters. In addition to these, there are present in foul air varying quantities of gases of various kinds, derived from manufactories and putrefaction, and also some very deadly organic substances found in the air respired by animals. It has been shown by Mr. Aitken that there are as many particles in one cubic inch of air taken from a room in which the gas is burning as there are inhabitants in Great Britain, and in three inches of gas from a Bunsen flame as many as there are inhabitants in the whole world. The method by means of which the number of micro-organisms in the atmosphere may be determined is extremely simple, though requiring great care. A certain quantity of air is allowed to filter slowly through a flask containing a layer of sterilised nutritive gelatine. The micro-organisms settle upon this, and immediately begin to develop into small colonies, which are visible to the naked eye. These are then counted, and from the numbers thus obtained the number of micro-organisms present in a given amount of air can be easily calculated. The number of micro-organisms present in the air as compared with the dust particles is extremely small, and they vary in different localities, being least in pure country air, such as moorland air, and greatest in densely populated districts and in very close, stuffy rooms. The organic matter found in the breath of animals is perhaps one of the most injurious of the air impurities which we have to consider. It has been shown recently that this is of such a nature as to act, when in sufficient quantities, as a deadly poison. Recent experiments have shown that animals which have been made to breathe the same air over and over again have ultimately died, being poisoned by the organic matters respired. What these poisons are, where and how they are formed, are facts not yet completely known, but it is extremely important for us to realise that they are of so injurious a nature. These are the substances which give the offensive, sometimes fetid, smell so often found in shut-up living and sleeping rooms, and which cause the headache and depression so constantly experienced in what is commonly called a stuffy atmosphere. Worse than this, it is supposed that many of our terrible zymotic diseases are in great measure assisted in their ravages by such an atmosphere, and many authorities on the subject show that the disease generally known as consumption, so common in England, is in large part at least caused by the constant breathing of such a tainted atmosphere.

Professor Carnelley's experiments were here alluded to, in which he has shown that over-crowding is accompanied by foul air—as shown by the presence of micro-organism and organic matter—increased death-rate, and reduction of mean age of death. It was further pointed out that in respect of foul air, well-ventilated sewers were considerably better than

many of the houses in the crowded districts of large towns. So far as is at present known, and contrary to what was formerly supposed, carbonic acid gas is a comparatively harmless substance, in the small quantities in which it generally occurs in the atmosphere. In connection with disease it was shown, by means of tables compiled from the Registrar-General's report for 1888, that the death-rate from consumption and diseases of the respiratory organs was much larger in crowded town districts than in the country. For example, roughly speaking, in Hunslet the death-rate per 1,000 in 1888 was about 25, of which 7·1 were due to consumption, &c., Holbeck 21 with 6·0, Halifax 20 with 6·6, Sheffield 24 with 7·0, Leeds 23 with 6·7, Scarborough 17 with 4·3, Sedbergh 13 with 3·8, Wharfedale 15 with 3·7, &c., the larger number in each case being the death-rate per 1,000 from all causes, the smaller one the death-rate per 1,000 from consumption and diseases of the respiratory organs. To get rid of the impurities constantly poured forth into the atmosphere, constant mixing of the foul with the fresh air is necessary, and this can only be obtained in houses by allowing a constant stream of fresh air to circulate through them. As regards the action of the oxygen of the air, either in the ordinary state, or in the condensed state, known as ozone upon the organic matter of respiration, very little is known. It has been said that the organic matter is only got rid of when it comes into contact with ozone; but we know very little as to the existence of this latter in the atmosphere, and still less as to the part it plays in getting rid of the organic matter. Much has been done by way of sanitation, improvement of water-supply, &c., to improve the condition of the people in crowded districts; but a great deal yet remains to be done in the way of ventilation, especially in houses, in the living and sleeping rooms. This applies to a large extent to the country as well as the town. The importance of ventilation in the houses both of rich and poor in town and country cannot, in fact, be too emphatically insisted upon. It may be that a good supply of fresh air for everyone will tend largely to decrease the social degradation and immorality of our crowded centres by improving the general health. At any rate, as Dr. Noble once said, "A tainted atmosphere is one among the many causes that depress vitality, and that lower the tone alike of the muscular, nervous, and assimilative energies." The subject of "foul air" is so important a one that it deserves much more attention than is given to it at the present day.

A vote of thanks was passed to Mr. W. A. Carlton, the gentleman who very kindly brought over the splendid donation of birds' skins and eggs to the club from Mr. G. A. Keartland, of Melbourne.

Meeting held in the Library of the Philosophical Hall, October 27th, 1890, James W. Addyman, B.A., in the chair.

SOME OF THE POSSIBLE CAUSES OF VARIATION IN THE SHAPE AND COLOUR OF THE EGGS OF BIRDS.*

H. BENDELACK HEWETSON, M.R.C.S., F.L.S.

In the consideration of a subject of this sort we see what a wonderful tendency there is in nature to adopt methods of self-preservation and defence in one way or another. We are dealing with a vast area of very deep truths which cannot be overlooked. It involves not merely the study of birds' eggs, but also of the laws of evolution, so ably put before us by Darwin and Wallace. It is only by the observation of apparently infinitesimal causes that we find there is a great work going on, of the fringe only of which we have knowledge. Take, first of all, the case of the Bunting. What simple means for concealing the eggs the bird adopts, viz., that of sitting on them. Otherwise they would be pretty evident. Not only does it conceal the eggs by overhanging herbage, as in the case of the Larks and Tit-larks, but, in addition, there is a great concealing power in the colour of the bird itself. Perhaps it would be well to consider, first of all, how eggs are formed so as to imitate their surroundings. Mimicry is not a good word with which to describe the process, for it seems to be associated with something frivolous. In Nature there is no ridiculous side, and to the general public the word mimicry, applied to the habits of birds, is misleading. Imitation is a better word than mimicry, because there is no second meaning behind it. It is a wonderful thing, then, that a bird, by a process of evolution, should so select its surroundings before depositing an egg that they should afford protection to that egg. There is not a better instance of this than the Kentish Plover, which literally selects a stone exactly like the egg it lays, and deposits the egg near the stone. Professor Newton, when lecturing to his students at Cambridge, one day held up before them an egg of this bird and a stone found beside it, and they could not tell which was which. The probability is that the stone is selected before the egg is laid. Again, the Ring Dotterel selects exactly the kind of nest which will best prevent detection. It does this with an absolute knowledge that the colour of the eggs is an imitation of the surroundings. Supposing the rising of unexpected tides compels the Dotterel to retreat from the sea-shore on to ploughed land, it alters its habits in a moment. It knows perfectly well that, surrounded by the brown soil its eggs will be easily seen, and so it collects shells off the beach and places them round the nest so as to detract attention from the eggs. Mr. Hewetson said he had frequently seen it done. The power of imitation is strongly noticeable in the case of the Lesser Tern, one of our most graceful birds, and which is

* A paper read before Section D of the British Association meeting, 1890.

to be found near the mouth of the Humber. When placed amongst pebbles, the eggs of this bird are exceedingly difficult to find. Jackdaws, Rooks, and Gulls would be very glad to make a meal off these eggs, and considering the number of their enemies, it is remarkable that the Lesser Tern is so common. The birds themselves are very conspicuous, and the preservation of the race depends entirely on the colour of the eggs and of the down of the young. The down is absolutely imitative of the surroundings of the young bird, and on that account its life is preserved. The same observations apply to the other Terns. The breeding-grounds of some birds are so thickly covered with eggs that identification by the birds themselves would be almost impossible if it were not for a variation in the blotches on the shells. Animals and birds work by what we please to call instinct, because we do not know what else it is. Differences which to us seem very small may be enormous differences to them.

Mr. Hewetson then went on to speak of the habits of the Norfolk Plover, a species unfortunately decreasing in number. This bird refuses to be surrounded by a hedge. It must be on an open plain, where it can watch everything that goes on around it. The nest of the Plover must be approached from the leeward side. The bird has such acute sight and hearing that if approached from the wind side the intruder will be observed. It is able to simulate its surroundings in a wonderful manner. Generally it lays two or three eggs amongst flint stones, and it is very difficult for a person with the sharpest eyes to detect them. One has to have a training after the manner of the "tracker," who is able to tell the direction a traveller has gone in, and many other things about him, from an inspection of the leaves of the bushes which have been passed, and the marks on the ground. There are thousands of keen eyes on the look-out for the eggs of the Norfolk Plover, for they are valuable as food for both animals and birds. It is, therefore, a tussle between the animal prowling for food and the bird desiring to perpetuate its species. The Common Lapwing is so conspicuous a bird that it does not trust to its own colouring, as many birds do, to protect the eggs when it is sitting on them. As soon as it observes the enemy coming it flies away. It has a particular antipathy to the Rook. The Rook is, Mr. Hewetson believes, the great destroyer of game birds. It has a very sharp eye, and the other birds whose eggs are preyed upon know that they have to be on the alert to conceal them, else they would fail in the race for life. In the case of the Brush Turkey, neither the male nor the female sit on the nest. This is made of leaves, damp in the centre, and the eggs are hatched by a process analogous to fermentation. If the Partridge does not sit very close, it is difficult for it to protect its eggs. As soon as it leaves the nest the eggs are perfectly evident. The Partridge's nest is very deep, and is made in some grassy copse, so that there is a general tendency towards concealment, except when a person passes immediately over it. But there is nothing so difficult to find as a Partridge's nest if the bird has only the sense to sit still. It is difficult to conceive how instinct shows a bird in what way to

colour its eggs, just as it is to understand how the colouring of the hairs on a Sloth changes when the leaves of the forest change. But animals do know when and how to arrange themselves so as to avoid detection. What is the utility of these things? Why, for instance, are the eggs of many birds white? It is to enable them to be seen in the dark. Besides being white, some eggs have a shiny surface, which reflects the light to a great extent. Of such a character are the Woodpecker's and Kingfisher's eggs, and they are laid in holes. It is convenient for the birds to have light-giving objects in their nests. In the case of Ducks, which build nests in dark places, the eggs are of that china whiteness which is not found in the eggs of other Ducks. The female Sheldrake has no power of concealment in itself, and so it builds its nest in a rabbit-hole, and it is necessary that the eggs should be white, so that the bird may see them as it walks down the hole. The Starling, again, frequently builds its nest in holes, and although the egg is of a bluish tinge, it has a bright surface, and is easily seen in the dark. The egg of the Golden Eagle is a conspicuous object, and it is obvious the Eagle does not care whether it is protected or not. First of all, there is the precipice to deal with before the Eagle's nest can be reached; and secondly, there is the ferocity of the bird. The colouring of the Guillemot's eggs seems to be ridiculous so far as its protection is concerned. Guillemots lay their eggs on the shelves of rocks on precipices, and it might be said that they were pretty safe on account of the safety accorded to the Gull's eggs. But this is not so in the least. On the first appearance of danger the Guillemot leaves its eggs to take care of themselves. But the shape of the eggs is such that to some extent they can do that. Jackdaws and Gulls are constantly seeking the eggs of the Guillemot, and it is rather a curious circumstance that at a distance of say 200 feet the eggs are hardly discernible with the unaided sight. Mr. Hewetson gave a case where he was only able to see two eggs of the Guillemot distinctly on a ledge of rock some distance down a cliff. A man went to get these and found 26 others on the ledge. The eggs were of various colours, and when he came to study the reason why he was only able to see two of them, he realised that it was because of the effect which colours seen at a distance have on the retina of the eye. The first impression, and the right one, of colours seen from a distance is soon lost. The complementary colours take the place of those originally seen. Guillemot's eggs are coloured so as to imitate the tints given to the sea by the atmosphere, and the eye of the observer was thus deceived.

Mr. Hewetson, in conclusion, stated that he had only touched the fringe of his subject, any branch of which might be made the basis of a whole lecture.

Meeting held in the Library of the Philosophical Hall, November 3rd, 1890. J. Charters Birch, L.D.S., in the chair.

THE STERNA AND SHOULDER GIRDLES OF BIRDS.

EDGAR R. WAITE, F.L.S.

Sterna are of very great value to the naturalist, as they are largely used for the purpose of classification. If we turn our attention to the classification of birds we are met at the very outset by the sternum. Birds are divided into two great classes, the *Ratitæ* and the *Carinatæ*. The *Ratitæ* include all the true non-flying birds, such as the Ostrich, Emu, and Apteryx, &c. The sternum of these birds is quite flat, like a raft, from the resemblance to which they take their name. The *Carinatæ*, on the other hand, possess a "carina" or keel to their sterna, and are capable of flight. The sterna of all flying birds do not bear the same relative size. Those birds which have a large keel are much better flyers than those which have a much smaller one; this was well seen on comparing the keels of the Woodpecker and the Sand Grouse: that of the latter bird is more than twice the relative size of the former, and the difference in their flight is correspondingly marked. The Woodpecker does little more than fly from the top of one tree to the bottom of another, while the Sand Grouse "goes like the wind." After giving a description of the various bones comprising the sternal girdle and the muscles connected with them, the peculiarities of variation in different families of birds was next pointed out and explained, among other things why the Swifts should be separated from the Swallows, and why the *Strigidæ* should be removed from the other Owls. In dealing with the furculum (or merrythought), it was shown that its principal function appeared to be to keep the head of the shoulder-bones apart during the down-stroke of the bird. In the *Falconidæ* (Eagles, Hawks, &c.), this bone forms a perfect arch, capable of resisting great pressure; while in some other birds it is long, thin, and weak, *e.g.*, in the Grouse family, and in non-flying birds it is rudimentary or entirely absent. Speaking of the coracoids, Mr. Waite showed that in many birds these bones were incapable of more than a very slight movement on the sternum; but in others, such as the Gannet—a powerful diving bird—it was shown that the movement is very great, and by this means the shock of the bird entering the water is broken. The address was illustrated by a large collection of sterna and by many diagrams.

Meeting held in the Medical School, November 10th, 1890, Professor de Burgh Birch, M.D., C.M., F.R.S.E. (President), in the chair.

DEMONSTRATION OF DIGESTION.

PROFESSOR BIRCH.

It was shown at the outset that digestion was the conversion of substances into such a condition that they can be absorbed into the body.

All food is indirectly derived from the soil—that is to say, the chemical constituents of the soil are first absorbed by the plants. The plants are then eaten by the herbivorous animals (vegetable feeders), these are then preyed upon by the carnivorous animals (flesh feeders), after which ranks man, who is both a vegetable and flesh feeder. In the very first stages of digestion or assimilation, an intermediate cause is necessary before this can take place. The soil in which the plant is found must have gone through some preparation before the plant can absorb the nutriment it requires. This preparation is made by one of the lowest forms of vegetable life, the nitrification bacillus. This organism breaks up the chemical constituents of the soil, and thus provides food for the plant, which it would be incapable of doing for itself, and hence would die of starvation. In animals also a preparation has to be made, which is much more complicated, before digestion can take place. It was pointed out that the lower animals had a better and more rapid digestion than man; the dog, for instance, is able to digest bones. A diagram was shown of the human alimentary duct. The mouth, through which the food first passes, is provided with saliva from the salivary glands, which causes the conversion of starch into alkali. The food then passes into the œsophagus, or gullet, where there is a supply of gastric or acid juice. The food next passes into the intestine, where it is again met with alkaline secretion. It was shown that the absence of these juices was the cause of indigestion. The lecture was illustrated by numerous experiments.

Meeting held in Room No. 80, Municipal Buildings, November 17th, 1890. Professor L. C. Miall, F.G.S., F.L.S. (Vice-President), in the chair.

The preliminary business included the acknowledgment of a valuable series (22 in number) of pamphlets by Professor O. C. Marsh, on North American Palæontology, presented by the author, and sent direct from Yale University Museum, New Haven, Connecticut, U.S.A.

A SKETCH OF THE LIFE-HISTORY OF SIMULIUM.

ARTHUR WALKER.

Simulium belongs to the animal sub-kingdom Arthropoda in the class of insects, and to the order Diptera. Little attention has been given to this subject either by naturalists or biologists, and perhaps the only published work worthy of reference is that of F. Meinert, a Danish writer, who gives an excellent, though very brief, description of the exoskeleton of the larva and pupa, but has nothing to say of its earlier stages or of the internal anatomy. The eggs are laid on the leaves and stems of aquatic plants, watercress, water ranunculus, glyceria fluitans, &c., and in the fastest part of the stream. They are of a yellowish-brown colour, resembling somewhat to the unaided eye a crop of diatoms. The eggs, which comprise many hundreds, are irregularly arranged and embedded in

a gelatinous mass held firmly together by threads of fibres. The eggs have thick shells, which make the study of the embryological development difficult to follow. The time required for hatching out is about seven or eight days. Allowance should be made, perhaps, for the fact that the eggs watched were not kept in running water. Development will doubtless be more rapid in running water where there is plenty of air and light. It is a well-known fact that the frog-spawn develops very quickly when it gets air and light, but can be checked considerably by taking the spawn away from these environs. The larvæ when just hatched are very transparent, with exoskeleton and appendages developed, but the internal structure—alimentary canal, nervous, dorsal, and tracheal systems—not readily traced. After a few days the larva assumes a greyish-brown colour (perhaps due to the suspended matter in the water), which renders them very opaque. The size of the larva when full grown is $\frac{3}{8}$ in. to $\frac{1}{2}$ in. in length, which is increased when about to change into pupa. The food upon which the larva subsists are diatoms, desmids, and crustaceans ; but they exercise no discrimination ; so long as the food is sufficiently small it passes it. When taking food the larva stands on the anal foot at right angles. The hinder end of the abdomen and thorax in larva are much thickened. The fore part of the abdomen is contracted ; the head also is proportionately small. Eleven segments may easily be made out behind the head, and on theoretical grounds we may suppose that there are one or two more. Chironomus, a nearly allied species, has thirteen distinct segments. Simulium has thirteen nerve centres, which give strong evidence of there being thirteen segments. The five or six segments at the middle of the body are clearly defined, but the three segments of the thorax and the four segments at the hinder end of the abdomen by being distended are almost entirely obliterated. The head of the larva is elongated with prominent labium in the front, arched on the inside, and covered with setæ of varying lengths, with eyes and accessory eyes on the side, apparently mere pigment spots. The antennæ are small, tapering, and three-jointed. The rotatory organs, or, as they are sometimes called, flabelliform appendages, are somewhat like those of culex (common gnat) but better developed, and project from the side of the labium. Each is furnished with about 50 setæ, which may be expanded or closed up into a pencil. These organs are used in feeding. When expanded there is a vibrating motion, which causes a small whirlpool—the food is thus drawn directly into the mouth. Should anything too large be attracted, doubtless the open mandibles or jaws are brought together, which will crush or liberate. When the larva is not feeding, the rotatory are folded up compactly and laid down the œsophagus or gullet. The mandibles are strong, curved, and tapering, provided at the extreme end with 12 to 15 teeth, arranged in irregular rows, fringed with setæ along the inner margin and on the inner side. The maxillæ are blunt, soft, and densely clothed with setæ, the inner setæ long and inclined towards the mouth. The maxillary palps are two-jointed, tapering and terminating with a

cluster of hooks. The labium corresponding to the second pair of maxillæ is a single plate transversely elongated, lying beneath and behind the mouth, its fore edges are armed with a row of small denticles. On the under side of the prothorax is a pair of appendages, so completely united as to resemble a single limb (which in chironomus are paired). The free extremity is furnished with a suctorial disc, whose edges are armed with a multitude of fine hooks, arranged in radiating rows. This organ can be retracted by means of a pair of long muscles which pass to the side of the thorax. None of the remaining segments carry appendages until we come to the last abdominal segment. Here, again, we find the paired appendages, seen in chironomus, which are replaced by what looks at first sight like an additional segment. It forms a suctorial cup, like one of the suckers on the arms of a cuttle fish. The raised margin is provided with rows of fine teeth, very like those of the prothoracic limb. Within the contracted cup, formed by the united anal feet, are three papillæ, which are alterable in shape, and may be protruded or withdrawn into the rectum at pleasure. These papillæ are, perhaps, used for loosing the anal foot. The anus is situated in the construction just in front of the contractive disc and on the dorsal side of the body. Alimentary Canal.—The œsophagus is a simple tube furnished with transverse muscles, and is deeply folded into the proventriculus or crop. The stomach is long, cylindrical, and simple. Both crop and stomach are lined by a chitinous membrane, which encloses the food, as in chironomus, crane fly, blow fly, and various diptera. Two small malpighian tubules are given off on each side at the commencement of the intestine. The salivary glands are simple, but extremely long. They extend to the hinder end of the body, and are then bent forward to about one-third of its length. The salivary ducts open upon a prominence or thread organ on the floor of the mouth a little in front of the labrum. The use of this thread is for mooring the larva, and for making pupa case or cocoon. The body of pupa projects about one-third of its length out of the opening of the cocoon, and is provided with respiratory tufts of four pairs on each side, situated on the fore part of the dorsal side of the thorax. In the development of the head of the fly many of the organs appear in the larva, as in chironomus, culex, and corethæ. The compound eyes, for example, can be easily seen near the simpler eyes of the larva. There is an important difference in the development of simulium as compared with chironomus. In the latter nearly all the organs of the head are developed in the prothorax, whereas in simulium the new parts form beneath the corresponding organs of the larva. The imago is a small two-winged fly, with large and enormously arched thorax. In hot countries some of the simulidæ, and especially on the banks of great rivers, are a great annoyance to men and cattle. The bite raises a small blister. In Hungary and the Lower Danube they are sometimes very mischievous; the cattle become furious, and rush wildly about, rubbing their hides against trees and rocks. The fly attacks the corner of the eye of man; the species is *S. maculatum*, or a closely allied

one. Another species attacks the eyes of sufferers from ophthalmia in Egypt. The malignant species are not believed to occur in Britain. The paper was illustrated by lantern slides and microscopical preparations. There was a short discussion, in which the Chairman, Messrs. Edgar R. Waite, F.L.S., and Harold Wager took part.

Meeting held in the Municipal Buildings, November 24th, 1890, James W. Addyman, B.A., in the chair.

THE SURFACE FILM OF WATER AND ITS RELATION TO PLANTS AND ANIMALS.

PROFESSOR L. C. MIALL, F.G.S., F.L.S.

A number of interesting physical experiments were first made in proof of the microscopical film upon water. Objects whose specific gravity are heavier than water were placed on the top, and by the surface film floated, but when the film is broken through the objects descended to the bottom. It was shown that this surface film in relation to plants and animals was full of interest to naturalists; at the same time, it was a new subject, and would well repay the personal observations of members. Attention was directed to some interesting facts in water-lilies, the provision in nature for the leaves and buds to cut the surface film. Each is provided with a fine tapering point, which readily cuts the film; the leaves then unfold, and rest on the top of the water; if by chance the leaf become submerged, the scoop-like leaf, with its sharp edge all round, cuts the film, and the water runs off through the slit adjacent to the stem. Without these provisions these plants would have the greatest difficulty to get through this elastic surface film. The duckweeds were next alluded to. It was shown that the common oval leaf duckweed was able to cut the surface film, and always grows on the top of the water; whereas the ivy-leaf duckweed, which cannot cut this film, was always found under water. Several other plants were mentioned, which had each their peculiar way of coping with this film. To a number of insects the surface film formed a safe platform to skate and jump upon. Their tarsus, or feet, are covered with many hairs, which thus enable them to skim on the surface. Many interesting facts were given in regard to dipterous larvæ and the water-spider.

THE CONVERSAZIONE.

The annual conversazione was held at the Philosophical Hall on Wednesday evening, December 3rd, 1890. Coffee was served at half-past seven, and for half an hour a reception was held by the President (Professor De Burgh Birch, M.D.). For the entertainment and instruction of the guests abundant provision had been made. Those lightly affected

towards science were able to enjoy readings by Mr. Ernest Denny; lantern slides, illustrating the history and scenery of Lincolnshire, by Mr. C. H. Bothamley, F.I.C.; while the committee had made arrangements by which the picture by Mr. Lockhart, R.S.A., portraying the Jubilee Celebration in Westminster Abbey could be inspected, and also a selection of life-studies made in preparation for the picture. In addition the library had been furnished as a drawing-room by Messrs. Reid Bros., and hung by Mr. Broadhead, of Albion Street, with an excellent collection of oil paintings kindly contributed by Miss Taylor, and Messrs. W. P. Bowman, A. S. Dixon, R. Jackson, J. Broadhead, W. F. Smithson, John Waite, and Richard Wilson. A selection of music was given by the Leeds Private Orchestral Society, under the direction of Mr. Staniland Hall. The scientific interest of the visitors was maintained in various ways. Amongst the microscopic exhibits shown under forty-one microscopes was a series dealing with the larvæ, pupa, and imago of simulium, exhibited by Mr. Arthur Walker. Other objects included two donations to the Society, made during the year. These are a fine collection of birds' skins and eggs from the interior of Australia, the gift of Mr. G. A. Keartland, of Melbourne, who has relatives in Leeds; and a series of illustrated publications sent by Professor Marsh, of Yale, United States, who was a visitor at the Leeds meeting of the British Association, dealing with the cretaceous fauna of North America. Among the general exhibits may be mentioned a collection of birds and skins (chiefly British), and clutches of the eggs of British birds; photographs of mummies in the British Museum; and water-colour drawings of mammals, all contributed, and the latter executed, by Mr. Edgar R. Waite, F.L.S. A very perfect specimen of a trilobite was exhibited by Mr. E. Robinson; and a finely executed series of micrographs was contributed by Mr. J. Jamieson.

THE STRUCTURE AND LIFE-HISTORY OF A FUNGUS.

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THE object of the present paper is to give an account of the structure and life-history of a small microscopic fungus, scientifically known as *Peronospora parasitica*, as a type of that group of plants known as the Fungi. It is perhaps, in some respects, not the best type for this purpose, yet it has the advantage of having a comparatively simple structure and method of development, easy to understand, and serving as an excellent introduction to the morphological study of the Fungi. This type is also the more interesting because many structural details, which are fully described in this paper, have been more completely worked out in it than in any other.

CHARACTERISTIC FEATURES OF THE FUNGI.

The Fungi are mainly distinguished from all other plants by the absence of chlorophyll, but they are further distinguished by a distinct and characteristic mode of development, which is even sufficient to separate them from the Algæ—the group with which they are most closely connected—apart from any considerations as to the presence or absence of chlorophyll. Plants which contain chlorophyll are able by its means to take up from inorganic food substances all the materials which they require to build up their tissues—transforming them during the process into the extremely complex organic compounds which enter into their composition. Fungi, on the other hand, owing to the absence of chlorophyll, are unable to do this; they require organic compounds already prepared, and in consequence have to depend for their food upon organic substances formed by other plants or by

animals. They must therefore obtain their food either as parasites, and prey upon other living plants or animals, or as saprophytes, living upon dead organic substances. In some cases a fungus may resort to both these methods; it may be parasitic in one stage of its development and saprophytic in another.

Structure of Peronospora Parasitica.

Peronospora parasitica belongs to that division of the Fungi which is known as Peronosporeæ, and which includes a large number of forms, most of which are well known to agriculturists and others as producing many of the diseases to which plants are liable, such as the potato and turnip diseases and many others.

The Peronosporeæ are, in the majority of cases, parasitic in the interior of living plants. The numerous forms found in the group differ in detail, but they are all closely allied in their structure and method of development.

P. parasitica is common on many species of cruciferous plants, especially the cabbage and the common Shepherd's Purse. The infected plants are easily distinguished from their fellows by being covered externally with large, white, dusty-looking patches which may be found clothing the stem, leaves and fruits, in many cases completely hiding their normal structure, and often causing the infected parts to swell up to many times their original size. This increase in size, or hypertrophy as it is called, can be seen extremely well in the seed capsules of Shepherd's Purse when they become infected.

In addition to *P. parasitica* another fungus is commonly found forming white patches on the same plants; and the two are often associated with each other. This second fungus, *Cystopus candidus*, can, however, be easily distinguished from *P. parasitica*, the white patches of which have a dusty appearance, by its smooth and shining surface.

Structure of the Hyphæ.

The white patches are composed of large numbers of spore-bearing filaments which are connected below the epidermis of the plant, with a large number of other filaments which penetrate in

all directions between its cells, from the epidermis to the pith, in the tissues of the leaves, and in the seed vessels. These filaments are long narrow tubes capable of rapid growth and elongation (Fig. I. *a*), able to push their way between the cells of any of the tissues and are much branched. They never divide up by transverse walls except at the points where reproductive organs are formed, these being always cut off completely from the remainder of the filament. We may, therefore, speak of them as simple cells. Such a mass of fungal filaments, whether found inside a plant or outside is spoken of as a mycelium, and the individual filaments are called hyphæ.

The hyphæ contain a considerable quantity of protoplasm, which forms a thick parietal layer on the walls, enclosing a central cavity, across which numerous thick protoplasmic strands pass. In some places, however, they appear to be quite full of protoplasm, with no central cavity, and it is probable that at these points rapid growth and elongation are taking place. Nuclei are found in large numbers in the protoplasm in all parts of the mycelium, both in the parietal layer and in the central strands (Fig. I. *n*), but in those places mentioned above, where the hyphæ appear to be completely full of protoplasm, the number of nuclei present is considerably increased, and they form a not inconsiderable portion of the contents of the hyphæ. In other places, however, the nuclei are comparatively few in number, and are scattered here and there, often at considerable intervals, in the protoplasm.

The hyphæ obtain their nourishment from the host-plant through a large number of short globular expansions which are formed laterally on the hyphæ, and penetrate into the interior of the cells of the host (Fig. I. *b*), whence they absorb the food substances required and transmit them to the filaments, where they are used up in furthering the growth and development of the fungus. These structures are known as haustoria, and may be developed anywhere on a hypha. They are often developed in whorls consisting of as many as five or six, or even more, radiating from the hypha in a very regular manner. They vary considerably in size, and sometimes almost completely fill the cells into which they penetrate; they are also often lobed or branched, and they always contain a large quantity of protoplasm and numerous nuclei, which have passed into them from the filament.

The Nucleus.

The presence of nuclei in the cells of the higher plants has long been known to be of the greatest importance to their life and development. The exact function of the nucleus is at present unknown, but looking at its extreme complexity of structure and the complicated changes which take place in it during the growth and division of a cell, it must be an important one. It becomes, therefore, a point of considerable interest to determine whether the cells of the lower plants contain nuclei or not, and also whether they have a structure and undergo changes comparable with what is found in the nuclei of the higher plants. As regards the presence of the nuclei in the lower plant cells, we are now able, thanks to the researches of Schmitz,[1] Zacharias,[2] Scott,[3] and others, to show that the cells of all plants, with the exception of the Bacteria, contain one or more nuclei; and the same may be said of the animal kingdom. It should be remarked, however, that the nuclei in these lower plants are so small that it becomes a matter of some difficulty to distinguish them from other small bodies contained in the protoplasm. Dr. Schmitz,[4] who in 1879 announced that he had been able to show the presence of nuclei in the cells of all Fungi, relied largely upon the fact that when placed in a staining solution such as haematoxylin, the nuclei become more deeply stained than the remainder of the protoplasm. This method of distinguishing them from the other granules in the protoplasm is, however, hardly satisfactory, because the granules take the stain as well as the nuclei; moreover, it sometimes happens that, owing to defective methods of preparation, the protoplasm forms roundish deeply-staining coagulations, which may be easily mistaken for nuclei. There is, in fact, at the present day no decisive test for nuclei, except the morphological one of structure. Zacharias and others have, it is true, done much to show that the presence of a nucleus may be determined by chemical means, but their tests, although they are extremely valuable, are not so much tests of the presence of a nucleus as of the presence of nuclear substance; and, as has been pointed out, the nuclear substance may be dissolved in the cell protoplasm. Although much may be done in the future, from the chemical side, it is,

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[1] Sitzgsber d. Niederrh. Ges., 1879. [2] Bot. Zeitung, xlv., 1887.
[3] Linn. Soc. Journal Bot., 1887. [4] Loc. Cit.

I think, necessary at the present time, in order to decide whether in any given case the numerous small bodies in the protoplasm should be looked upon as nuclei—in the same sense in which we speak of them in the higher plants and animals—to show that they have some perfectly definite structure which distinguishes them from the other bodies in the protoplasm.

Perhaps the most important factor in the determination of this question lies in the division of the nucleus; where this is indirect or karyokinetic we have the most satisfactory proof of the nuclear nature of the body in question. It is not necessary that the changes which take place during this karyokinesis should be so complicated or so numerous as those which take place in the higher plants. It is sufficient if we are able to recognise that the division is one which conforms to some simple generalisation in which the changes which take place in the nuclei of the higher plants are included. In the nuclei of the higher plants we can, roughly speaking, recognise two distinct constituents in each nucleus: one which is capable of becoming stained deeply by aniline dyes, and another which remains unstained. The former is called *chromatin* the latter *achromatin.* When the division of the nucleus takes place, it does so in such a manner as to bring about the separation of the chromatin into two equal—or in some cases perhaps even unequal—parts, each of which becomes a perfect nucleus.

The changes which take place may be summed up as follows. The chromatin breaks up into a number of isolated parts of characteristic form, which may be called the chromatic elements. These become arranged in the median plane of the nucleus between its two poles; they then divide into two halves, one of which goes to either pole, and there they become transformed into the network of two new nuclei. This process of division is known as karyokinesis.

So far as I am aware, two observers only have made researches upon karyokinesis in the nuclei of the Fungi. Rosenvinge[5] has obtained indications of it in certain Agaricineæ, but was not able to demonstrate it satisfactorily; and Hartog[6] has recently shown that some of the phenomena of karyokinesis

[5] Ann. des Sci. Nat., Série VII., tome iii.

[6] Hartog—Recherches sur la Structure des Saprolegniées.

occur in the division of the nuclei in the Saprolegnieæ. In *Peronospora parasitica*, however, the nuclei have a definite structure, and the process of division in them is distinctly karyokinetic and closely allied to that which takes place in the nuclei of the higher plants.

Nuclei of the Hyphæ.

The nuclei of the hyphæ, in the resting stage, are spherical or slightly oval bodies (Fig. II. 1, 5.) In those parts of the hyphæ which appear to be rapidly growing, the nuclei may become considerably elongated and deformed (Fig. IV.) Each nucleus is vesicular, and contains a considerable quantity of chromatin, which is arranged peripherally on its wall. In some nuclei, the chromatin appears to form a continuous ring, while in others it is broken at one or more points, and in others again it presents a somewhat granular appearance. It is, therefore, probable that the chromatin body is of a somewhat irregular shape, and may form a coarse network of very thick threads; or it may be divided into two or more segments. But although indications of the above structure are visible, it is impossible to say with certainty what is the exact structure of the chromatin body in the nucleus in the resting stage. Inside the chromatin is a substance which does not stain very deeply, and in many cases is not distinctly seen owing to the thickness of the surrounding chromatin. The nucleus appears to be surrounded by a limiting layer or nuclear membrane.

The division of the nucleus is preceded by a perceptible increase in size, and by considerable changes in the chromatin, leading to the formation, or separation of it into distinct threads. In many cases the chromatin appears to form granules in the nucleus, but their appearance seems to be due to the fact that the nucleus is in such a position as to show only the ends of the threads. The threads appear to be few in number; they are somewhat elongated, and are arranged irregularly. The nuclear membrane can be distinctly seen at this stage; it appears to belong entirely to the nucleus, and it persists, so far as can be seen at present, during the whole of the changes which the nucleus undergoes during its division. The nucleus next elongates slightly, and at the same time the threads arrange them-

selves longitudinally in the equatorial plane. A separation of the threads then takes place into two groups which travel to either end of the nucleus. At this stage the nucleus appears to consist of an oval mass of slightly staining substance, in which the deeply stained threads are to be seen grouped at each end. The next stage is seen in the gradual constriction or inflection of the nuclear membrane, and at the same time the filaments at each end of the nucleus begin to unite with each other to form the daughter nuclei. A narrow bridge connecting the two nuclei remains for some time, but this is finally broken down, and the two daughter nuclei are completely formed.

Organs of Reproduction.

We have now to consider the way in which the Fungus reproduces itself. In *P. parasitica* as well as in most other Fungi, there are two distinct methods of reproduction. (1) Asexual or vegetative, in which a certain portion of the plant is cut off and from which a new plant is ultimately developed, and (2) Sexual in which a new element or spore is formed by the combination (?)* of two masses of protoplasm from the same or from different filaments.

The asexual organs of reproduction are found on special branches of the filament which project through the epidermis of the host plant into the air, to form the white patches already mentioned. These branches are known as sporophores. They branch freely, and each branch becomes bifid at the tip. The spores are borne on these tips. They arise as slight expansions which gradually increase in size, obtain protoplasm and nuclei from the filament and are finally cut off by a constriction. The spore when thus cut off is a somewhat oval body, full of protoplasm and nuclei. These differ structurally from the nuclei in the mycelium. They are round or oval bodies consisting of a small central mass of chromatin surrounded by a layer of less deeply staining substance, which appears to be enclosed in a nuclear membrane. (Fig. V. n.)

When ripe the spore falls off and immediately begins to put forth a tube which penetrates the epidermis of the host and gradually develops into a new plant.

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* As will be seen later it is doubtful whether fertilisation does take place in *P. parasitica*.

In other species of the genus the spores develop in a different manner. The spores fall into a drop of water-rain or dew, where their protoplasm breaks up into a number of distinct pieces, which escape from the cell and are able to swim about by means of two cilia with which they are furnished. After swimming about for a time they settle down on the plant, send out a germ tube into the epidermis and begin to develop in its tissues in the manner described above.

This formation of motile spores is of common occurrence in the Fungus of the potato disease, and during moist, damp weather increases considerably its power of extending rapidly over large areas.

The manner in which the first tube, developed from the spore, penetrates the epidermis varies in the different species. It is of course necessary for the young Fungus to obtain food material as soon as possible, as it contains very little, if any, reserve food material in itself, and its first care, therefore, is to obtain a safe footing in the host plant. In the case of the potato disease fungus, the motile spores, as soon as they come to rest on the epidermis of the potato plant, surround themselves with a delicate cell-wall and immediately afterwards put forth a tube which penetrates at once into the host plant by piercing the cell-wall, it thus obtains food at once, and is able to pass into the intercellular spaces beneath the epidermis where it begins to ramify and form a mycelium. In other cases the spore sends out germ tubes which pass through the stomata of the plant directly into the intercellular spaces, and from these gradually pushes its way into all parts of the plant.

Sexual Method of Reproduction.

There are two kinds of sexual organs, male, antheridia, and female, oogonia. The oogonia are formed as swellings on the hyphæ. They may be either terminal or intercalary. In the former case the oogonium begins to form as a slight expansion of the end of a filament, this gradually expands into a globular sac of considerable size, which becomes filled with protoplasm and nuclei obtained from the hypha. When the oogonium has reached its full size, it is cut off from the hypha by a transverse wall. (Fig. VI.)

An intercalary oogonium is formed on the filament at any place other than the apex, as a swelling which increases in size until it has reached its full development when it is cut off from the filament by two septa, one on either side.

Simultaneously with the formation of an oogonium one or more antheridia are developed in connection with it. These are produced either on the same hypha or on hyphæ adjacent to it. The antheridia come into close contact with the oogonium and keep pace with it in its development. They contain protoplasm and nuclei derived from the hyphæ, and like the oogonia are cut off by transverse walls from the remainder of the filament (Fig. VI.). The oogonia and antheridia are found in large numbers in all parts of the host plant. They appear to be developed at first near the surface, but are afterwards produced abundantly in the deeper tissues of the plant. They sometimes vary considerably in size, but as a rule the oogonia obtained in sections from the same piece of infected tissue do not exhibit much variation in this respect.

The number of nuclei present in a single young oogonium is considerable, I have counted as many as 112; and it is possible that in some oogonia there are more than this; while in others the number is considerably less. The antheridia contain from six to twelve nuclei each.

The male and female organs undergo considerable changes before the cell which is to produce the new individual is perfected. These changes are somewhat complicated owing to the changes which take place in the nuclei during the process. The following is a description of the phenomena in question, such as would be seen in fresh specimens without any special preparation.

The most important changes take place in the oogonium. Soon after the delimitation of the latter from the hypha, the protoplasm contained in it begins to separate into a central portion, which forms a smooth, globular body known as the egg-sphere or oosphere, which becomes surrounded by a delicate hyaline membrane; and an outer portion called the periplasm which surrounds the oosphere and assists later in completing the formation of its cell wall. The antheridium also undergoes changes. It develops a tube which penetrates the wall of the oogonium and comes into contact with the wall of the oosphere. A small

opening is formed between the oosphere and the antheridial or fertilising tube, and it is probable that when ripe a small quantity of protoplasm passes over into the oosphere from the antheridium. This passage of protoplasm has not been seen in *P. parasitica* directly nor in any of the Peronosporas, but in some members of the group, such as *Pythium*, a considerable quantity of protoplasm has been seen to pass over into the oosphere from the male organ. After fertilisation has taken place, a thick outer cell wall begins to form around the oosphere, and this is probably developed entirely from the periplasm. This wall forms a thick, brown, coarse outer layer for the oospore, fitting closely to its inner and more delicate one; its outer surface is covered with irregular thickenings, giving it a very rugged appearance.

This description may be looked upon as a simple expression of the phenomena of oospore formation. It does not, however, represent all that takes place. The formation of the oosphere is preceded and accompanied by changes which take place in the nuclei of both the antheridium and oogonium. The structure of these nuclei just at the time when the oogonium is delimited from the filament is similar to the structure of the resting nuclei in the mycelium. As development proceeds they become much enlarged, and, at the same time, the chromatin becomes distinctly visible in the form of threads (Figs. III. and VII.). The chromatin itself appears to increase in amount, as there is certainly more chromatin in the enlarged nuclei than in those in the resting stage. Where this chromatin is obtained is at present doubtful. It may perhaps be absorbed in some way from the surrounding protoplasm, but further investigation on this point is needed.

While the nuclei are increasing in size, changes are taking place in the protoplasm. Numerous vacuoles appear in it (Fig. VII.), and these gradually increase in size until at a slightly later stage nearly the whole of the central space is taken up by them (Fig. VIII.). During their formation the protoplasm is displaced and becomes almost entirely restricted to the periphery of the oogonium, a small quantity only of granular protoplasm remaining in the centre and connected with the peripheral portion by a few thick protoplasmic strands (Fig. VIII.). The nuclei also accompany the protoplasm to the periphery, the last few passing along the

protoplasmic strands. At this stage the nuclei exhibit a very distinct nuclear membrane and present an appearance very much like that of the nuclei of the higher plants in a stage just preliminary to division (Figs. III and VIII.). The nuclei, while still in this stage, take up a position in the protoplasm so as to form a very regularly arranged layer, on the innermost side of it next to the central space. This central space is large, taking up about two-thirds of the whole space in the oogonium, and almost completely spherical; it is extremely well defined by the layer of granular protoplasm surrounding it. The nuclei now enlarge still more and become slightly elongated in a tangential direction. The chromatin threads become more distinct and are seen to be almost equal in size; they are scattered irregularly in the substance of the nucleus. The nuclear membrane now becomes invisible and the chromatic threads appear to lie loosely in the protoplasm. They next become arranged longitudinally in the equatorial plane of the nucleus. In some nuclei a slightly-stained, somewhat cone-shaped mass may be observed at each end of the nucleus. This may be a spindle-figure, but it is much too indistinct to be satisfactory. I have only seen it under the most careful illumination and with an apochromatic objective. It is indicated in Fig. IX. *s*, but is a little too strongly shaded. The nuclei next divide into two groups of threads which separate from each other to form two daughter nuclei (Fig. III. 3, 4).

Simultaneously with these changes in the nuclei of the oogonium, similar changes have been taking place in the antheridium, the nuclei of which divide up in exactly the same manner and at the same time. The changes in the oogonium and antheridium go on very regularly together, but I have not been able to observe any separation of the protoplasm of the antheridium into a central and peripheral portion as in the oogonium.

The arrangement of the nuclei in the oogonium now becomes somewhat irregular. Further divisions of the nuclei take place; the nuclei at each division becoming smaller in size (Fig. X.). A small number, two or three, of these smaller nuclei then pass along the protoplasmic strands towards the centre of the oogonium (Fig. X. *n*); the others remaining outside in the peripheral layer.

While these nuclei are passing along the protoplasmic strands towards the centre, the cell-wall of the oosphere begins to form

as a delicate layer, composed of minute protoplasmic granules, on the inner side of the periplasmic layer and just outside the central space and its small quantity of protoplasm and nuclei (Fig. X. *o*). This granular layer is probably derived from the periplasm. By the complete fusion of these granules with one another a delicate hyaline membrane is formed (Fig. XI. *o*), the cell-wall of the oosphere. This wall gradually increases in thickness by the addition of new layers to its exterior, which are derived also from the periplasm. The nuclei of the periplasm are at this stage dividing up rapidly, so far as can be seen, by a process of karyokinesis, into a large number of very small nuclei, and these are gradually transformed into layers forming the outer cell wall of the oospore. These periplasmic nuclei thus seem to have a very distinct function; forming as they do a large part of the material out of which the cell wall is built up.

At the time when the nuclei are arranged regularly in the peripheral protoplasm of the oogonium the antheridium begins to develop a fertilising tube which penetrates the oogonium, and increases in length until it comes in contact with the oosphere, just at the time when the cell wall of the latter is formed (Figs. X. and XI.). The antheridial tube is much elongated, and does not pass directly to the oosphere, but takes a somewhat oblique course to one side of it. The end of the tube is swollen in a characteristic manner. The swelling is cylindrical and takes up about one-third of the length of the tube. It is this portion of the tube which comes into close contact with the wall of the oosphere. In two cases, at least, I have been able to observe an opening between the terminal portion of this swelling and the oosphere (Fig. XII. *f*); this opening, however, is extremely small and easily overlooked.

The antheridium contains at this period a large number of small nuclei which have been derived from the division of the pre-existing larger nuclei (Fig. XII.). One or more of these nuclei pass over into the fertilising tube together with a small quantity of protoplasm (Fig. XI.). The oosphere at this stage contains one nucleus, which exists in place of the two or more pre-existing nuclei, these having fused together to form the single central nucleus; at a later stage, however, two nuclei are to be observed (Fig. XII. *n*), and at a still later stage a single

nucleus only is again seen. The most natural interpretation of this is, that a nucleus passes over from the fertilising tube into the oosphere and fuses with the central nucleus. I have not been able to observe these phenomena directly, however, and, therefore, I think the question as to whether fertilisation does or does not take place is at present an open one.

The nuclei in the oosphere, at all stages except the earliest, appear to contain very little chromatin, and are very different in appearance from the other nuclei. I may, however, point out here that observations on the protoplasm and nuclei inside the wall of the fully formed oosphere are rendered somewhat difficult on account of the thickness of the cell wall, which prevents the proper penetration of the preservative and other fluids.

At a late stage in the formation of the oosphere, the antheridium contains only a very small number of nuclei. It appears that some of them pass into the fertilising tube and then into the periplasm, through the breaking down of the swollen end of the tube, which disappears altogether at a later stage, the smaller portion of the tube also becoming lost to view.

The outer layer of the wall of the oospore is formed by the deposition of the whole remaining mass of protoplasm and nuclei upon its inner wall in the form of a rugose mass which gradually becomes converted into a dense exosporium. The wall of the oogonium at the same time contracts and forms at this stage a much crumpled and more or less disorganised envelope for the oospore. The antheridium also contracts and finally disappears altogether.

When mature, the oospore contains a considerable quantity of oily substance which is generally found in the centre, surrounded by a layer of granular protoplasm. It now enters upon a period of rest which probably lasts until the following spring, when it begins to germinate. In the different species of the group this germination varies. The oospore enlarges and bursts the exosporium and the inner portion sends forth a tube which may at once develop into a new plant, or it may produce a sporangium in which are formed motile spores, each capable of germinating and producing a new individual.

The formation of oospores appears to depend to some extent upon the nutriment available. During the summer, when the

fungus can obtain plenty of nourishment from good healthy host-plants, the asexual method of reproduction is the only one that exists. As soon as autumn begins, however, and nutriment fails, the fungus begins to produce sexual organs in great abundance, and it is interesting to observe what an immense amount of material is used up in forming the protective layers of the oospore, compared with that which is set aside to develop during the next spring into the new plant. Roughly speaking, out of the 112 or more nuclei which are contained in the young oogonium one or two only are set apart, together with a very small quantity of protoplasm, to form the protoplasmic contents of the new cell, the others, as already seen, are used up in forming the protective coverings for this cell.

Methods of Examination.

It may be useful here to give a brief summary of the methods used in the examination of the various structures mentioned in this paper.

For the examination of the Fungus in the living state, thin sections of the infected plant were made by a sharp razor, and mounted in water, and were then examined first under low and next under high power.

To obtain preparations showing the nuclei, thin sections of the infected plant were stained for some time in a dilute solution of hæmatoxylin, and mounted in Canada balsam in the ordinary way. Other preparations were stained in picronigrosin and mounted in glycerine jelly. These preparations, however, although they clearly showed the presence of nuclei, were not found to exhibit the structure of the nucleus, or any of the minute detail in the sexual organs satisfactorily, as the protoplasm itself was stained too deeply, and sections could not be obtained thin enough to allow the nucleus to be seen, except through a layer of protoplasm.

Recourse was therefore had to the Cambridge ribbon-section-cutting microtome. The following are some details as to the methods employed. The fresh infected tissues of the Shepherd's Purse were cut up into small pieces, to allow the easy penetration of preservative and other fluids, and placed at once either in absolute alcohol or chromic acid solution. The chromic acid specimens after remaining in the solution for twenty-four hours

or more, according to size, were then thoroughly washed in 70 per cent. of alcohol, until all the chromic acid disappeared, then transferred to methylated alcohol, and finally to absolute alcohol. The tissues were then treated in two ways.

(1) The pieces of tissue were transferred to the stained fluid, a strong solution of haematoxylin in Kleinenberg's solution. They were left in this for a few days, and were then successively washed in 70 per cent., 90 per cent., and 100 per cent. of alcohol. They were left in absolute alcohol for twenty-four hours or more, until thoroughly dehydrated. When perfectly free from water they were transferred to turpentine for about forty-eight hours, and were then placed in soft melted paraffin wax for about twenty-four hours and were finally transferred into hard paraffin wax, where they were left for about two days. The melting point of the hard wax was 59° C., of the soft 49° to 50° C. The tissues were then embedded in small square blocks of the hard paraffin wax, and very thin sections cut by means of the microtome. The ribbons of sections were cemented to the slide with a solution of shellac in creosote, and mounted at once in Canada balsam.

(2) The preparation of the tissues was the same as above except that the staining was left out until the sections had been cut and cemented to the slide. The ribbons of sections were cemented to the slide with a solution of white of egg and glycerine. The paraffin wax was melted by placing the slide on a water bath, and was then washed off in turpentine. The slide was then placed in absolute alcohol, to get rid of the turpentine, and afterwards transferred to the staining solution. All these operations are best performed in small beakers, containing the various solutions used. The best staining solution was found to be a dilute solution of Kleinenberg's haematoxylin in water. This was made by adding a few drops of a strong haematoxylin solution to a beaker of water until the whole was decidedly coloured. The sections were left in this until they were considerably overstained, and were then placed in a dilute solution of acid alcohol to reduce the stain. The acid alcohol solution was only just strong enough to reduce the stain slowly. It was made by adding a few drops of strong hydrochloric acid to a beaker of 70 per cent. alcohol. The sections were then successively washed in 70 per cent., 90 per cent., and 100 per cent. of alcohol, and were next transferred to turpentine until quite clear and transparent (a few minutes was found to be sufficient for this),

and were then mounted in Canada balsam. The preparations thus obtained, owing to the thinness of the sections, which were on the average only about the $\frac{1}{8000}$ of an inch thick, exhibited the structure of the nucleus clearly and distinctly.

The observations described in this paper, upon the minute structure of the nuclei and sexual organs, have been made almost entirely upon sections obtained in this manner.

EXPLANATION OF FIGURES.

FIG. I.—Section showing branches (*a*) of the mycelium of *P. parasitica* growing between the cells of the pith of Shepherd's Purse, *b.* haustoria. Zeiss D.

FIG. II.—Figures illustrating nuclear division in the mycelium as seen under a low magnifying power. Zeiss D.

FIG. III.—Nuclei of oogonium in various stages of division, × 1,500.[1] The numbers in the above two figures denote the successive stages of division.

FIG. IV.—Small piece of the mycelium containing elongated nuclei. × 1,000.

FIG. V.—Section of a spore on sporangium of *P. parasitica*, showing the numerous nuclei, *n.* slightly stained portion of nucleus, *c.* chromatin.

FIG. VI.—Section of an oogonium and antheridium which have just been delimited from the hypha. The nuclei have enlarged slightly, and the chromatin is somewhat broken up. × 1,000.

FIG. VII.—Section of an oogonium at a little later stage than Fig. VI.; the nuclei are larger and the thread structure is distinctly visible. Numerous vacuoles *v.* are present. × 1,000.

FIG. VIII.—Section of an oogonium with its antheridium. The nuclei are arranged very regularly in the periphery of the oogonium. The central portion of the oogonium contains a quantity of less dense protoplasm; *a*, antheridium; *p*, periplasm; *o*, protoplasm of the oosphere. × 1,000.

FIG. IX.—Section through the peripheral portion of an oogonium at the stage shown in Fig. VIII., so as to include a complete layer of the nuclei. The nuclei exhibit a thread structure, many of them in a stage just previous to division. Some very faint conical, slightly stained masses, *s*, probably of the nature of a spindle figure are to be seen in connection with many of them; *n*, nucleus seen from the end; n^1 nucleus seen slightly oblique. × 1500.

1. Except where otherwise stated, the figures have been drawn by means of the camera lucida, and the apochromatic object glasses of Zeiss.

FIG. X.—Section of an oogonium in which the peripheral nuclei have divided up into a number of smaller nuclei, n^1. The wall o the oosphere, *o*, is just beginning to form, and appears as a somewhat granular layer, just inside the layer of periplasm, *p*. The nuclei of the antheridium, *a*, have also divided up in the same manner; *b*, antheridial tube. A single nucleus, *n*, is seen in the protoplasm of the oosphere, × about 1,000; Swifts $\frac{1}{16}$ water-immersion.

FIG. XI.—Section of an oogonium and antheridium, showing fertilising tube containing two nuclei. × 1,000.

FIG. XII.—Section of an oogonium and antheridium after fertilisation is supposed to have taken place. The fertilising tube is seen to open into the oosphere by a small hole, *f*, placed very near the end of its swollen portion. The antheridium contains a number of nuclei, and the oospore, *o*, contains two very faintly stained nuclei, *n*. × 1,000.

RULES.

THE LEEDS NATURALISTS' CLUB AND SCIENTIFIC ASSOCIATION,

Is established for the association of its members for mutual assistance in Natural History, and Scientific Research, and to spread a taste for Scientific knowledge in Leeds and district, together with the detailed and systematic investigation of the natural productions and physical features of West Yorkshire.

These objects it endeavours to attain by affording facilities for the reading and discussion of papers on scientific subjects, and the examination of specimens and apparatus; by the formation of a scientific library and of local collections; by the publication of reports and papers; and by the organising of out-door excursions.

MEMBERSHIP.

1. The Club consists of two classes of members—Ordinary and Honorary.

2. Candidates for ordinary membership are proposed and seconded on a nomination form provided by the Club. It is read at the first ordinary meeting thereafter, and voted upon at the next meeting. Any ordinary member has the right to demand a ballot, when the votes of one-third of the ordinary members present shall reject the candidate. Ordinary members contribute not less than 6/- annually, which sum is due on the 1st January in each year.

3. Written resignation is necessary for the termination of membership, and subscriptions are due and payable down to the actual date of resignation.

4. A resolution of the Council, confirmed by the unanimous vote of a meeting of the Club at which ten ordinary members are present and vote, is sufficient for the exclusion of any member.

5. All ordinary members are entitled to free admission and the right to vote at all meetings of the Club, and to receive its publications on such terms as are from time to time fixed by the Club; also to the use of the Library and local collections, and such other privileges as the Club has to offer.

6. Honorary members may be elected by the Club at any meeting, upon the unanimous recommendation of the Council.

7. The Council

Has the general management of the Club's affairs, and regulates and decides all matters not specifically provided for in these rules. It consists of a President, four Vice-presidents (including the last two occupants of the Presidential chair), one or more Secretaries, a Treasurer, and six other members; five of whom form a quorum. They may appoint out of their number any committees they think proper.

8. They may, in case of emergency, suspend the operation of any rule, but their action in this respect must be confirmed by a subsequent meeting of the Club.

9. All members of the Council are eligible for re-election, save that the President shall not occupy that office for more than two years in immediate succession.

Meetings.

10. The Ordinary Meetings of the Club are held weekly, with such variations as the Council may direct, on such days and at such hour and place as the Council shall fix. Special meetings are convened by circular under the direction of the Council.

11. The sessions of the Club extend from the 1st of February to the first week in December inclusive. The first portion of each evening is devoted to short papers, demonstrations, and (when appointed) sectional meetings; after which opportunity is given for the exhibition of specimens, &c., and, after the chairman has left the chair, general conversation.

12. The Annual Meeting

Is the last meeting of the session. The annual report of the outgoing Council is then read, and the Treasurer's accounts are submitted to the members, and the Council and officers for the ensuing year are elected. The Treasurer's accounts shall have been previously audited by two members appointed by the Club at some previous meeting.

13. The outgoing Council submits to the meeting the names of members whom they deem most suitable to form the new Council; but it is competent for the member voting to substitute the names

of such other member or members as he may prefer, in lieu of any of the names on the list. The voting is by ballot. Two or more scrutineers are selected by the President, and receive papers for the first half-hour of the meeting, and report to the President the number of votes for each member, and the President then declares the names of the members so elected.

*Library.

14. The affairs of the Library are entrusted to a Library Committee of the Council, including the Librarian, with power to enter into such arrangements with the Corporation as may seem desirable in the interests of the Club. The Library Committee shall also have custody of the other apparatus and portable property of the Club.

Alteration of Rules.

15. No alteration of the Rules can be made except at a General Meeting of the members, specially convened for that purpose by a printed circular, sent seven days previously by post to every member; and every such proposed alteration shall be exhibited during that period in the meeting room of the Club.

Dissolution of the Club.

16. The Club cannot be dissolved except by a vote of a clear majority of its whole membership at a General Meeting specially convened for that purpose. In the event of such dissolution being resolved upon, the property of the Club shall not be divided, but shall be placed in the hands of the Mayor of Leeds for the time being and the then Principal of the Yorkshire College, who shall dispose of it in such manner as shall, in their absolute judgment, be most conducive to the advancement of the objects of the Club.

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* See also page 96.

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The following rules have been agreed to between the Leeds Naturalists' Club and the Leeds Public Library Committee :—

1.—That the Naturalists' Library remain in the present room and that it be considered a part of the Reference Library while remaining the property of the Club, so that members of the Club would be enabled to consult the books at any time, as well as other books from the Reference Library in their room, and that the Club stamp be retained on the books as a sufficient guarantee against loss.

2.—That the issue of Books from the Naturalists' Club Library to members of the Club as a lending library and subject to rules as a lending library, and to the public be undertaken by the Librarian and staff of the Public Library.

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No.		Vol.	Date.
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No.			Vol.	Date.
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No.		Vol.	Date.
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239	Microscope, The; W. B. Carpenter's, edited and revised by Dallinger...	1 ...	1891
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176	Naturalist, Journal of a...	1 ...	1838
112	Naturalists' Recorder, Yorkshire (*ed.*) J. Wainwright...	1 ...	1873
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No.		Vol.	Date.
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No.		Vol.	Date.
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154	Yarrell, William; History of British Fishes	2 ...	1859
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